Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

I Semester (Group A) Bachelor of Technology (B.Tech.)

W.E.F. JULY 2022

GROUP A: (AB, RM, AN, AT, CS, EE, EI, EV, EX, IE, IT, MI, MM, AG, SD, CO, PC)

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
Mandatory Induction Program (First three weeks)				Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations									
Fourth week onwards classes will start													
1.	**BT101**	BSC-1	**Engineering Chemistry**	70	20	10	30	20	150	3	-	2	4
2.	**BT102**	BSC-2	**Mathematics-I**	70	20	10	-	-	100	3	1	-	4
3.	**BT103**	HSMC-1	**English for Communication**	70	20	10	30	20	150	3	-	2	4
4.	**BT104**	ESC-1	**Basic Electrical & Electronics Engineering**	70	20	10	30	20	150	2	-	2	3
5.	**BT105**	ESC-2	**Engineering Graphics**	70	20	10	30	20	150	2	-	2	3
6.	**BT106**	ESC-3	**Manufacturing Practices**	-	-	-	15	10	25	-	-	2	1
7.	**BT107**	DLC-1	**Internship-I (60 Hrs Duration) at the Institute level**	**To be completed during or at the end of the second semester. Its evaluation/credit to be added in third semester.**									
8.	**BT108**	DLC-2	Swachh Bharat Summer Internship Unnat Bharat Abhiyan (100Hrs)/ Rural Outreach				15	10	25	-	-	4	2
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**13**	**1**	**14**	**21**

Automation and Robotics(AB), Robotics and Mechatronics (RM), Agriculture Engineering (AN), Agriculture Technology (AT), Computer Science & Engineering(CS), Electrical Engineering (EE), Electronics & Instrumentation Engineering (EI), Electric Vehicles (EV), Electrical & Electronics Engineering (EX), Applied Electronics & Instrumentation Engineering (IE), Information Technology (IT), Mining Engineering (MI), Mining and Mineral Processing (MM), 3 D Animation & Graphics (AG), Computer Science & Design (SD), Computer Engineering (CO), Petrochemical Engineering (PC)

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

II Semester (Group A) Bachelor of Technology (B.Tech.)

W.E.F. JULY 2022

GROUP A: (AB, RM, AN, AT, CS, EE, EI, EV, EX, IE, IT, MI, MM, AG, SD, CO, PC)

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem Exam.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
1.	**BT201**	BSC-3	**Engineering Physics**	70	20	10	30	20	150	2	1	2	4
2.	**BT202**	BSC-4	**Mathematics-II**	70	20	10	-	-	100	3	1	-	4
3.	**BT203**	ESC-4	**Basic Mechanical Engineering**	70	20	10	30	20	150	3	-	2	4
4.	**BT204**	ESC-5	**Basic Civil Engineering & Mechanics**	70	20	10	30	20	150	3	-	2	4
5.	**BT205**	ESC-6	**Basic Computer Engineering**	70	20	10	30	20	150	3	-	2	4
6.	**BT206**	HSMC-2	**Language Lab & Seminars**	-	-	-	30	20	50	-	-	2	1
7.	**BT107**	DLC-1	**Internship-I (60 Hrs Duration) at the Institute level**	**To be completed during first/second semester. Its evaluation/credit to be added in third semester.**									
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**14**	**2**	**10**	**21**

Automation and Robotics(AB), Robotics and Mechatronics (RM), Agriculture Engineering (AN), Agriculture Technology (AT), Computer Science & Engineering(CS), Electrical Engineering (EE), Electronics & Instrumentation Engineering (EI), Electric Vehicles (EV), Electrical & Electronics Engineering (EX), Applied Electronics & Instrumentation Engineering (IE), Information Technology (IT), Mining Engineering (MI), Mining and Mineral Processing (MM), 3 D Animation & Graphics (AG), Computer Science & Design (SD), Computer Engineering (CO), Petrochemical Engineering (PC)

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

I Semester (Group B) Bachelor of Technology (B.Tech.)

W.E.F. JULY 2022

GROUP B: (AD, AL, CL, AU, BM, CE, CI, CM, DS, EC, FT, IO, IP, IS, ME, RA, CY, CN, CD, AI, IA)

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem Exam.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
Mandatory Induction Program (First three weeks)				Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations									
Fourth week onwards classes will start													
1.	**BT201**	BSC-3	**Engineering Physics**	70	20	10	30	20	150	2	1	2	4
2.	**BT102**	BSC-2	**Mathematics-I**	70	20	10	-	-	100	3	1	-	4
3.	**BT203**	ESC-4	**Basic Mechanical Engineering**	70	20	10	30	20	150	3	-	2	4
4.	**BT204**	ESC-5	**Basic Civil Engineering & Mechanics**	70	20	10	30	20	150	3	-	2	4
5.	**BT205**	ESC-6	**Basic Computer Engineering**	70	20	10	30	20	150	3	-	2	4
6.	**BT206**	HSMC-2	**Language Lab & Seminars**	-	-	-	30	20	50	-	-	2	1
7.	**BT107**	DLC-1	**Internship-I (60 Hrs Duration) at the Institute level**	**To be completed during first/second semester. Its evaluation/credit to be added in third semester.**									
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**14**	**2**	**10**	**21**

Artificial Intelligence and Data Science (AD), CSE-Artificaial Intelligence and Machine Learning(AL), Artificaial Intelligence and Machine Learning(CL), Automobile Engineering (AU), Biomedical Engineering (BM), Civil Engineering (CE), Computer Science & Information Technology(CI), Chemical Engineering (CM), Data Science (DS), Electronics & Communication Engineering (EC), Fire Technology & Safety Engineering (FT), CSE –IOT(IO), Industrial Production Engineering (IP), CSE- IOT and Cyber Security Including Block Chain Technolgy (IS), Mechanical Engineering (ME), Robotics and Artificial Intelligence (RA), CSE-Cyber Security (CY), Cyber Security (CN), CSE-Data Science (CD), Artificial Intelligence (AI), CSE-Artificial Intelligence (IA)

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

II Semester (Group B) Bachelor of Technology (B.Tech.)

W.E.F. JULY 2022

GROUP B: (AD, AL, CL, AU, BM, CE, CI, CM, DS, EC, FT, IO, IP, IS, ME, RA, CY, CN, CD, AI, IA)

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
1.	**BT101**	BSC-1	**Engineering Chemistry**	70	20	10	30	20	150	3	-	2	4
2.	**BT202**	BSC-4	**Mathematics-II**	70	20	10	-	-	100	3	1	-	4
3.	**BT103**	HSMC-1	**English for Communication**	70	20	10	30	20	150	3	-	2	4
4.	**BT104**	ESC-1	**Basic Electrical & Electronics Engineering**	70	20	10	30	20	150	2	-	2	3
5.	**BT105**	ESC-2	**Engineering Graphics**	70	20	10	30	20	150	2	-	2	3
6.	**BT106**	ESC-3	**Manufacturing Practices**	-	-	-	15	10	25	-	-	2	1
7.	**BT107**	DLC-1	**Internship-I (60 Hrs Duration) at the Institute level**	**To be completed during or at the end of the second semester. Its evaluation/credit to be added in third semester.**									
8.	**BT108**	DLC-2	Swachh Bharat Summer Internship Unnat Bharat Abhiyan (100Hrs)/ Rural Outreach				**15**	**10**	**25**	**-**	**-**	**4**	**2**
			Total	**350**	**100**	**50**	**150**	**100**	**750**	**13**	**1**	**14**	**21**

Artificial Intelligence and Data Science (AD), CSE-Artificaial Intelligence and Machine Learning(AL), Artificaial Intelligence and Machine Learning(CL), Automobile Engineering (AU), Biomedical Engineering (BM), Civil Engineering (CE), Computer Science & Information Technology(CI), Chemical Engineering (CM), Data Science (DS), Electronics & Communication Engineering (EC), Fire Technology & Safety Engineering (FT), CSE –IOT(IO), Industrial Production Engineering (IP), CSE- IOT and Cyber Security Including Block Chain Technolgy (IS), Mechanical Engineering (ME), Robotics and Artificial Intelligence (RA), CSE-Cyber Security (CY), Cyber Security (CN), CSE-Data Science (CD), Artificial Intelligence (AI), CSE-Artificial Intelligence (IA)

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

B.Tech. First Year

Branch- Common to All Disciplines

BT101	**Engineering Chemistry**	**3L-0T-2P**	**4 Credits**

Course Contents:

(i) Water – Analysis, Treatments and Industrial Applications (4 Lectures)

Sources, Impurities, Hardness & its units, Determination of hardness by EDTA method, Alkalinity & It's determination and related numerical problems.

(ii) Boiler problem & softening methods (4 Lectures)

Boiler troubles (Sludge & Scale, Priming & Foaming, Boiler Corrosion, Caustic Embrittlement), Softening methods (Lime-Soda, Zeolite and Ion Exchange Methods) and related numerical problems.

(iii)Lubricants and Lubrication (4 Lectures)

Introduction, Mechanism of lubrication, Classification of lubricants, significance & determination of Viscosity and Viscosity Index, Flash & Fire Points, Cloud & Pour Points, Aniline Point, Acid Number, Saponification Number, Steam Emulsification Number and related numerical problems.

(iv)Polymer & polymerization (4 Lectures)

Introduction, types of polymerisation, Classification, mechanism of polymerisation (Free radical & Ionic polymerization). Thermoplastic &Thermosetting polymers Elementary idea of Biodegradable polymers, preparation, properties & uses of the following polymers- PVC, PMMA, Teflon, Nylon 6, Nylon 6:6, Polyester phenol formaldehyde, Urea- Formaldehyde, Buna N, Buna S, Vulcanization of Rubber.

(v) Phase equilibrium and Corrosion (5 Lectures

Phase diagram of single component system (Water) Phase diagram of binary Eutectic System (Cu-Ag.) Corrosion: Types, Mechanisms & prevention.

(vi) Spectroscopic techniques and application (6 Lectures)

Principle, Instrumentation & Applications, electronics spectroscopy, Vibrational & Rotational Spectroscopy of diatomic molecules.

(vii) Periodic properties (4 Lectures)

Effective Nuclear Charge, Variations: S, P, d & f Orbital energies of atoms in periodic table, Electronics Configuration, atomic & Ionic sizes, electron affinity & electro negativity, Ploarizability & Oxidation States.

Course Outcomes

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

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

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular

energy levels in various spectroscopic techniques

- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Practical List

NOTE: At least 8 of the following core experiments must be performed during the session.

1. Water testing

(i) Determination of Total hardness by Complexometric titration method.

(ii) Determination of mixed alkalinity

a) OH & CO3

b) CO3 & HCO3

(iii) Chloride ion estimation by Argentometric method.

2. Fuels & Lubricant testing:

(i) Flash & fire points determination by

a) Pensky Martin Apparatus,

b) Abel's Apparatus

c) Cleveland's open cup Apparatus

d) Calorific value by bomb calorimeter.

(ii) Viscosity and Viscosity index determination by

a) Redwood viscometer No.1

b) Redwood viscometer No.2

(iii) Proximate analysis of coal

a) Moisture content

b) Ash content

c) Volatile matter content

d) Carbon residue

(iv) Steam emulsification No & Anline point determination

(v) Cloud and Pour point determination of lubricating oil

3. Alloy Analysis

(i) Determination of percentage of Fe in an iron alloy by redox titration using N-Phenyl anthranilic acid as internal indicator.

(ii) Determination of Cu and or Cr in alloy by Iodometric Titration.

(iii) Determination of % purity of Ferrous Ammonium Sulphate & Copper Sulphate.

Reference Books :

1 Chemistry in Engineering and Technology - Vol.1 &2 Kuriacose and Rajaram , McGraw Hill Education

2 Fundamental of Molecular Spectroscopy C.N. Banwell , McGraw Hill Education

3 Engineering Chemistry – B.K. Sharma, Krishna Prakashan Media (P) Ltd., Meerut.

4 Basics of Engineering Chemistry – S.S. Dara & A.K. Singh, S. Chand &Company Ltd., Delhi.

5 Applied Chemistry – Theory and Practice, O.P. Viramani, A.K. Narula, New Age International Pvt. Ltd. Publishers, New Delhi.

6 Elementary Spectroscopy ,Y .R. Sharma , S. Chand Publishing

7 Polymer Science, Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, New Age International Pvt. Ltd

8 Advanced Inorganic Chemistry, G.R. Chatwal, Goal Publishing house

9 Engineering Chemistry (NPTEL Web-book) B.L. Tembe, Kamaluddin and M.S. Krishna

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

B. Tech. First Year (I Semester)

Branch- Common to All Disciplines

BT102	**MATHEMATICS-I**	**3L-1T-0P**	**4 Credits**

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

To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.

To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.

To familiarize the student with functions of several variables that is essential in most branches of engineering.

To develop the essential tool of matrices and linear algebra in a comprehensive manner.

Course Contents:

Module 1: Calculus: (10 hours): Rolle's theorem, Mean Value theorems, Expansion of functions by Mc. Laurin's and Taylor's for one variable; Taylor's theorem for function of two variables, Partial Differentiation, Maxima & Minima (two and three variables), Method of Lagranges Multipliers.

Module 2: Calculus: (8 hours): Definite Integral as a limit of a sum and Its application in summation of series; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Multiple Integral, Change the order of the integration, Applications of multiple integral for calculating area and volumes of the curves.

Module 3: Sequences and series: (6 hours): Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Vector Spaces (8hours): Vector Space,Vector Sub Space, Linear Combination of Vectors,Linearly Dependent, Linearly Independent, Basis of a Vector Space,Linear Transformations.

Module 5: Matrices (8 hours): Rank of a Matrix, Solution of Simultaneous Linear Equations by Elementary Transformation, Consistency of Equation, Eigen Values and Eigen Vectors, Diagonalization of Matrices, Cayley-Hamilton theorem and its applications to find inverse.

Textbooks/References:

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

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

B.Tech. First Year

Branch- Common to All Disciplines

BT103	**English for Communication**	**3L-0T-2P**	**4 Credits**

COURSE CONTENTS:

Unit-I

Identifying Common errors in writing: Articles, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Reported Speech: Direct and Indirect, Sentence Structure.

Unit-II

Vocabulary building and Comprehension:

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, synonyms, antonyms, Reading comprehension.

Unit-III

Communication:

Introduction, Meaning and Significance, Process of Communication, Oral and Written Communication, 7 c's of Communication, Barriers to Communication and Ways to overcome them, Importance of Communication for Technical students, nonverbal communication.

Unit-IV

Developing Writing Skills:

Planning, Drafting and Editing, Precise Writing, Précis, Technical definition and Technical description. Report Writing: Features of writing a good Report, Structure of a Formal Report, Report of Trouble, Laboratory Report, Progress Report.

Unit-V

Business Correspondence:

Importance of Business Letters, Parts and Layout; Application, Contents of good Resume, guidelines for writing Resume, Calling/ Sending Quotation, Order, Complaint, E-mail and Tender.

Books Recommended:

1. 'Technical Communication : Principles and practice', Meenakshi Raman and Sangeeta Sharma (Oxford)
2. 'Effective Business Communication', Krizan and merrier (Cengage learning)
3. 'Communication Skill, Sanjay Kumar and pushlata, OUP2011
4. "Practical English Usage Michael Swan OUP, 1995.
5. "Exercises in spoken English Parts I-III CIEFL, Hyderabad, Oxford University Press
6. On writing well, William Zinsser, Harper Resource Book 2001.
7. Remedial English Grammar, F.T. Wood,Macmillan2007.

Course Outcomes:

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

Communicative Language Laboratory:

Course objective: The language laboratory focuses on the practice of English through audio-visual aids and Computer software. It intends to enable the students to speak English correctly with confidence and intends to help them to overcome their inhibitions and self –consciousness while speaking in English.

Topics to be covered in the Language laboratory sessions:

1. Listening Comprehension.
2. Pronunciation, Intonation, Rhythm
3. Practising everyday dialogues in English
4. Interviews.
5. Formal Presentation

Final Assessment should be based on assignment, assessment, presentation and interview of each candidate.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

B.Tech. First Year

Branch- Common to All Disciplines

BT104	**Basic Electrical & Electronics Engineering**	**2L-0T-2P**	**3Credits**

Course Contents:

Unit- I :

D.C. Circuits: Voltage and current sources, dependent and independent sources, Units and dimensions, Source Conversion, Ohm's Law, Kirchhoff's Law, Superposition theorem, Thevenin's theorem and their application for analysis of series and parallel resistive circuits excited by independent voltage sources, Power & Energy in such circuits. Mesh & nodal analysis, Star Delta transformation & circuits.

Unit – II :

1- phase AC Circuits: Generation of sinusoidal AC voltage, definition of average value, R.M.S. value, form factor and peak factor of AC quantity , Concept of phasor, Concept of Power factor, Concept of impedance and admittance, Active, reactive and apparent power, analysis of R-L, R-C, R-L-C series & parallel circuit

3-phase AC Circuits: Necessity and advantages of three phase systems, Meaning of Phase sequence, balanced and unbalanced supply and loads. Relationship between line and phase values for balanced star and delta connections. Power in balanced & unbalanced three-phase system and their measurements

Unit – III : Magnetic Circuits: Basic definitions, magnetization characteristics of Ferro magnetic materials, self inductance and mutual inductance, energy in linear magnetic systems, coils connected in series, AC excitation in magnetic circuits, magnetic field produced by current carrying conductor, Force on a current carrying conductor. Induced voltage, laws of electromagnetic Induction, direction of induced E.M.F.

Single phase transformer- General construction, working principle, e.m.f. equation, equivalent circuits, phasor diagram, voltage regulation, losses and efficiency, open circuit and short circuit test

Unit IV:

Electrical Machines: Construction, Classification & Working Principle of DC machine, induction machine and synchronous machine. Working principle of 3-Phase induction motor, Concept of slip in 3- Phase induction motor, Explanation of Torque-slip characteristics of 3-Phase induction motor. Types of losses occurring in electrical machines. Applications of DC machine, induction machine and synchronous machine.

Unit V :

Basic Electronics: Number systems & Their conversion used in digital electronics, De morgan's theorem, Logic Gates, half and full adder circuits, R-S flip flop, J-K flip flop. Introduction to Semiconductors, Diodes, V-I characteristics, Bipolar junction transistors (BJT) and their working, introduction to CC, CB & CE transistor configurations, different configurations and modes of operation of BJT

Course outcomes:

The final outcome of the subject will result into an enhancement in understanding the basic concepts of Core Electrical Engineering subjects. The topics covered under this subject will help to enhance the basic understanding of Electrical machines and power systems and basic electronics.

Evaluation: Evaluation will be continuous and integral part of the class followed by final examination.

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
- Determination of equivalent circuit parameters of a single phase transformer by O.C. and S.C. tests and estimation of voltage regulation and efficiency at various loading conditions and

verification by load test.

- Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super- synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Study of V-I Characteristics of Diodes.
- Applications of Diodes and their verification.
- Transistor applications as amplifier and switch.
- Verification of truth table for various gates, Flip-Flops.
- Realizations of Various gates, Flip-Flops etc.
- Verification of De morgan's theorems.

References

1. D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, latest edition.
2. S.N. Singh , Basic Electrical Engineering, P.H.I.,2013
3. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall,2014
4. M.S. Sukhija, T. K. Nagsarkar, Basic Electrical and electronics engineering, Oxford University press,2012
5. C.L. Wadhwa, Basic Electrical Engineering. New Age International.
6. B.L. Theraja & A.K Theraja Textbook of Electrical Technology - Vol. 1, S. Chand Publication
7. E. Hughes & I.M. Smith Hughes Electrical Technology Pearson
8. Vincent Del Toro Electrical Engineering Fundamentals

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

B.Tech. First Year

Branch- Common to All Disciplines

BT105	**Engineering Graphics**	**2L-0T-2P**	**3Credits**

Course Objective:

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

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

Course Contents:

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

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

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering, Principles of Orthographic Projections- Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering, those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

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

Module 5: Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids;

Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

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

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

Module 8: Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Goals & Outcomes:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

Text/Reference Books:

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

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New Scheme Based On AICTE Flexible Curricula

B.Tech. First Year

Branch- Common to All Disciplines

BT106	**Manufacturing Practices**	**0L-0T-2P**	**1Credits**

Course Objective:

Manufacturing is fundamental to the development of any engineering product. The course on Engineering Workshop Practice is intended to expose engineering students to different types of manufacturing / fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included.

Course Contents:

Lectures & videos: (10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical &Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications.
- Selection of a suitable technique for meeting a specific fabrication need.
- Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.
- Introduction to different manufacturing methods in different fields of engineering.
- Practical exposure to different fabrication techniques.
- Creation of simple components using different materials.
- Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

(ii) Workshop Practice:(60 hours)

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics**(8 hours)**
5. Welding shop **(8 hours (Arc welding 4 hrs + gas welding 4 hrs)**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic moulding & Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

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

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New Scheme Based On AICTE Flexible Curricula

B. Tech. First Year

Branch- Common to All Disciplines

BT201	**Engineering Physics**	**2L-1T-2P**	**4 Credits**

Course Contents:

Module 1: Wave nature of particles and the Schrodinger equation (8 lectures)

Introduction to Quantum mechanics, Wave nature of Particles, operators ,Time-dependent and time-independent Schrodinger equation for wavefunction, Application: Particle in a One dimensional Box, Born interpretation, Free-particle wavefunction and wave-packets, v_g and v_p relation Uncertainty principle.

Module 2: Wave optics (8 lectures)

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer.

Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Module 3: Introduction to solids (8 lectures)

Free electron theory of metals, Fermi level of Intrinsic and extrinsic, density of states, Bloch's theorem for particles in a periodic potential, Kronig-Penney model(no derivation) and origin of energy bands. V-I characteristics of PN junction, Zener diode, Solar Cell, Hall Effec .

Module 4: Lasers (8 lectures)

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers(ruby, Neodymium),Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine. Introduction to Optical fiber, acceptance angle and cone, Numerical aperture, V number, attenuation.

Module 5: Electrostatics in vacuum (8 lectures)

Calculation of electric field and electrostatic potential for a charge distribution; Electric displacement, Basic Introduction to Dielectrics, Gradient, Divergence and curl,Stokes' theorem, Gauss Theorem, Continuity equation for current densities; Maxwell's equation in vacuum and non-conducting medium; Poynting vector.

List of Experiment

1. To determine the dispersive power of prism.
2. To determine the ʎ of sodium light with the help of newton's Ring.
3. Resolving Power of Telescope.
4. YDSE (Young's double slit Experiment).
5. To determine the frequency of AC mains supply.
6. V-I Characteristics of P-N junction diode.
7. To determine the ʎ of diode loses by single slit diffraction.
8. To determine the plank's constant with the help of photocell.
9. Hall's effect experiment.
10. Calibration of ammeter by using reference zener diode.

11. To study the effect of temperature on reverse saturation current in P-N junction diode and to determine the energy band gap.
12. To determine the ʎ of sodium by using plane diffraction grating.
13. To determine the prominent lines of mercury source by plane diffraction grating.
14. To determine the numerical aperture of an optical fiber.
15. To determine ʎ of given laser by plane diffraction grating.

Suggested Reference Books

1. A. Ghatak, Optics.
2. O. Svelto, Principles of Lasers.
3. David Griffiths, Introduction to Electrodynamics.
4. D.J. Griffiths, Quantum Mechanics.
5. Halliday & Resnick, Physics.

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New Scheme Based On AICTE Flexible Curricula

B. Tech. First Year (II Semester)

Branch- Common to All Disciplines

BT202	**MATHEMATICS-II**	**3L-1T-0P**	**4 Credits**

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

- To introduce effective mathematical tools for the solutions of ordinary and partial differential equations that model physical processes.
- To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.
- To acquaint the student with mathematical tools available in vector calculus needed various field of science and engineering.

Course Contents:

Module 1:Ordinary Differential Equations I :(6 hours) : Differential Equations of First Order and First Degree (Leibnitz linear, Bernoulli's, Exact), Differential Equations of First Order and Higher Degree, Higher order differential equations with constants coefficients, Homogeneous Linear Differential equations, Simultaneous Differential Equations.

Module 2:Ordinary differential Equations II:(8 hours) : Second order linear differential equations with variable coefficients, Method of variation of parameters, Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 3: Partial Differential Equations : (8 hours) : Formulation of Partial Differential equations, Linear and Non-Linear Partial Differential Equations, Homogeneous Linear Partial Differential Equations with Constants Coefficients.

Module 4: Functions of Complex Variable :(8 hours) : Functions of Complex Variables: Analytic Functions, Harmonic Conjugate, Cauchy-Riemann Equations (without proof), Line Integral, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for Evaluation of Real Integral (Unit Circle).

Module 5: Vector Calculus : (10 hours) : Differentiation of Vectors, Scalar and vector point function, Gradient, Geometrical meaning of gradient, Directional Derivative, Divergence and Curl, Line Integral, Surface Integral and Volume Integral, Gauss Divergence, Stokes and Green theorems.

Textbooks/References:

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

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New Scheme Based On AICTE Flexible Curricula

B. Tech. First Year

Branch- Common to All Disciplines

BT203	**Basic Mechanical Engineering**	**3L-0T-2P**	**4 Credits**

Course Contents:

Unit I :

Materials : Classification of engineering material, Composition of Cast iron and Carbon steels, Iron Carbon diagram. Alloy steels their applications. Mechanical properties like strength, hardness, toughness , ductility, brittleness , malleability etc. of materials , Tensile test- Stress-strain diagram of ductile and brittle materials ,Hooks law and modulus of elasticity, Hardness and Impact testing of materials, BHN etc.

Unit II:

Measurement: Concept of measurements, errors in measurement, Temperature, Pressure, Velocity, Flow strain, Force and torque measurement, Vernier caliper, Micrometer, Dial gauge, Slip gauge, Sine-bar and Combination set.

Production Engineering: Elementary theoretical aspects of production processes like casting, carpentry, welding etc Introduction to Lathe and Drilling machines and their various operations.

Unit III :

Fluids : Fluid properties pressure, density and viscosity etc. Types of fluids , Newton's law of viscosity , Pascal's law , Bernoulli's equation for incompressible fluids, Only working principle of Hydraulic machines, pumps, turbines, Reciprocating pumps .

Unit IV:

Thermodynamics : Thermodynamic system, properties, state, process, Zeroth, First and second law of thermodynamics, thermodynamic processes at constant pressure, volume, enthalpy & entropy.

Steam Engineering : Classification and working of boilers, mountings and accessories of boilers, Efficiency and performance analysis, natural and artificial draught**,** steam properties, use of steam tables.

Unit V:

Reciprocating Machines :

Working principle of steam Engine, Carnot, Otto, Diesel and Dual cycles P-V & T-S diagrams and its efficiency, working of Two stroke & Four stroke Petrol & Diesel engines. Working principle of compressor.

Reference Books:

1- Kothandaraman & Rudramoorthy, Fluid Mechanics & Machinery, New Age .
2- Nakra & Chaudhary , Instrumentation and Measurements, TMH.
3- Nag P.K, Engineering Thermodynamics , TMH .
4- Ganesan , Internal Combustion Engines, TMH .
5- Agrawal C M, Basic Mechanical Engineering ,Wiley Publication.
6- Achuthan M , , Engineering Thermodynamics ,PHI.

List of Suggestive Core Experiments:

Theory related Eight to Ten experiments including core experiments as follows:

1- Study of Universal Testing machines.
2- Linear and Angular measurement using, Micrometer, Slip Gauges, Dial Gauge and Sine-bar.
3- Study of Lathe Machine.
4- Study of Drilling Machines.
5- Verification of Bernoulli's Theorem.
6- Study of various types of Boilers.
7- Study of different IC Engines.
8- Study of different types of Boilers Mountings and accessories.

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New Scheme Based On AICTE Flexible Curricula

B. Tech. First Year

Branch- Common to All Disciplines

BT204	**Basic Civil Engineering & Mechanics**	**3L-0T-2P**	**4 Credits**

Course Contents:

Unit I Building Materials & Construction

Stones, bricks, cement, lime, timber-types, properties, test & uses, laboratory tests concrete and mortar Materials: Workability, Strength properties of Concrete, Nominal proportion of Concrete preparation of concrete, compaction, curing.

Elements of Building Construction, Foundations conventional spread footings, RCC footings, brick masonry walls, plastering and pointing, floors, roofs, Doors, windows, lintels, staircases – types and their suitability

Unit II Surveying & Positioning:

Introduction to surveying Instruments – levels, thedolites, plane tables and related devices. Electronic surveying instruments etc. Measurement of distances – conventional and EDM methods, measurement of directions by different methods, measurement of elevations by different methods. Reciprocal leveling.

Unit III Mapping & sensing:

Mapping details and contouring, Profile Cross sectioning and measurement of areas, volumes, application of measurements in quantity computations, Survey stations, Introduction of remote sensing and its applications.

Engineering Mechanics

Unit IV

Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non-concurrent Co- planner forces, free Diagram, Force Diagram and Bow's notations, Application of Equilibrium Concepts: Analysis of plane Trusses: Method of joints, Method of Sections. Frictional force in equilibrium problems

Unit – V

Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment Inertia of Area and Mass, Radius of Gyration, Introduction to product of Inertia and Principle Axes.

Support Reactions, Shear force and bending moment Diagram for Cantilever & simply supported beam with concentrated, distributed load and Couple.

Reference Books:

1. S. Ramamrutam & R.Narayanan; Basic Civil Engineering, Dhanpat Rai Pub.
2. Prasad I.B., Applied Mechanics, Khanna Publication.
3. Punmia, B.C., Surveying, Standard book depot.
4. Shesha Prakash and Mogaveer; Elements of Civil Engg & Engg. Mechanics; PHI
5. S.P,Timoshenko, Mechanics of stricture, East West press Pvt.Ltd.
6. Surveying by Duggal – Tata McGraw Hill New Delhi.
7. Building Construction by S.C. Rangwala- Charotar publications House, Anand.
8. Building Construction by Grucharan Singh- Standard Book House, New Delhi
9. Global Positioning System Principles and application- Gopi, TMH
10. R.C. Hibbler – Engineering Mechanics: Statics & Dynamics.
11. A. Boresi & Schmidt- Engineering Mechines- statics dynamics, Thomson' Books
12. R.K. Rajput, Engineering Mechanics S.Chand & Co.

List of suggestive core Experiments:

Students are expected to perform minimum ten experiments from the list suggested below by preferably selecting experiments from each unit of syllabus.

1. To perform traverse surveying with prismatic compass, check for local attraction and determine corrected bearings and to balance the traverse by Bowditch's rule.
2. To perform leveling exercise by height of instrument of Rise and fall method.
3. To measure horizontal and vertical angles in the field by using Theodolite.
4. To determine (a) normal consistency (b) Initial and Final Setting time of a cement Sample.
5. To determine the workability of fresh concrete of given proportions by slump test or compaction factor test.
6. To determine the Compressive Strength of brick.
7. To determine particle size distribution and fineness modulus of course and fine Aggregate.
8. To verify the law of Triangle of forces and Lami's theorem.
9. To verify the law of parallelogram of forces.
10. To verify law of polygon of forces
11. To find the support reactions of a given truss and verify analytically.
12. To determine support reaction and shear force at a given section of a simply Supported beam and verify in analytically using parallel beam apparatus.
13. To determine the moment of inertia of fly wheel by falling weight method.
14. To verify bending moment at a given section of a simply supported beam.

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New Scheme Based On AICTE Flexible Curricula

B. Tech. First Year

Branch- Common to All Disciplines

BT205	**Basic Computer Engineering**	**3L-0T-2P**	**4 Credits**

Course Contents:

UNIT I

Computer: Definition, Classification, Organization i.e. CPU, register, Bus architecture, Instruction set, Memory & Storage Systems, I/O Devices, and System & Application Software. Computer Application in e-Business, Bio-Informatics, health Care, Remote Sensing & GIS, Meteorology and Climatology, Computer Gaming, Multimedia and Animation etc.

Operating System: Definition, Function, Types, Management of File, Process & Memory. Introdcution to MS word, MS powerpoint, MS Excel

UNIT II

Introduction to Algorithms, Complexities and Flowchart, Introduction to Programming, Categories of Programming Languages, Program Design, Programming Paradigms, Characteristics or Concepts of OOP, Procedure Oriented Programming VS object oriented Programming. Introduction to C++: Character Set, Tokens, Precedence and Associativity, Program Structure, Data Types, Variables, Operators, Expressions, Statements and control structures, I/O operations, Array, Functions,

UNIT III

Object & Classes, Scope Resolution Operator, Constructors & Destructors, Friend Functions, Inheritance, Polymorphism, Overloading Functions & Operators, Types of Inheritance, Virtual functions. Introduction to Data Structures.

UNIT IV

Computer Networking: Introduction, Goals, ISO-OSI Model, Functions of Different Layers. Internetworking Concepts, Devices, TCP/IP Model. Introduction to Internet, World Wide Web, E-commerce

Computer Security Basics: Introduction to viruses, worms, malware, Trojans, Spyware and Anti-Spyware Software, Different types of attacks like Money Laundering, Information Theft, Cyber Pornography, Email spoofing, Denial of Service (DoS), Cyber Stalking, ,Logic bombs, Hacking Spamming, Cyber Defamation , pharming Security measures Firewall, Computer Ethics & Good Practices, Introduction of Cyber Laws about Internet Fraud, Good Computer Security Habits,

UNIT V

Data base Management System: Introduction, File oriented approach and Database approach, Data Models, Architecture of Database System, Data independence, Data dictionary, DBA, Primary Key, Data definition language and Manipulation Languages.

Cloud computing: definition, cloud infrastructure, cloud segments or service delivery models (IaaS, PaaS and SaaS), cloud deployment models/ types of cloud (public, private, community and hybrid clouds), Pros and Cons of cloud computing

List of Experiment

01. Study and practice of Internal & External DOS commands.
02. Study and practice of Basic linux Commands – ls, cp, mv, rm, chmod, kill, ps etc.
03. Study and Practice of MS windows – Folder related operations, My-Computer, window explorer, Control Panel,
04. Creation and editing of Text files using MS- word.
05. Creation and operating of spreadsheet using MS-Excel.
06. Creation and editing power-point slides using MS- power point
07. Creation and manipulation of database table using SQL in MS-Access.
08.WAP to illustrate Arithmetic expressions
09. WAP to illustrate Arrays.
10. WAP to illustrate functions.
11. WAP to illustrate constructor & Destructor
12. WAP to illustrate Object and classes.

13. WAP to illustrate Operator overloading
14. WAP to illustrate Function overloading
15. WAP to illustrate Derived classes & Inheritance
16. WAP to insert and delete and element from the Stack
17. WAP to insert and delete and element from the Queue
18. WAP to insert and delete and element from the Linked List

Recommended Text Books:

1. Fundamentals of Computers : E Balagurusamy, TMH
2. Basic Computer Engineering: Silakari and Shukla, Wiley India
3. Fundamentals of Computers : V Rajaraman, PHI
4. Information Technology Principles and Application: Ajoy Kumar Ray & Tinku Acharya PHI.

Recommended Reference Books:

1. Introduction of Computers : Peter Norton, TMH
2. Object Oriented Programming with C++ :E.Balagurusamy, TMH
3. Object Oriented Programming in C++: Rajesh K.Shukla, Wiley India
4. Concepts in Computing: Kenneth Hoganson, Jones & Bartlett.
5. Operating Systems – Silberschatz and Galvin - Wiley India
6. Computer Networks:Andrew Tananbaum, PHI
7. Data Base Management Systems, Korth, TMH
8. Cloud Computing, Kumar, Wiley India

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New Scheme Based On AICTE Flexible Curricula

B. Tech. First Year

Branch- Common to All Disciplines

BT206	**Language Lab and Seminars**	**0L-0T-2P**	**1 Credits**

Course objective: This course intends to impart practical training in the use of English Language for Communicative purposes and aims to develop students' personality through language Laboratory.

Topics to be covered in the Language laboratory sessions:

1. Introducing oneself, family, social roles.
2. Public Speaking and oral skills with emphasis on conversational practice, extempore speech, JAM(Just a minute sessions), describing objects and situations, giving directions, debate, telephonic etiquette.
3. Reading Comprehension: Intensive reading skills, rapid reading, and reading aloud (Reading material to be selected by the teacher).
4. To write a book review. Standard text must be selected by the teacher.
5. Role plays: preparation and delivery topic to be selected by teacher/faculty.

A Guide to Induction Program

1 Introduction

(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.[1] *This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help institutions in understanding the spirit of the accepted Induction Program and implementing it.)*

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them

[1] A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs.

work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

2 Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature.[2]

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

[2]Induction Program as described here borrows from three programs running earlier at different institutions: (1) Foundation Program running at IIT Gadhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsary course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high effectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member.

Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2.2 Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.[3]

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

[3]The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilties.

3 Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

3.1 Initial Phase

Time	*Activity*
Day 0	
Whole day	*Students arrive - Hostel allotment. (Preferably do pre-allotment)*
Day 1	
09:00 am - 03:00 pm	*Academic registration*
04:30 pm - 06:00 pm	Orientation
Day 2	
09:00 am - 10:00 am	Diagnostic test (for English etc.)
10:15 am - 12:25 pm	Visit to respective depts.
12:30 pm - 01:55 pm	*Lunch*
02:00 pm - 02:55 pm	Director's address
03:00 pm - 05:00 pm	Interaction with parents
03:30 pm - 05:00 pm	Mentor-mentee groups - Introduction within group. (Same as Universal Human Values groups)

3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Sessn.	*Time*	*Activity*	*Remarks*
	Day 3 onwards		
	06:00 am	*Wake up call*	
I	06:30 am - 07:10 am	Physical activity (mild exercise/yoga)	
	07:15 am - 08:55 am	*Bath, Breakfast, etc.*	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	*Lunch*	
IV	02:30 pm - 03:55 pm	Afternoon Session	See below.
V	04:00 pm - 05:00 pm	Afternoon Session	See below.
	05:00 pm - 05:25 pm	*Break / light tea*	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	*Rest and Dinner*	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off. Saturdays have the same schedule as above or have outings.

3.2.2 Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept./Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	*Session*	*Remarks*
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	For 3-5 days
Proficiency Modules	V	Daily, but only for those who need it

3.3 Closing Phase

Time	*Activity*
Last But One Day	
08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor-mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological

etc. (For every 10 undergraduate first year students, there would be a senior student as a *student guide*, and for every 20 students, there would be a *faculty mentor*.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline[4].

Here we list some important suggestions which have come up and which have been experimented with.

3.4.1 Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor's home for dinner or tea, nature walk, etc.)

3.4.2 Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters.

It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

4 Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one's family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta-skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and

[4]We are aware that there are advantages in mixing the students from different depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from different depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept.

nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help.

References:

Motivating UG Students Towards Studies,
Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors),
31 March 2016, IIT Directors' Secretariat, IIT Delhi.

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18 June 2017

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)

Electronics and Communication (Advanced Communication Technology)

III Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	BT301	BSC-5	Mathematics-III	70	20	10	-	-	100	3	1	-	4
2.	EA 302	DC-1	Probability Theory	70	20	10	-	-	100	3	1	-	4
3.	EA 303	DC-2	Digital Electronics	70	20	10	30	20	150	3	-	2	4
4.	EA 304	DC-3	Electronic Devices	70	20	10	30	20	150	3	-	2	4
5.	EA 305	DC-4	Circuit Analysis	70	20	10	30	20	150	3	-	2	4
6.	EA 306	DLC-3	Probability Theory Lab	-	-	-	30	20	50	-	-	4	2
7.	BT107	DLC-1	Evaluation of Internship-I completed at I year level	-	-	-	-	50	50			4	2
8.	BT307	DLC-4	90 hrs Internship based on using various software's –Internship -II	To be completed anytime during Third/ fourth semester. Its evaluation/credit to be added in fifth semester.									
			Total	350	100	50	120	130	750	15	2	14	24
9.	BT308	MC	Indian Constitution	Non-credit course									
NC301		NSS/NCC											

*Students can earn additional credits from the University recognized MOOC courses.

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), III Semester

BT301	**Mathematics-III**	**3L-1T-0P**	**4Credits**

OBJECTIVES

The objective of this course is to fulfill the needs of engineers to understand applications of Numerical Analysis, Transform Calculus, and Statistical techniques in order to acquire mathematical knowledge and solve a wide range of practical problems appearing in different sections of science and engineering. More precisely, the objectives are:

- To introduce effective mathematical tools for the Numerical Solutions of algebraic and transcendental equations.
- To enable young technocrats to acquire mathematical knowledge to understand Laplace transformation, Inverse Laplace transformation, and Fourier Transform which are used in various branches of engineering.
- To acquaint the student with mathematical tools available in Statistics needed in various fields of science and engineering.

Module 1: Numerical Methods – 1 (8 hours)

Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method, and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Module 2: Numerical Methods – 2 (6 hours)

Numerical Differentiation, Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8th rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, and Crout's methods. Jacobi's, Gauss-Seidal, and Relaxation methods.

Module 3: Numerical Methods – 3 (10 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second-order equations. Milne's and Adam's predictor-corrector methods. Partial differential equations: Finite difference solution of two-dimensional Laplace equation and Poisson equation. Implicit and explicit methods for one-dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods). Finite difference explicit method for wave equation.

Module 4: Transform Calculus (8 hours)

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method. Fourier transforms.

Module 5: Concept of Probability (8 hours)

Probability Mass Function, Probability Density Function. Discrete Distribution: Binomial, Poisson's. Continuous Distribution: Normal Distribution, Exponential Distribution.

Textbooks/References:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, *Numerical Methods*, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S. S. Sastry, *Introductory Methods of Numerical Analysis*, PHI, 4th Edition, 2005.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.
4. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 35th Edition, 2010.

5. N. P. Bali and Manish Goyal, *A Textbook of Engineering Mathematics*, Laxmi Publications, Reprint, 2010.
6. P. G. Hoel, S. C. Port, and C. J. Stone, *Introduction to Probability Theory*, Universal Book Stall, 2003 (Reprint).
7. S. Ross, *A First Course in Probability*, 6th Ed., Pearson Education India, 2002.
8. W. Feller, *An Introduction to Probability Theory and its Applications*, Vol. 1, 3rd Ed., Wiley, 1968.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), III Semester

EA 302 – Probability Theory

Unit 1: Set Theory and Combinatorics

Basic Set Operations: Union, Intersection, Complement, Cartesian Product; Venn Diagrams; Partition of a Set; Combinatorics and Counting Techniques: The Principle of Multiplication and Addition, Permutations, Combinations, Binomial Theorem and Pascal's Triangle, Binomial Coefficients, Pigeonhole Principle, Ordered Sampling with and without Replacement, Unordered Sampling with and without Replacement; Applications of Set Theory and Combinatorics in Probability.

Unit 2: Basics of Probability

Random Experiment; Sample Space; Events; Definitions of Probability and Interpretations; Axioms of Probability; Some Simple Propositions; Conditional Probability and Independence of Events; Law of Total Probability and Bayes' Theorem; Combined Experiments; Bernoulli Trials; DeMoivre–Laplace Theorem; Simple Problems Including Those on Bit Errors in Communication Systems.

Unit 3: Random Variables and Distributions

Concept and Definition of a Random Variable: Discrete and Continuous; Probability Mass Function (PMF), Probability Density Function (PDF), and Cumulative Distribution Function (CDF); Expectation (Mean), Variance, and Standard Deviation; Common Discrete Distributions: Bernoulli, Binomial, Geometric, Poisson; Common Continuous Distributions: Uniform, Exponential, Gaussian (Normal); Properties and Some Applications.

Unit 4: Two Random Variables and Joint Distributions

Joint PDFs and PMFs for Two Random Variables; Marginal and Conditional PDFs and PMFs; Statistical Independence; Correlation and Covariance; PDF and PMF of the Sum of Two Independent Random Variables; Central Limit Theorem; Other Simple Functions of One and Two Random Variables; Some Applications.

Unit 5: Elements of Statistics

Sampling Theory: The Sample Mean, Median, Mode, Variance, Standard Deviation, Histograms and Frequency Distributions; Sampling Distributions; Confidence Intervals, Basics of Hypothesis Testing, Introduction to Linear Regression; Correlation between Two Sets of Data; Some Applications.

Textbooks:

1. S. Ross, *A First Course in Probability*, 10th Edition, Pearson Education.
2. G. R. Cooper and C. D. McGillem, *Probabilistic Methods of Signal and System Analysis*, Third Edition, Oxford University Press.
3. M. R. Spiegel, J. Schiller, and R. A. Srinivasan, *Schaum's Outline of Probability and Statistics*, 4th Edition, McGraw-Hill.

Reference Books:

1. H. Stark and J. W. Woods, *Probability and Random Processes with Applications to Signal Processing*, 3rd Edition, Pearson Education.
2. A.Papoulis and S. Unnikrishnan Pillai, *Probability, Random Variables and Stochastic Processes*, Fourth Edition, McGraw Hill.
3. P. Z. Peebles, Jr., *Probability, Random Variables, and Random Signal Principles*, 4th Edition, Tata McGraw Hill.
4. K. L. Chung and F. AitSahlia, *Introduction to Probability Theory with Stochastic Processes and an Introduction to Mathematical Finance*, Springer International.
5. K. H. Rosen, *Discrete Mathematics and Its Applications*, 8th Edition, McGraw Hill.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), III Semester

EA 303 – Digital Electronics

Unit 1: Number Systems: Decimal, Binary, Octal, and Hexadecimal systems; conversion from one base to another; Codes – BCD, Excess-3, Gray Reflected, ASCII, EBCDIC. Logic gates and binary operations – AND, OR, NOT, NAND, NOR, Exclusive-OR, and Exclusive-NOR. Implementation of Logic Functions using gates, NAND-NOR implementations, Multi-level gate implementations, Multi-output gate implementations. Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean function, Canonical and standard forms, Minimization of Boolean functions, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), Karnaugh map minimization, Don't care conditions, Quine-McCluskey method of minimization.

Unit 2: Combinational Logic Circuits: Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Binary Adder, Parallel Binary Subtractor, Fast Adder, Carry Look Ahead Adder, Serial Adder/Subtractor, BCD Adder, Binary Multiplier, Binary Divider, Multiplexer/De-multiplexer, Decoder, Encoder, Parity Checker, Parity Generators, Code Converters, Magnitude Comparator.

Unit 3: Sequential Logic Design: Building blocks like S-R, JK, and Master-Slave JK Flip-Flop, Edge Triggered Flip-Flop, Finite State Machines, Design of Synchronous FSM, Algorithmic State Machines Charts, Designing Synchronous Circuits like Pulse Train Generator, Pseudo-Random Binary Sequence Generator, Clock Generation.

Unit 4: Registers and Counters: Asynchronous Ripple or Serial Counter, Asynchronous Up/Down Counter, Synchronous Counters, Synchronous Up/Down Counters, Programmable Counters, Design of Synchronous Counters: State Diagram, State Table, State Minimization, State Assignment, Excitation Table and Maps, Circuit Implementation, Modulo-n Counter, Registers, Shift Registers, Universal Shift Registers, Shift Register Counters, Ring Counter, Shift Counters, Sequence Generators.

Unit 5: Logic Families and Semiconductor Memories: TTL NAND Gate, Specifications, Noise Margin, Propagation Delay, Fan-in, Fan-out, Tri-State TTL, ECL, CMOS Families and Their Interfacing, Memory Elements, Concept of Programmable Logic Devices like FPGA, Logic Implementation Using Programmable Devices.

Text/Reference Books:

1. Malvino & Leach, *Digital Principles and Applications*, TMH.
2. M. Morris Mano, *Digital Logic Design*, PHI.
3. R.P. Jain, *Modern Digital Design*, TMH.
4. S. Salivahanan & S. Arivazhagan, *Digital Circuits and Design*, Vikas Publishing.
5. D. Roy Chaudhuri, *Digital Circuits: An Introduction Part-1 & 2*, Eureka Publisher.
6. Ronald J. Tocci, *Digital Systems: Principles and Applications*, PHI.
7. Taub & Schilling, *Digital Integrated Electronics*, TMH.

Digital Electronics Lab:

1. Study of different basic digital logic gates and verification of their truth table.
2. Study and verification of the laws of Boolean Algebra and De-Morgan's Theorem.
3. Construction and verification of various combinational circuits such as Half Adder, Full Adder, and Half & Full Subtractor.
4. Study of Multiplexer and De-multiplexer.
5. Study of different Code Converters, Encoder, and Decoder.
6. Construction and verification of various types of Flip-Flops using gates and ICs.
7. Construction and verification of different Shift Registers.
8. Construction and verification of different types of Counters.
9. Study of important TTL technologies and verification of important TTL circuit parameters.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), III Semester

EA 304 – Electronic Devices

Unit 1: Semiconductor Material Properties: Elemental and compound semiconductor materials; bonding forces and energy bands in intrinsic and extrinsic silicon; charge carriers in semiconductors; carrier concentration; junction properties; equilibrium condition; biased junction; steady-state condition; breakdown mechanism (Rectifying Diodes, Zener Diodes); Metal-Semiconductor Junction. Special diodes include Tunnel diodes, Varactor diodes, Schottky diode, Photodiodes, Photodetector, LED, and Solar cell.

Unit 2: Diode Circuits: Ideal and practical diode, Clipper, Clamper. Power Supply: Rectifiers - Half Wave, Full Wave, Bridge Rectifier; filter circuits; voltage regulation using shunt and series regulator circuits; voltage regulation using ICs.

Unit 3: Fundamentals of BJT: Construction, basic operation, current components and equations; CB, CE, and CC configurations; input and output characteristics; Early effect; regions of operation: active, cut-off, and saturation; BJT as an amplifier. Ebers-Moll model; power dissipation in transistor (Pd, max rating); Photo Transistor. Transistor biasing circuits and analysis: Introduction, various biasing methods: Fixed bias, Self bias, Voltage Divider bias, Collector to Base bias; Load-line analysis: DC and AC analysis, operating point and bias stabilization, thermal runaway. Transistor as a switch.

Unit 4: Small Signal Analysis: Small signal amplifier, amplifier bandwidth, hybrid model, analysis of transistor amplifier using h-parameters. Multistage amplifier: Cascading amplifier, Bootstrapping technique, Darlington amplifier, Cascode amplifier; coupling methods in multistage amplifier. Low and high-frequency response, Hybrid π-model, current mirror circuits. Large Signal Analysis and Power Amplifiers: Class A, Class B, Class AB, Class C, Class D amplifiers; Transformer coupled and Push-Pull amplifiers.

Unit 5: FET Construction - JFET: Construction, n-channel and p-channel, transfer and drain characteristics, parameters, equivalent model and voltage gain; analysis of FET in CG, CS, and CD configurations. Enhancement and Depletion MOSFET drain and transfer characteristics. Unijunction Transistor (UJT) and Thyristors: UJT principle of operation, characteristics, and UJT relaxation oscillator.

Text/Reference Books:

1. Millman & Halkias, *Electronic Devices And Circuits*, TMH.
2. Salivahanan, Kumar & Vallavaraj, *Electronic Devices And Circuits*, TMH.
3. Boylestad & Neshelsky, *Electronic Devices & Circuits*, PHI.
4. Schilling & Belove, *Electronic Circuits: Discrete & Integrated*, TMH.
5. Chattopadhyay & Rakhshit, *Electronic Fundamentals & Applications*, New Age.
6. Adel S. Sedra & Kenneth C. Smith, *Microelectronic Circuits*, OUP.
7. R. A. Gayakwad, *Op-Amps And Linear Integrated Circuits*, PHI.
8. Theodore F. Bogart & Jeffrey S. Beasley, *Guillermo Rico Electronic Devices & Circuits*.
9. Allen Mottershead, *Electronic Devices & Circuits*.

Electronic Devices Lab:

1. Diode Characteristics:
   a) pn junction diode characteristics and static & dynamic resistance measurement from graph.
   b) Plot Zener diode characteristics curve.
2. Clipper/Clamper:
   a) Plot the characteristics curve of various clipper circuits.
   b) Plot the characteristics curve of various clamper circuits.
3. Half Wave, Full Wave & Bridge Rectifier:
   a) Measure Vrms and Vdc for half-wave, full-wave, and bridge rectifier.
   b) Measure ripple factor and rectification ratio for full-wave and half-wave rectifiers.
4. Voltage Regulation:
   Using Zener diode shunt regulator and transistor series voltage regulator in the following cases:
   a) Varying input.
   b) Varying load.

5. Characteristics of BJT:
   a) Plot input and output characteristics curve in CB and CE configurations.
   b) Find α and β and Q point from the curve.
   c) Plot the characteristics curve of various clipper circuits.
6. h-Parameters:
   Measure h-parameters (Av, Ai, Ro, and Ri) in CE amplifier.
7. Multistage Amplifier:
   a) Plot the characteristics curve for direct-coupled amplifier.
   b) Plot the characteristics curve for RC-coupled amplifier.
   c) Plot the characteristics curve for transformer-coupled amplifier.
8. FET Characteristics:
   a) Plot the characteristics curve for n-channel JFET in CS configuration.
   b) Find the pinch-off voltage from the characteristics curve.
9. UJT Characteristics:
   a) Plot the characteristics curve for UJT.
   b) Determine intrinsic stand-off ratio.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), III Semester

EA 305- Circuit Analysis

Unit 1: Introduction to Circuit Theory: Basic circuit elements R, L, and C, and their characteristics in terms of linearity and time-dependent nature; voltage and current sources; controlled and uncontrolled sources. KCL and KVL analysis, steady-state sinusoidal analysis using phasors; concept of phasor and vector, impedance and admittance, nodal and mesh analysis. Analysis of magnetically coupled circuits, dot convention, coupling coefficient, tuned circuits, series and parallel resonance.

Unit 2: Network Graph Theory: Concept of network graph, tree, tree branch and link, incidence matrix, cut set and tie set matrices, dual networks.

Unit 3: Network Theorems: Thevenin's and Norton's theorems, superposition, reciprocity, compensation, substitution, maximum power transfer, Millman's theorem, Tellegen's theorem. Problems involving dependent and independent sources.

Unit 4: Transient Analysis: Transients in RL, RC, and RLC circuits; initial and final conditions, time constants. Steady-state analysis. Laplace transform: Solution of integro-differential equations, transform of waveform synthesized with step ramp, gate and sinusoidal functions, initial and final value theorems, network theorems in the transform domain.

Unit 5: Two-Port Parameters: Z, Y, ABCD, hybrid parameters, their inverse and image parameters, relationship between parameters, interconnection of two-port networks, reciprocity and symmetry in all parameters.

Text/Reference Books:

1. M.E. Van Valkenburg, *Network Analysis*, Pearson.
2. S.P. Ghosh & A.K. Chakraborty, *Network Analysis & Synthesis*, McGraw-Hill.
3. NPTEL: Networks and Systems.

Reference:

1. Sudhakar, *Circuit Network Analysis & Synthesis*, TMH.
2. J. David Irwin, *Engineering Circuit Analysis*, Tenth Edition, Wiley India.
3. Kuo, *Network Analysis & Synthesis*, Wiley India.
4. Robert L. Boylestad, *Introductory Circuit Analysis*, Pearson.
5. Smarajit Ghosh, *Network Theory: Analysis and Synthesis*, PHI.
6. Roy Choudhary D., *Network and Systems*, New Age Publishers.
7. Bhattacharya and Singh, *Network Analysis & Synthesis*, Pearson.

Experiments List:

1. To verify Thevenin's theorem and Superposition theorem.
2. To verify Reciprocity theorem and Millman's theorem.
3. To verify Maximum Power Transfer theorem.
4. To determine open circuit and short circuit parameters of a two-port network.
5. To determine A, B, C, D parameters of a two-port network.
6. To determine h-parameters of a two-port network.
7. To find frequency response of RLC series and parallel circuits and determine resonance and 3 dB frequencies.
8. To determine charging and discharging times of capacitors.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), III Semester

EA 306 – Probability Theory Lab

SUGGESTED LIST OF EXPERIMENTS

1. To introduce MATLAB and Python.
2. To demonstrate combinatorial problems.
3. To demonstrate interesting puzzles, such as Monty Hall problem.
4. To explore the uniform random variable and generate uniformly distributed random numbers in a given interval and plot the histogram with specified number of bins.
5. To explore the Gaussian (normal) random variable and to generate normally distributed randomnumbers with specified mean and variance and plot the histogram.
6. To learn to approximate a histogram to a PDF for normally distributed random numbers.
7. To verify central limit theorem using a large number of independent and identically distributed (i.i.d.) random numbers using uniform and exponential distributions.
8. To verify the linearity and other properties of Gaussian (normal) random variables.
9. To explore other distributions, such as, exponential, Bernoulli, Binomial, and Poissondistributions.
10. To learn Monte Carlo simulation (MCS) through simple examples.
11. To compute and plot the Q-function and error function.
12. To implement random signal processing through LTI systems.
13. To estimate the PSD of random signals using the periodogram method.

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)

Electronics and Communication (Advanced Communication Technology)

IV Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Term work / Lab Work & Sessional		L	T	P	
1.	ES401	BSC	Energy & Environmental Engineering	70	20	10	-	-	100	3	1	-	4
2.	EA 402	DC	Signals & Systems	70	20	10	30	20	150	2	1	2	4
3.	EA 403	DC	Communication Theory	70	20	10	30	20	150	3	1	2	5
4.	EA 404	DC	Control System	70	20	10	30	20	150	3	1	2	5
5.	EA 405	DC	Analog Circuits	70	20	10	30	20	150	3	0	2	4
6.	EA 406	DLC *	Communication Simulation Lab-I	-	-	-	30	20	50	-	-	4	2
7.	BT407	DLC	90 hrs Internship based on using various software's –Internship -II	To be completed anytime during fourth semester. Its evaluation/credit to be added in fifth semester.									3
			Total	350	100	50	150	100	750	14	4	12	24
8.	BT408	MC	Cyber Security	Non-credit course									
9.	BT409I	MC	Indian Knowledge System	Non-credit course									
	NC001		NSS/NCC										

***A minimum of 2hours per week should be allotted for the Virtual Lab along with the slot fixed for the conventional lab classes.**

MST: Minimum of two mid semester tests to be conducted.

*Students can earn additional credits from the University recognized MOOC courses.

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Electronics and Communication (Advanced Communication Technology), IV Semester

ES401	**Energy & Environmental Engineering**	**3L-1T-0P**	**4 Credits**

The objective of this Course is to provide *an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application.*

Module 1: Introduction to Energy Science:

Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment; Overview of energy systems, sources, transformations, efficiency, and storage; Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries)

***Module2*: Ecosystems**

- Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.)Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

***Module 3*: Biodiversity and its conservation**

- Introduction – Definition: genetic, species and ecosystem diversity; Bio-geographical classification of India; Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, National and local levels; India as a mega-diversity nation; Hot-sports of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

***Module 4:* Environmental Pollution**

- Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards; Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution; Pollution case studies; Disaster

management: floods, earthquake, cyclone and landslides.

Module 5: **Social Issues and the Environment**

- From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns. Case Studies
  Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies Wasteland reclamation; Consumerism and waste products; Environment Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

Module 6: Field work

- Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

REFERENCE

1. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc.
2. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB).
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai,
4. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
5. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards', Vol I and II, Enviro Media (R)
6. Boyle, Godfrey, Bob Everett, and Janet Ramage (Eds.) (2004), Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press.
7. Schaeffer, John (2007), Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living, Gaiam

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), IV Semester

EA 402 – Signals and Systems

Unit-1 Introduction of Signals and Systems: Definition of signal, Classification of Signal and representation: Continuous time and discrete time, even/odd, periodic/aperiodic, random/deterministic, energy/power, one/multidimensional, some standard signals, , Basic Operations on Signals for CT/DT signal, transformation of independent & dependent variables,

Definition of system and their classification: CT/DT, linear/non-linear, variant/non-variant, causal and non-causal system state/dynamic system, interconnection of systems. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.

Unit-2 Linear Time- Invariant Systems: Introduction, Impulse Response Representation for LTI Systems, Convolution, Properties of the Impulse Response Representation for LTI Systems, Difference Equation for LTI Systems, Block Diagram Representations(direct form-I, direct form-II, Transpose, cascade and parallel). Impulse response of DT-LTI system and its properties.

Unit-3 z-Transform: Introduction, ROC of finite duration sequence, ROC of infinite duration sequence, Relation between Discrete time Fourier Transform and z-transform, properties of the ROC, Properties of z-transform, Inverse z-Transform, Analysis of discrete time LTI system using zTransform, Unilateral z-Transform.

Unit-4 Fourier analysis of discrete time signals: Introduction, Properties and application of discrete time Fourier series, Representation of Aperiodic signals, Fourier transform and its properties, Convergence of discrete time Fourier transform, Fourier Transform for periodic signals, Applications of DTFT.

Unit-5 State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction:

Reference Books:

1. Simon Haykin, “Signals and Systems”, John Wiley.
2. Simon Haykin, “Analog and Digital Communications”, John Willey.
3. Bruce Carlson, “Signals and Systems”, TMH.
4. Oppenheim & Wilsky, “Signals & Systems”, PHI.
5. Taub and Schilling "Principles of communication signals", 2nd ed. New York: Mcgraw-Hill, 1986.

LIST OF EXPERIMENTS

1. Introduction to MATLAB Tool.
2. To implement delta function, unit step function, ramp function and parabolic function for continuous-time.
3. To implement delta function, unit step function, ramp function and parabolic function for discrete-time.
4. To implement rectangular function, triangular function, sinc function and signum function for continuous-time.
5. To implement rectangular function, triangular function, sinc function and signum function for discrete-time.
6. To explore the communication of even and odd symmetries in a signal with algebraic operations.
7. To explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling & shifting).
8. To explore the time variance and time invariance property of a given system.
9. To explore causality and non-causality property of a system.
10. To demonstrate the convolution of two continuous-time signals.
11. To demonstrate the correlation of two continuous-time signals.
12. To demonstrate the convolution of two discrete-time signals.
13. To demonstrate the correlation of two discrete-time signals.
14. To determine Magnitude and Phase response of Fourier Transform of given signals.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), IV Semester

EA 403– Communication Theory

Unit 1: Introduction to Communication Systems and Fourier Transform

Overview of Communication Systems; Objectives; Types: Analog and Digital, Block Diagrams, Functions of Each Block, Need for Modulation, Comparison.

Concept of Frequency Domain; Frequency Domain Representation of Continuous-Time Signals: Fourier Transform and Its Properties; Fourier Transform of Some Useful Signals: Impulse, Step, Signum, Cosine, Sine, Gate Pulse, Constant; Properties of Impulse (Dirac Delta) Function.

Time Autocorrelation Function; Energy Spectral Density; Power Spectral Density.

Unit 2: Essentials of Analog Communication

Amplitude Modulation (AM): Principles of AM, DSB, VSB, Introduction to SSB with Brief Hilbert Transform Explanation; Modulation Index, Power Considerations; AM Demodulation Techniques (Envelope Detector, Coherent Detection); Spectral Analysis of AM Signals, such as Single-Tone AM Signals; Superheterodyne Receiver: Basic Block Diagram, Functionality, Characteristics.

Angle Modulation (FM and PM): Frequency Modulation (FM) and Phase Modulation (PM) Principles; Narrowband and Wideband FM; Modulation Index; Carson's Rule; Demodulation of FM and PM (Discriminator, PLL); Spectral Analysis of Single-Tone FM Signals; Comparison of AM, FM, and PM.

Unit 3: Random Processes and Noise in Communication

Review of Probability Theory, Random Variables, PDF, CDF, and Expectation; Introduction to Random Processes: Stationary (WSS) and Ergodic Processes; Autocorrelation Function, Power Spectral Density (PSD); Noise: Classification, Sources of Noise, Signal-to-Noise Ratio (SNR), Noise Figure, Noise Temperature, Noise Bandwidth; Properties of White Noise, Gaussian Noise; Filtering of Random Signals through Linear Time-Invariant (LTI) Systems; Hilbert Transform and Complex-Baseband Representation of Real-Passband Signals and Systems.

Unit 4: Essentials of Digital Communication

Pulse Code Modulation (PCM) and Delta Modulation: Sampling Theorem, Ideal and Practical Sampling, Aliasing, Quantization, Quantization Noise, Companding, Pulse Code Modulation (PCM); 6-dB Rule; Differential PCM (DPCM) and Delta Modulation; Line Coding.

Inter-Symbol Interference (ISI); Nyquist Criterion for ISI-Free Transmission; Introduction to Pulse Shaping and Equalization.

Digital Modulation Techniques: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), and Phase Shift Keying (PSK); Quadrature Amplitude Modulation (QAM); Spectral Efficiency and

Bandwidth Considerations; Matched Filter, MAP and ML Detection Techniques, Gram–Schmidt Orthonormalization and the Concept of Signal Space; Bit Error Rate (BER) and Signal-to-Noise Ratio (SNR) for Digital Modulation Techniques.

Unit 5: Introduction to Information Theory and Coding

Definition of Information, Entropy, Source Coding Theorem; Shannon–Fano and Huffman Coding; Discrete Memoryless Channels, Mutual Information; Channel Capacity: The Shannon-Hartley Theorem and SNR–Bandwidth Trade-Off; Channel-Coding Theorem; Introduction to Channel Coding: Hamming Distance, Error Detection, and Correction (Hamming Codes, CRC)

Textbooks

1. S. Haykin and M. Moher, *Communication Systems*, 5th Edition, Wiley.
2. U. Madhow, *Introduction to Communication Systems*, Cambridge University Press.

Reference Books

1. B. P. Lathi, *Modern Digital and Analog Communication Systems*, 4th Edition, Oxford University Press.
2. J. G. Proakis and M. Salehi, *Communication Systems Engineering*, 2nd Edition, Pearson Education.
3. H. Taub and D. L. Schilling, *Principles of Communication Systems*, 3rd Edition, Tata McGraw-Hill.
4. Hwei P. Hsu, *Schaum's Outline of Analog and Digital Communications*, 2nd Edition, McGraw-Hill.
5. R. P. Singh and S. D. Sapre, *Communication Systems: Analog and Digital*, 3rd Edition, McGraw Hill.
6. P. R. Rao, *Communication Systems*, McGraw Hill, 2013.

SUGGESTED LIST OF EXPERIMENTS

1. Amplitude Modulation (AM) and Demodulation
2. Frequency Modulation (FM) and Demodulation
3. Pre-emphasis and De-emphasis Circuits
4. Phase-Locked Loop (PLL)
5. AM Superheterodyne Radio Receiver
6. Frequency-Division Multiplexing (FDM) and Demultiplexing
7. Sampling and Reconstruction: Oversampling and Undersampling
8. PCM Transmitter and Receiver
9. Time-Division Multiplexing and Demultiplexing
10. Study of ASK, FSK, PSK, QPSK
11. Delta Modulation and Demodulation

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), IV Semester

EA 404 Control Systems

Unit-1 Introduction to Control system: Terminology and classification of control system, examples of control system, mathematical modeling of mechanical and electrical systems, differential equations, transfer function, block diagram representation and reduction, signal flow graph techniques.

Feedback characteristics of control systems Open loop and closed loop systems, effect of feedback on control system and on external disturbances, linearization effect of feedback, regenerative feedback

.**Unit-2 Time response analysis** Standard test signals, time response of 1st order system, time response of 2nd order system, steady-state errors and error constants, effects of additions of poles and zeros to open loop and closed loop system.

Time domain stability analysis Concept of stability of linear systems, effects of location of poles on stability, necessary conditions for stability, Routh-Hurwitz stability criteria, relative stability analysis, Root Locus concept, guidelines for sketching Root-Locus.

Unit-3 Frequency response analysis Correlation between time and frequency response, Polar plots, Bode Plots, all-pass and minimum-phase systems, log-magnitude versus Phase-Plots, closed-loop frequency response.

Frequency domain stability analysis : Nyquist stability criterion, assessment of relative stabilityusing Nyquist plot and Bode plot (phase margin, gain margin and stability).

Unit-4 Approaches to system design Design problem, types of compensation techniques, design of phase-lag, phase lead and phase lead-lag compensators in time and frequency domain, proportional, derivative, integral and Composite Controllers.

Unit-5 State space representation of systems, block diagram for state equation, transfer function decomposition, solution of state equation, transfer matrix, relationship between state equation and transfer function, controllability and observability.

Text/Reference Books:

1. Albert D. Helfrick, William David Cooper, "Modern electronic instrumentation and measurement techniques", TMH 2008.
2. Oliver Cage, "Electronic Measurements and Instrumentation", TMH, 2009.
3. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Buterworth Heinmann), 2008.
4. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Ed., PHI, New Delhi2008.
5. H.S. Kalsi, "Electronics Instrumentation", TMH Ed. 2004
6. A.K.Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai.
7. MMS Anand, "Electronic Instruments & Instrumentation Technology", PHI Pvt. Ltd., NewDelhi Ed. 2005

CONTROL SYSTEM LAB

Control System performance analysis and applications of MATLAB in Control system performance analysis & design.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), IV Semester

EA 405 Analog Circuits

COURSE CONTENTS:

Feedback Amplifier and Oscillators: Concept of feedback and their types, Amplifier with negative feedback and its advantages. Feedback Topologies.

Oscillators: Concept of Positive feedback, Classification of Oscillators, Barkhausen criterion, Types of oscillators: RC oscillator, RC Phase Shift, Wien Bridge Oscillators. LC Oscillator: Hartley, Colpitt's, Clapp and Crystal oscillator.

Introduction to integrated circuits: Advantages and characteristic parameters of IC's, basic building components, data sheets

Operational Amplifier: Differential amplifier and analysis, Configurations- Dual input balanced output differential amplifier, Dual input Unbalanced output differential amplifier, Single input balanced output differential amplifier, Single input Unbalanced output differential amplifier Introduction of op-amp, Block diagram, characteristics and equivalent circuits of an ideal opamp, Power supply configurations for OP-AMP.

Characteristics of op-amp: Ideal and Practical, Input offset voltage, offset current, Input bias current, Output offset voltage, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio (CMRR), Slew rate and its Effect, PSRR and gain bandwidth product, frequency limitations and compensations, transient response, analysis of TL082 datasheet.

OP-AMP applications: Inverting and non-inverting amplifier configurations, Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO, Comparator, Zero Crossing Detector. OP-AMP AS FILTERS: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, Notch filter; all pass filters, self-tuned filters, AGC,AVC using op-AMP.

TIMER:IC-555 Timer concept, Block pin configuration of timer. Monostable, Bistable and AstableMultivibrator using timer 555-IC, Schmitt Trigger, Voltage limiters, Clipper and

clampers circuits, Absolute value output circuit, Peak detector, Sample and hold Circuit, Precision rectifiers, Voltage-to-current converter, Current-to-voltage converter.

Voltage Regulator: simple OP-AMP Voltage regulator, Fixed and Adjustable Voltage Regulators, Dual Power supply, Basic Switching Regulator and characteristics of standard regulator ICs such as linear regulator, Switching regulator andlow-drop out regulator. Study of LM317, TPS40200 and TPS7250

TEXT BOOKS:

1. RamakantA.Gaikward,"OP- Amp and linear Integrated circuits" Third edition 2006, Pearson.
2. B. Visvesvara Rao Linear Integrated Circuits Pearson.
3. http://www.nptelvideos.in/2012/11/analog-ics.html
4. http://nptel.ac.in/courses/117108107/

REFERENCES:

1. David A. Bell: Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition,2010.
2. D. Roy Choudhury:Linear Integrated Circuits New Age Publication.
3. B. Somanathan Nair: Linear Integrated Circuits analysis design and application Wiley India Pvt. Ltd.
4. Maheshwary and Anand: Analog Electronics, PHI.
5. S.Salivahanan,V S KanchanaBhaaskaran: Linear Integrated Circuits",second edition, McGraw Hill.
6. Gray Hurst Lewis Meyer Analysis and design of analog Integrated Circuits fifth edition Wiley India.
7. RobertF.Coughlin, Frederick,F.Driscoll: Operational Amplifiers and Linear Integrated Circuits, sixth edition, Pearson.
8. Millman and Halkias: Integrated electronics, TMH.
9. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
10. Sedra and Smith: Microelectronics, Oxford Press.

List of Experiments :

Apparatus Required –Dual Channel Cathode Ray Oscilloscope (0-20 MHz), Function Generator (10MHz and above), Dual Power Supply, LM741, TL082, MPY634,TPS7250, Probes, digital multimeter.

1. To measure and compare the op-amp characteristics: offset voltages, bias currents, CMRR, Slew Rate of OPAMP LM741 and TL082.
2. To determine voltage gain and frequency response of inverting and non-inverting amplifiers using TL082.
3. To design an instrumentation amplifier and determine its voltage gain using TL082.
4. To design op-amp integrator (low pass filter) and determine its frequency response.
5. To design op-amp differentiator (high pass filter) and determine its frequency response.

6. Design 2nd order Butterworth filter using universal active filter topology with LM741
7. To design Astable, Monostable and Bistablemultivibrator using 555 and analyse its characteristics.
8. Automatic Gain Control (AGC) Automatic Volume Control (AVC)using multiplier MPY634
9. To design a PLL using opampwith MPY634 anddetermine the free running frequency, the capture range and the lock in range of PLL
10. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with TPS7250 IC.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), IV Semester

EA 406 Communication Simulation Lab - I

COURSE CONTENTS:

Simulations using MATLAB, SIMULINK, Python, and GNU Radio:

1. Amplitude Shift Keying
2. Phase Shift Keying
3. Frequency Shift Keying
4. Quadrature Phase Shift Keying
5. Differential Phase Shift Keying
6. ASK Demodulation Using Product Detection
7. FSK Demodulation Using Envelope Detector
8. Noise Generation Using PM Sequence
9. Time Division Multiplexing
10. Implement a complete digital communication system and carry out its performance analysis.

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New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)

Electronics and Communication (Advanced Communication Technology)

V Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credit
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Term work / Lab Work & Sessional		L	T	P	
1.	EA501	DC	Digital Signal Processing	70	20	10	30	20	150	2	1	2	4
2.	EA502	DC	Electromagnetic Theory and Transmission Lines	70	20	10	30	20	150	2	1	2	4
3.	EA503	DE	Departmental Elective	70	20	10	-	-	100	4	-	0	4
4.	EA504	OE	Open Elective	70	20	10	-	-	100	3	-	0	3
5.	EA505	D Lab	Communication Simulation Lab-II	-	-	-	30	20	50	-	-	4	2
6.	EA506	O/E Lab	Programming, Data Structures and Algorithms using Python/MATLAB	-	-	-	30	20	50	-	-	4	2
7.	BT407	IN	Evaluation of Internship-II	-	-	-	-	100	100	-	-	6	3
8.		IN	Internship-III	To be completed anytime during fifth/sixth semester. Its evaluation/credit to be added in seventh semester.									
9.	EA508	P	Minor Project-I	-	-	-	-	50	50	-	-	4	2
10.	Additional Credits[#]	*[#]Additional credits can be earned through successful completion of credit based MOOC's Courses available on SWAYAM platform (MHRD) at respective UG level.*											
		Total		280	80	40	120	230	750	11	2	22	24

Departmental Electives	Open Electives
EA503 (A) Wireless and Cellular Communications	EA504 (A) Applied Linear Algebra
EA503 (B) Detection and Estimation Theory	EA504 (B) Computer System Organization
EA503 (C) Microprocessor and Microcontroller	EA504 (C) VLSI Design

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

A501 – Digital Signal Processing

Unit 1: Discrete-Time Signals and Systems

Discrete-time signals, discrete-time systems, analysis of discrete-time linear time-invariant systems, discrete-time systems described by difference equations, solution of difference equations, implementation of discrete-time systems, stability and causality, frequency domain representation of discrete-time signals and systems

Unit 2: The z-Transform

The direct z-transform, properties of the z-transform, rational z-transforms, inversion of the z-transform, analysis of linear time-invariant systems in the z-domain, block diagrams and signal flow graph representation of digital networks, matrix representation

Unit 3: Frequency Analysis of Discrete-Time Signals

Discrete Fourier series (DFS), properties of the DFS, discrete Fourier transform (DFT), properties of DFT, two-dimensional DFT, circular convolution

Unit 4: Efficient Computation of the DFT

FFT algorithms: decimation-in-time algorithm, decimation-in-frequency algorithm, decomposition for composite numbers

Unit 5: Digital Filter Design Techniques

Design of IIR and FIR digital filters, impulse invariance and bilinear transformation, windowing techniques (rectangular and other windows), examples of FIR filter design using windowing

Textbooks:

1. **Alan V. Oppenheim, Ronald W. Schafer, John R. Buck**, *Discrete-Time Signal Processing*, Prentice-Hall.
2. **John G. Proakis and Dimitris G. Manolakis,** *Digital Signal Processing, 4e*, Pearson Education.

References:

1. **Ingle and Proakis,** *Digital Signal Processing – A MATLAB-Based Approach*, Thomson.
2. **Johnny R. Johnson,** *Introduction to Digital Signal Processing*, PHI Learning.
3. **Rabiner and Gold,** *Theory and Application of Digital Signal Processing*, PHI Learning.

Suggested NPTEL Course:

1. **Prof. V. M. Gadre,** *Digital Signal Processing and its Applications*, IIT Bombay, 2020 [Online]. Available: https://archive.nptel.ac.in/courses/108/101/108101174/

Suggested List of Experiments

(To be performed using MATLAB/Octave/Python)

1. Generate basic sequences: impulse, step, rectangular, triangular, real and complex exponential, and sinusoidal, with specified shifts in a given interval.
2. Compute the energy/average power of a given sequence.
3. Generate an arbitrary sequence and perform shifting, reflection, and time-scaling operations on it.
4. Perform addition, subtraction, multiplication, and convolution of sequences.
5. Implement an M-point moving average filter.
6. Obtain impulse and step responses of an LTI system.
7. Check basic system properties: linearity, time-invariance, causality, and stability.
8. Decompose a real sequence into its even and odd components and a complex sequence into its conjugate symmetric and conjugate anti-symmetric components.
9. Implement down-sampling and observe its effects.
10. Carry out correlation analysis and use it to estimate the delay and corresponding attenuation in a multipath system.
11. Verify the sampling theorem with oversampling and observe the aliasing effect caused by undersampling.
12. Plot the frequency response of a digital filter in a desired frequency interval.
13. Verify DTFT properties.
14. Design a digital Butterworth low-pass filter using bilinear transformation.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

EA502 – Electromagnetic Theory and Transmission Lines

Unit 1: Static Electric Field

Steady electric field: Coulomb's law, units, electric field intensity, electric flux and flux density, Gauss's law, boundary relations, concept of divergence, curl, scalar and vector potential, electric field in dielectrics and conductors, continuity equation, methods of images.

Unit 2: Magnetic Field

Magnetic field due to steady currents, force between current-carrying wires, Stokes's theorem, vector magnetic potential, magnetization vector and its relation to the magnetic field.

Unit 3: Maxwell's Equations and Plane Waves

Maxwell's equations: Time-varying field and displacement current, Faraday's law. Wave equation: Poynting vector, plane electromagnetic waves in free space, dielectric medium, and conducting medium; skin depth, Slepian vector.

Unit 4: Wave Propagation in Dielectrics

Wave propagation in lossy dielectrics, plane waves in lossless dielectrics, reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence

Unit 5: Transmission Lines

Concept of distributed elements, transmission line parameters (primary and secondary), transmission line equations, standing waves and impedance transformation, Smith chart and its applications, applications of transmission lines of various lengths, impedance matching using transmission lines

Textbooks:

1. **W. Hayt and J. Buck**, *Engineering Electromagnetics*, 7th Edition, McGraw Hill.
2. **Matthew N. O. Sadiku,***Elements of Electromagnetics*, 2nd Edition, Saunders College Publishing.
3. **J. D. Kraus,***Electromagnetics*, McGraw Hill.
4. **John D. Ryder,***Networks and Transmission Lines*, 4th Edition, Pearson Learning.

Reference Books:

1. **E. C. Jordan & K. G. Balmain,***Electromagnetic Waves & Radiating Systems*, Prentice Hall.
2. **S. Ramo, J. R. Whinnery & T. Van Duzer,***Fields & Waves in Communication Electronics*, John Wiley & Sons.
3. **N. N. Rao,***Elements of Engineering Electromagnetics*, 3rd Edition, Prentice Hall.
4. **R. K. Shevgaonkar,***Electromagnetic Waves*, McGraw Hill.

Similar NPTEL Courses:

1. P. Kumar, *Electromagnetic Theory*, NPTEL, 2022. [Online]. Available: https://onlinecourses.nptel.ac.in/noc22_ee69/

Suggested List of Experiments

1. Study the frequency characteristics of the transmission line.
2. Measure the characteristic impedance of a transmission line.
3. Study the establishment of a stationary wave in a transmission line and understand the concept of reflection.
4. Plot the frequency response and calculate the bandwidth of an *m*-derived low-pass filter section.
5. Plot the frequency response and calculate the bandwidth of an *m*-derived high-pass filter section.
6. Plot the frequency response and calculate the bandwidth of an *m*-derived band-pass filter section.
7. Plot the frequency response and calculate the bandwidth of a constant-*k* low-pass filter section.
8. Plot the frequency response and calculate the bandwidth of a constant-*k* high-pass filter section.
9. Plot the frequency response and calculate the bandwidth of a constant-*k* band-reject filter section.
10. Plot the frequency response and calculate the bandwidth of a constant-*k* band-pass filter section.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

EA503 (A) – Wireless and Cellular Communications

Unit 1: Overview of Cellular Systems and Evolution

Evolution of 2G/3G/4G/5G, cellular concepts – frequency reuse, co-channel and adjacent channel interference, C/I, handoff, blocking, Erlang capacity

Unit 2: Radio Propagation and Cellular Engineering Concepts

Fundamental radio propagation and system concepts, propagation characteristics, models of multipath-faded radio signals – unmodulated carrier, envelope and phase faded, level crossing rate and fade duration, delay spread measurements

Unit 3: Speech Coding Techniques

Speech coding techniques for audio and voice – pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation, vocoder, and linear predictive coding (LPC); performance comparison of speech processing techniques

Unit 4: Digital Modulation-Demodulation (Modem) Principles and Architectures

Coherent modem – baseband modem equivalence, coherent and differentially coherent binary phase shift keying (BPSK) systems, synchronization – carrier recovery and symbol timing recovery, differential encoding and decoding requirements, quadrature phase shift keying (QPSK) – coincident and offset types, $\pi/4$ DQPSK modems.

Unit 5: Interference in Wireless Digital Communication

Carrier-to-interference and carrier-to-noise limited systems, co-channel interference, adjacent channel interference, externally caused co-channel interference; definitions and performance of spectral and power efficiency, relationship of the bit-energy to noise-density ratio and the carrier-to-noise ratio, power efficiency and bit-error-rate performance in an additive white Gaussian noise (AWGN) environment; concepts of diversity branch and signal paths, combining and switching methods.

Textbooks:

1. **W. C. Lee,** *Mobile Cellular Telecommunications*, McGraw-Hill.
2. **T. S. Rappaport,** *Wireless Communication*, Prentice Hall.

References:

1. **David Tse and Pramod Viswanath,** *Fundamentals of Wireless Communication*, Cambridge University Press.
2. **Andrea Goldsmith,** *Wireless Communications*, Stanford University.

Suggested NPTEL Course:

1. **Prof. R. David Koilpillai**, *Introduction to Wireless and Cellular Communications*, IIT Madras, [Online]. Available: https://nptel.ac.in/courses/106106167

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

EA 503(B) – Detection and Estimation Theory

Unit 1: Background and Statistical Decision Theory

Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in the discrete-time domain

Bayesian, minimax, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, asymptotic relative efficiency.

Unit 2: Detection of Deterministic Signals

Matched filter detector and its performance; generalized matched filter; detection of a sinusoid with unknown amplitude, phase, frequency, and arrival time; linear model.

Unit 3: Detection of Random Signals

Estimator-correlator, linear model, general Gaussian detection, detection of Gaussian random signals with unknown parameters, weak signal detection

Unit 4: Nonparametric Detection

Detection in the absence of a complete statistical description of observations; sign detector, Wilcoxon detector, detectors based on quantized observations, robustness of detectors

Unit 5: Estimation of Signal Parameters

Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency

Bayesian Estimation: Philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

Signal Estimation in Discrete-Time:
Linear Bayesian estimation, Wiener filtering, dynamical signal model, discrete Kalman filtering.

Textbooks:

1. **S. M. Kay,***Fundamentals of Statistical Signal Processing: Detection Theory*, Prentice Hall PTR, 1998.
2. **S. M. Kay,***Fundamentals of Statistical Signal Processing: Estimation Theory*, Prentice Hall PTR, 1993.

Reference Books:

1. **H. L. Van Trees,***Detection, Estimation, and Modulation Theory: Part I, II, and III*, John Wiley, NY, 1968.

2. **H. V. Poor,***An Introduction to Signal Detection and Estimation*, Springer, 2nd Edition, 1998.

Similar NPTEL Courses:

1. **R. Sinha,***Signal Detection and Estimation Theory*, NPTEL. [Online]. Available: https://nptel.ac.in/courses/117103018

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

EA503(C) – Microprocessor and Microcontroller

Unit 1: Introduction to Advanced Microprocessors

Salient features of advanced microprocessors; RISC & CISC processors; review and evolution of advanced microprocessors: 8086, 8088, 80186/286/386/486/Pentium.

Introduction to the 8086 processor: Register organization, architecture, signal description, minimum mode 8086 systems and timings, maximum mode 8086 systems and timings.

Unit 2: Intel 8086 Microprocessor Programming

8086 instruction set, addressing modes, and assembly language programming with the Intel 8086 microprocessor.

Unit 3: General-Purpose Programmable Peripheral Devices

8253/8254 programmable interval timer, 8259A programmable interrupt controller, 8257 DMA controller, USART, serial I/O, and data communication.

Unit 4: Introduction to Microcontrollers (8051) and Embedded Systems

8051 architecture, pin description, I/O configuration, interrupts, addressing modes, an overview of the 8051 instruction set, embedded systems, and the use of microcontrollers in embedded applications.

Unit 5: 8051 Interfacing, Applications, and Serial Communication

8051 interfacing with ADC and DAC, stepper motor interfacing, timer/counter functions, 8051-based data acquisition system, RS-232 connections, serial communication, serial communication modes, serial communication programming, and serial port programming in C.

Textbooks:

1. **A.K. Ray and K. M. Bhurchandi,***Advanced Microprocessor and Peripherals*, Tata McGraw Hill.
2. **Muhammad Ali Mazidi and Janice Gillespie Mazidi,***The 8051 Microcontroller and Embedded Systems*, Pearson Education, 2005.

Reference Books:

1. **D.V. Hall,***Microprocessor and Interfacing*, McGraw Hill.
2. **V. Udayashankara and M.S. Mallikarjunaswamy,***8051 Microcontroller: Hardware, Software & Applications*, Tata McGraw Hill, 2009.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

EA-504 (A) Applied Linear Algebra

Unit 1: Vectors and Vector Spaces

Vectors, Vector Space, Subspaces, Linear Combinations and systems of Linear Equations, Linear Dependence and Linear Independence, Bases and Dimension, Linear Transformations, Null spaces and Ranges.

Unit 2: Matrix Operations and Transformations

Matrix representation of a Linear Transformation, Composition of Linear Transformations and Matrix Multiplication, Invertibility and Isomorphism, Change of coordinate matrix, Elementary Matrix Operations and Elementary Matrices, Rank of a Matrix and Matrix Inverse

Unit 3: Determinants and Eigenvalues

Systems of Linear Equations-Theoretical and Computational, Determinants of order 2, Determinants of order n, Properties of Determinants, Eigen values and Eigen vectors, Diagonalizability, Invariant subspaces and the Cayley-Hemilton theorem.

Unit 4: Inner Products and Orthogonality

Inner Product and Norms, Gram Schmidt Orthogonalization Process and Orthogonal Complements, Adjoint of a Linear Operator, Normal and Self-Adjoint Operators, Unitary and Orthogonal Operators and their matrices, Orthogonal projections and spectral theorem.

Unit 5: Jordan Canonical Form and Minimal Polynomial

Jordan canonical form I, Jordan canonical form II, Minimal polynomial

Text Books

1. **Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence**, *Linear Algebra (4th Edition)*
2. **Sheldon Axler,***Linear Algebra Done Right (4th Edition)*

Reference Books

1. **Gilbert Strang**, *Linear Algebra and its Application,* 4th Edition
2. **Gilbert Strang,***Introduction to Linear Algebra,* 4th Edition
3. **Kenneth Hoffman, Ray Kunze**, *Linear Algebra,* 2nd Edition,Pearson
4. **Stevan Roman,***Advanced Linear Algebra*,2nd Edition,Springer
5. **K. B. Datta,***Matrix and Linear Algebra*, Prentice Hall of India

Similar NPTEL Courses:

1. **Aditya K. Jagarnnatham,***Applied Linear Algebra for Signal Processing, Data Analytics, and Machine Learning* ,IIT Kanpur, NPTEL [Online], Available:https://nptel.ac.in/courses/108104174

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

504 (B) Computer System Organization

Unit 1: Computer Basics and CPU

Von Neumann model, various subsystems, CPU, Memory, I/O, System Bus, CPU and Memory registers, Program Counter, Accumulator, Instruction register, Micro operations, Register Transfer Language, Instruction Fetch, decode and execution, data movement and manipulation, Instruction formats and addressing modes of basic computer.

Unit 2: Control Unit Organization

Hardwired control unit, Micro and nanoprogrammed control unit, Control Memory, Address Sequencing, Micro Instruction formats, Micro program sequencer, Microprogramming.

Arithmetic and Logic Unit
Arithmetic Processor, Addition, subtraction, multiplication and division, Floating point and decimal arithmetic and arithmetic units, design of arithmetic unit.

Unit 3: Input Output Organization

Modes of data transfer – program controlled, interrupt driven and direct memory access, Interrupt structures, I/O Interface, Asynchronous data transfer, I/O processor. Data transfer – Serial/parallel, synchronous/asynchronous, simplex/half duplex and full duplex.

Unit 4: Memory Organization

Memory Maps, Memory Hierarchy, Cache Memory - Organization and mappings, Associative memory, Virtual memory, Memory Management Hardware

Unit 5: Multiprocessors

Pipeline and Vector processing, Instruction and arithmetic pipelines, Vector and array processors, Interconnection structure and inter-processor communication

Textbooks

1. **Morris Mano,** *Computer System Architecture*, Pearson Education.
2. **William Stallings,** *Computer Organization and Architecture*, PHI.

References

1. **Carl Hamacher,** *Computer Organization*, TMH
2. **Tanenbaum,** *Structured Computer Organization*, Pearson Education

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

V-Semester:EA504 (C) VLSI Design

Unit 1: Practical Consideration and Technology in VLSI Design

Introduction, Size and complexity of Integrated Circuits, The Microelectronics Field, IC Production Process, Processing Steps, Packaging and Testing, MOS Processes, NMOS Process, CMOS Process, Bipolar Technology, Hybrid Technology, Design Rules and Process Parameters.

Unit 2: Device Modeling

DC Models, Small Signal Models, MOS Models, MOSFET Models in High Frequency and small signal, Short channel devices, Sub-threshold Operations, Modeling Noise Sources in MOSFET's, Diode Models, Bipolar Models, Passive component Models.

Unit 3: Circuit Simulation

Introduction, Circuit Simulation Using Spice, MOSFET Model, Level 1 Large signal model, Level 2 Large Signal Model, High Frequency Model, Noise Model of MOSFET, Large signal Diode Current, High Frequency BJT Model, BJT Noise Model, Temperature dependence of BJT

Unit 4: Structured Digital Circuits and Systems

Random Logic and Structured Logic Forms, Register Storage Circuits, Quasi Static Register Cells, Astatic Register Cell, Microcoded Controllers, Microprocessor Design, Systolic Arrays, Bit-Serial Processing Elements, Algotronix

Unit 5: CMOS Processing Technology

Basic CMOS Technology, A Basic n-well CMOS Process, Twin Tub Processes, CMOS Process Enhancement, Interconnects and Circuit Elements, Layout Design Rules, Latch-up, Physical Origin, Latch-up Triggering, Latch-up Prevention, Internal Latch-up Prevention Techniques

Textbooks

1. **Weste, Harris and Banerjee,** *CMOS VLSI Design*, Pearson Education.
2. **Pucknell and Eshraghian,** *Basic VLSI Design*, PHI Learning.

References

1. **Geiger, Allen and Strader,** *VLSI Design Techniques for Analog and Digital Circuits*, TMH.
2. **Sorab Gandhi,** *VLSI Fabrication Principles*, Wiley India.
3. **Sze,** *VLSI Technology*, TMH.

Suggested NPTEL Course

1. **Prof. Sudeb Dasgupta,***CMOS Digital VLSI Design*, IIT Roorkee, NPTEL. [Online]. Available: https://nptel.ac.in/courses/108107129

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

EA-505: Communication Simulation Lab - II

SUGGESTED LISTOFEXPERIMENTS

1. Study of Phase Detector (PD), Voltage-Controlled Oscillator (VCO), and Loop Filter.
2. Measure and analyze the lock range and capture range for different VCO frequencies.
3. Observe how the PLL responds to sudden phase/frequency changes.
4. Study different types of loop filters (e.g., passive, active) and their impact on phase noise.
5. Implement frequency multiplication and division using a PLL.
6. Measure phase noise and jitter in the PLL output.
7. Compare the performance of analog and digital PLLs.
8. Demonstrate PLL use in demodulating FM signals, clock recovery, and signal synchronization.
9. Setting up an SDR platform (e.g., RTL-SDR, HackRF, USRP).
10. Installing and configuring GNU Radio, SDR# (SDR Sharp), or MATLAB for SDR processing.
11. Capturing and analyzing real-world RF signals.
12. Observing spectrum occupancy in different frequency bands.
13. Implementing and testing AM/FM receivers using SDR.
14. Extracting audio from broadcast radio signals.
15. Transmitting and receiving digitally modulated signals.
16. Studying bit error rate (BER) and signal quality.
17. Observing LTE network signals using SDR.
18. Implementing a simple SDR-based transceiver.
19. Exploring SDR applications in IoT and LPWAN (LoRa, SigFox).
20. Intercepting and analyzing wireless signals (Wi-Fi, Bluetooth, RFID).

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), V Semester

506– Programming, Data Structures and Algorithms using Python/MATLAB

1. Perform basic operations using variables, conditionals, loops, and functions. Write a program to compute the greatest common divisor (GCD) using loops and recursion.
2. Perform operations on strings, lists, and tuples, including slicing and concatenation. Write a program to perform binary search on a sorted list. Implement selection sort and insertion sort, and analyze their performance.
3. Implement and compare merge sort and quicksort in terms of execution time and stability.Analyze the time complexity of different sorting algorithms and represent it using O() notation.
4. Implement functions with optional arguments, default values, and function arguments passed by reference and value.
5. Create a word frequency counter using Python/MATLAB dictionaries.
6. Write a program that handles common exceptions such as ZeroDivisionError, FileNotFoundError, and KeyError.
7. Implement stack and queue data structures and demonstrate their operations.
8. Create a Python class for a bank account, allowing deposit and withdrawal transactions.
9. Implement insertion, search, and deletion in a BST.
10. Implement Fibonacci sequence computation using recursion, memoization, and dynamic programming to compare execution times.

Similar NPTEL courses:

1. **M.Mukund,** *Programming, Data Structures And Algorithms Using Python*, NPTEL, 2022. [Online]. Available: https://onlinecourses.nptel.ac.in/noc22_cs26/preview

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)

Electronics and Communication (Advanced Communication Technology)

VI Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Term work / Lab Work & Sessional		L	T	P	
1.	EA601	DC	Data Communication and Networking	70	20	10	30	20	150	2	1	2	4
2.	EA602	DC	Antenna and Wave Propagation	70	20	10	30	20	150	2	1	2	4
3.	EA603	DE	Departmental Elective	70	20	10	-	-	100	4	-	0	4
4.	EA604	OE	Open Elective	70	20	10	-	-	100	4	-	0	4
5.	EA605	D Lab	Phase-Locked Loop (PLL) Lab	-	-	-	30	20	50	-	-	6	3
6.	EA606	O/E Lab	Essentials of Machine Learning using Python/MATLAB	-	-	-	30	20	50	-	-	6	3
7.	EA607	IN	Internship-III	To be completed anytime during Fifth/Sixth semester. Its evaluation/credit to be added in Seventh Semester.									
8.	EA608	P	Minor Project-II	-	-	-	-	50	50	-	-	4	2
9.	Additional Credits#	#*Additional credits can be earned through successful completion of credit based MOOC's Courses available on SWAYAM platform (MHRD) at respective UG level.*											
		Total		**280**	**80**	**40**	**120**	**130**	**650**	**12**	**2**	**20**	**24**

Departmental Electives	Open Electives
EA603 (A) 5G Technology	EA604 (A) Computer Vision and Image Processing
EA603 (B) Internet of Things	EA604 (B) Fundamentals of Machine Learning
EA603 (C) Multirate DSP	EA604 (C) Entrepreneurship and IP Strategy

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA601- Data Communication and Networking

Unit 1: Data Communication

Introduction, components, data representation, serial & parallel transmission, modes of data transmission,**Line Encoding:** Unipolar, Polar, Bipolar. **Networks:** Protocols and standards, standards organizations, line configurations, topology, transmission modes, categories of networks, internetworks.

Unit 2: OSI Model and Switching

Functions of the OSI layers,**Transmission Media:** Guided and unguided media, transmission impairment, performance. **Switching Techniques:** Circuit switching, packet switching (virtual circuit and datagram approach), message switching.

Unit 3: Networking Devices and TCP/IP Protocol Suite

Networking and Internetworking Devices: Repeaters, bridges, switches, routers, gateways. **Routing Algorithms:** Distance vector routing, link state routing,**UDP Frame Structure-TCP/IP Protocol Suite:** Overview of TCP/IP.

Unit 4: Error Control and Data Link Protocols

Error Detection and Correction: Types of errors, detection methods—Vertical Redundancy Check (VRC), Longitudinal Redundancy Check (LRC), Cyclic Redundancy Check (CRC), checksum, error correction. **Data Link Layer Protocols:** Framing, HDLC, ARQ (Stop and Wait, Sliding Window), efficiency analysis.

Unit 5: Networks, Addressing, and Security

LAN: Project 802, Ethernet, Token Bus, Token Ring, FDDI. **MAN:** IEEE 802.6 (DQDB), SMDS. **Other Networks:** X.25, Frame Relay, ATM, SONET/SDH. **Network Addressing,Introduction to Network Security and Troubleshooting**

Textbooks:

1. **B.A. Forouzan,***Data Communication & Networking*, Tata McGraw-Hill.
2. **A. Tanenbaum,***Computer Networks*, PHI.

Reference Books:

1. **Douglas E. Comer,***Networking with TCP/IP*, Vol. 1.
2. **William Stallings,***Network Security Essentials*, 4th Edition.
3. **W. Stallings,***Data and Computer Communication*, Pearson.
4. **Gerd E. Keiser,***Local Area Networks*, Tata McGraw-Hill.

Similar NPTEL Courses:

1. **Prof. Soumya Kanti Ghosh & Prof. Sandip Chakraborty,***Computer Networks and Internet Protocol*, NPTEL. [Online]. Available: https://archive.nptel.ac.in/courses/106/105/106105183/
2. **Prof. Shridhar Iyer, Prof. Kavya Alse & Prof. Ashutosh Raina,***Demystifying Networking*, NPTEL. [Online]. Available: https://nptel.ac.in/courses/106101209

Suggested List of Experiments

1. Study of network interface card (NIC), digital interface RS-232, twisted pair, coaxial cable, fiber optic cable, NRZ and RZ codes, parallel and serial transmission.
2. Configure a Local Area Network (LAN) with switches and PCs, assign static IP addresses, and test connectivity using *ping*.
3. Simulate and configure different network topologies (Star, Ring, Mesh, Bus).
4. Design networks using appropriate Ethernet cables (straight-through, crossover) and connect devices.
5. Implement static routing between different networks and test connectivity.
6. Configure dynamic routing protocols like RIP and OSPF.
7. Create and configure VLANs on switches, assign ports to different VLANs, and verify inter-VLAN routing.
8. Configure *router-on-a-stick* for communication between VLANs.
9. Configure a wireless LAN using wireless routers and connect PCs, laptops, and smartphones.
10. Simulate smart IoT devices (smart bulbs, sensors, etc.) and configure them to communicate with a central IoT server.
11. Implementation of error detection methods (Parity Check, CRC).
12. Study and implementation of the sliding window protocol.
13. Network simulation using software tools (Cisco Packet Tracer, GNS3, NS2/NS3).
14. Performance analysis of wired and wireless networks.
15. Packet tracing/capturing using Wireshark (analyzing TCP, UDP, ICMP packets).

Using Packet Tracer, perform the following experiments:

a) Create a basic network of two computers using appropriate network wiring.
b) Create a basic network of two computers using a hub.
c) Create a basic network of multiple (min. 6) computers using a hub.
d) Create a basic network of two computers using a switch.
e) Create a basic network of multiple (min. 6) computers using switches (Layer 2 switch).
f) Create a basic network of two computers using routers.
g) Create a basic network of multiple (min. 6) computers using routers (Layer 3 switch).
h) Use *Tracer* to analyze the flow of packets (ICMP, TCP, UDP).

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA602- Antenna and Wave Propagation

Unit 1: Radiation

Potential function and the electromagnetic field, potential functions for sinusoidal oscillations, retarded potential, the alternating current element (or oscillating electric dipole), power radiated by a current element, application to short antennas, assumed current distribution, radiation from a quarter-wave monopole or half-wave dipole, sine and cosine integral, electromagnetic field close to an antenna, solution of the potential equations, far-field approximation.

Unit 2: Antenna Fundamentals

Introduction, network theorems, directional properties of dipole antennas, traveling-wave antennas and effect of feed on standing-wave antennas, two-element array, horizontal patterns in broadcast arrays, linear arrays, multiplication of patterns, effect of earth on vertical patterns, binomial array, antenna gain, effective area.

Unit 3: Types of Antennas

Log-periodic antenna, loop antenna, helical antenna, biconical antenna, folded dipole antenna, Yagi-Uda antenna, lens antenna, turnstile antenna. **Long wire antenna:** Resonant and traveling wave antennas for different wavelengths, V-antenna, rhombic antenna, beverage antenna.

Unit 4: Radiation from Aperture and Slot Antennas

Radiation from rectangular apertures, uniform and tapered aperture, horn antenna, reflector antenna, aperture blockage, feeding structures, slot antennas, microstrip antennas – radiation mechanism – applications, numerical tools for antenna analysis.

Unit 5: Propagation of Radio Waves

Fundamentals of electromagnetic waves, effects of the environment, modes of propagation, **Ground wave propagation:** Introduction, plane earth reflection, space wave and surface wave, transition between surface and space wave, tilt of wave front due to ground losses, **Space wave propagation:** Introduction, field strength relation, effects of imperfect earth, curvature of earth and interference zone, shadowing effect of hills and buildings, absorption by atmospheric phenomena, variation of field strength with height, super refraction, scattering, tropospheric propagation, fading, path loss calculations, **Sky wave propagation:** Introduction, structural details of the ionosphere, wave propagation mechanism, refraction and reflection of sky waves by the ionosphere, ray path, critical frequency, MUF, LUF, OF, virtual height, skip distance, relation between MUF and skip distance.

Textbooks:

1. **C.A. Balanis,** *Antenna Theory: Analysis and Design*, Wiley India Pvt. Ltd.
2. **J.D. Kraus,** *Antennas and Wave Propagation*, McGraw Hill.

3. **A.R. Harish and M. Sachidananda,***Antennas and Wave Propagation*, Oxford University Press.

Reference Books:

1. **E.C. Jordan and K.G. Balmain,***Electromagnetic Waves & Radiating Systems*, Prentice Hall.
2. **G.S.N. Raju,***Antennas and Wave Propagation*, Pearson Education.
3. **G. Kennedy,***Electronic Communication Systems*, McGraw Hill.
4. **K.D. Prasad,***Antenna and Wave Propagation*, Satya Prakashan.

Similar NPTEL Course:

1. **G. Kumar,***NOC: Antennas*, NPTEL. Available Online:https://nptel.ac.in/courses/108101092

List of Experiments

1. Plot the radiation pattern of an omnidirectional antenna.
2. Plot the radiation pattern of a directional antenna.
3. Plot the radiation pattern of a parabolic reflector antenna.
4. Plot the radiation pattern of a log-periodic antenna.
5. Plot the radiation pattern of a patch antenna.
6. Plot the radiation pattern of a dipole/folded dipole antenna.
7. Plot the radiation pattern of a Yagi (3-EL/4-EL) antenna.
8. Plot the radiation pattern of a monopole/whip/collinear antenna.
9. Plot the radiation pattern of a broadside antenna.
10. Plot the radiation pattern of a square loop antenna.

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA 603(A) – 5G Technology

Unit 1: Overview of 5G Broadband Wireless Communications

Evaluation of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G.

Unit 2: The 5G Wireless Propagation Channels

Channel modeling requirements, propagation scenarios and challenges in the 5G modeling, Channel Models for mmWave MIMO Systems.

Unit 3: Transmission and Design Techniques for 5G

Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques – orthogonal frequency division multiple accesses (OFDMA), generalized frequency division multiple accesses (GFDMA), non-orthogonal multiple accesses (NOMA).

Unit 4: Device-to-Device (D2D) and Machine-to-Machine (M2M) Type Communications

Extension of 4G D2D standardization to 5G, radio resource management for mobile broadband D2D, multi-hop and multi-operator D2D communications.

Unit 5: Millimeter-Wave Communications

Spectrum regulations, deployment scenarios, beam-forming, physical layer techniques, interference and mobility management, Massive MIMO propagation channel models, Channel Estimation in Massive MIMO, Massive MIMO with Imperfect CSI, Multi-Cell Massive MIMO, Pilot Contamination, Spatial Modulation (SM).

Textbooks:

1. **Martin Sauter,***From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband,* Wiley-Blackwell.
2. **Afif Osseiran, Jose F. Monserrat, Patrick Marsch,** *Fundamentals of 5G Mobile Networks,*Cambridge University Press.

References:

1. **Jonathan Rodriguez,***Fundamentals of 5G Mobile Networks,* John Wiley & Sons.
2. **Amitabha Ghosh and Rapeepat Ratasuk,***Essentials of LTE and LTE-A,* Cambridge University Press.

Similar NPTEL Course:

1. **Prof. Rohit Budhiraja,***5G Wireless Standard Design*, IIT Kanpur, NPTEL. Available Online:https://nptel.ac.in/courses/117104484
2. **Prof. Suvra Sekhar Das,***Evolution of Air Interface towards 5G*,IIT Kharagpur, NPTEL. Available Online:https://archive.nptel.ac.in/courses/108/105/108105134/

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA 603(B) - Internet of Things (IoT)

Unit 1: Introduction

Definition, Characteristics of IoT, IoT Conceptual Framework, IoT Architectural View, Physical Design of IoT, Logical Design of IoT, Applications of IoT.

Unit 2: Machine-to-Machine (M2M), SDN, and NFV for IoT

Software Defined Networking (SDN) and Network Function Virtualization (NFV) for IoT, Data Storage in IoT, IoT Cloud-Based Services.

Unit 3: Design Principles for Web Connectivity

Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, MQTT, CoAP, SOAP, REST, HTTP Restful, and Web Sockets.

Internet Connectivity Principles: Internet Connectivity, Internet-Based Communication, IP Addressing in IoT, Media Access Control.

Unit 4: Sensor Technology

Participatory Sensing, Industrial IoT and Automotive IoT, Actuator, Sensor Data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Network Technology

Unit 5: IoT Design Methodology

Specification - Requirement, Process, Model, Service, Functional & Operational View, IoT Privacy and Security Solutions, Raspberry Pi & Arduino Devices.

IoT Case Studies: Smart City Streetlights Control & Monitoring.

Text/Reference Books:

1. **Rajkamal,***Internet of Things*, Tata McGraw Hill Publication.
2. **Vijay Madisetti and Arshdeep Bahga,***Internet of Things (A Hands-on Approach*, 1st Edition, Universal Press.

References:

1. **Hakima Chaouchi,***The Internet of Things: Connecting Objects*, Wiley Publication.
2. **Donald Norris**, *The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black*, McGraw Hill Publication.

Suggested NPTEL Course:

1. Prof. Sudip Misra, *Introduction to Internet of Things,*IIT Kharagpur, NPTEL. Available Online:https://nptel.ac.in/courses/106105166

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

VI Semester: EA603(C) Multirate DSP

Unit 1: Introduction

Introduction, Overview of Sampling and Reconstruction, Review of Discrete-Time Systems, Digital Filters, Oversampling Techniques, Discrete-Time Processing of Continuous-Time Signals

Unit 2: Multirate Systems

Fundamentals of Multirate Systems, Basic Building Blocks – Upsampling, Downsampling, Aliasing, Mathematical Framework for Sampling Rate Change, Multirate Filters, Polyphase Implementation with Up/Down Sampling

Unit 3: Multirate DSP Blocks

Interconnection of Multirate DSP Blocks, Multiplexer and Demultiplexer Functionality, Polyphase Decomposition, Noble Identities, Efficient Implementation of Sampling Rate Conversion

Unit 4: Multirate Filterbanks

Introduction to Multirate Filterbanks, Basics of DFT-Based Filterbanks and Their Applications, Interpolated FIR Filter Design: Simplified Approach, Cascaded-Integrator-Comb (CIC) Filters and Their Advantages, Understanding Spectral Analysis Using Filterbanks, Common Signal Impairments: Aliasing and Magnitude Distortion

Unit 5: Advanced Multirate DSP Techniques and Filter Design

Allpass Filters, Properties, Application in Two-Channel Filterbanks, Half-Band Filters, Power Complementary Filter Pairs, Mth Band Filters, Two-Channel Perfect Reconstruction Filterbanks, Block Transceivers with Redundancy, Zero-Padding, Cyclic Prefix, OFDM, Application of Multirate DSP – Delta Sigma A/D Conversion, Introduction to Wavelets

Textbooks:

1. **Alan V. Oppenheim, Ronald W. Schafer,** *Discrete-Time Signal Processing*, 3rd Edition, Pearson.
2. **P. P. Vaidyanathan,** *Multirate Systems and Filter Banks*, Pearson.

Reference Books:

1. **Lin, Phoong & Vaidyanathan,** *Filter Bank Transceivers for OFDM and DMT Systems*, Cambridge University Press.
2. **N. Fliege,** *Multirate Digital Signal Processing: Multirate Systems, Filter Banks, Wavelets*, Wiley.
3. **F. Harris,** *Multirate Signal Processing for Communication Systems*, Prentice Hall.

Similar NPTEL Courses:

1. R. D. Koilpillai, *Multirate DSP*, NPTEL, 2022. [Online]. Available: https://onlinecourses.nptel.ac.in/noc22_ee32/preview

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA 604(A) – Computer Vision and Image Processing

Unit 1: Introduction

Introduction to Computer Vision and Image Processing (CVIP): Basics of CVIP, History of CVIP, Evolution of CVIP, CV Models, Image Filtering, Image Representations, Image Statistics. Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, and Matching. Morphological Image Processing: Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss Transformation, Morphological Algorithm Operations on Binary Images, Morphological Algorithm Operations on Gray-Scale Images, Thinning, Thickening, Region Growing, Region Shrinking

Unit 2: Image representation and description

Image Representation and Description: Representation Schemes, Boundary Descriptors, Region Descriptors. Binary Machine Vision: Thresholding, Segmentation, Connected Component Labeling, Hierarchical Segmentation, Spatial Clustering, Split & Merge, Rule-Based Segmentation, Motion-Based Segmentation. Area Extraction: Concepts, Data Structures, Edge, Line-Linking, Hough Transform, Line Fitting, Curve Fitting (Least-Square Fitting)

Unit 3: Region Analysis

Region Analysis: Region Properties, External Points, Spatial Moments, Mixed Spatial Gray-Level Moments. Boundary Analysis: Signature Properties, Shape Numbers. General Frameworks for Matching: Distance Relational Approach, Ordered Structural Matching, View Class Matching, Models Database Organization

Unit 4: Facet Model Recognition

Facet Model Recognition: Labeling Lines, Understanding Line Drawings, Classification of Shapes by Labeling of Edges, Recognition of Shapes, Consistent Labeling Problem, Back-Tracking Algorithm. Perspective Projective Geometry, Inverse Perspective Projection, Photogrammetric-From 2D to 3D, Image Matching: Intensity Matching of 1D Signals, Matching of 2D Images, Hierarchical Image Matching, Object Models and Matching: 2D Representation, Global vs. Local Features

Unit 5: Knowledge-Based Vision

Knowledge-Based Vision: Knowledge Representation, Control Strategies, Information Integration. Object Recognition: Hough Transforms and Other Simple Object Recognition Methods, Shape Correspondence and Shape Matching, Principal Component Analysis, Feature Extraction, Neural Network and Machine Learning for Image Shape Recognition.

Text Books

1. **David A. Forsyth & Jean Ponce,***Computer Vision: A Modern Approach*
2. **Rafael C. Gonzalez & Richard E. Woods,***Digital Image Processing*

Reference Books

1. **Robert Haralick and Linda Shapiro**, *Computer and Robot Vision*, Vol I, II, Addison-Wesley, 1993.
2. **David A. Forsyth, Jean Ponce,***Computer Vision: A Modern Approach*, Pearson.
3. **Milan Sonka, Vaclav Hlavac, Roger Boyle**, *Image Processing, Analysis, and Machine Vision*, Thomson Lear.

Similar NPTEL Course:

1. **Prof. M.K. Bhuyan,*****Computer Vision and Image Processing***, IIT Guwahati, NPTEL. [Online]. Available:https://archive.nptel.ac.in/courses/108/103/108103174/

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA604 (B) – Fundamentals of Machine Learning

UNIT I: Introduction to Machine Learning

Introduction to machine learning, scope and limitations, Regression, probability, statistics, and linear algebra for machine learning, Convex optimization, data visualization, hypothesis function and testing, Data distributions, data preprocessing, data augmentation, normalizing data sets, Machine learning models: Supervised and unsupervised learning

UNIT II: Neural Networks and Training

Linearity vs non-linearity, activation functions (e.g., sigmoid, ReLU), Weights and bias, loss function, gradient descent, Multilayer network, back propagation, weight initialization, Training and testing, unstable gradient problem, Autoencoders, batch normalization, dropout, L1 and L2 regularization, Momentum, tuning hyperparameters

UNIT III: Convolutional Neural Networks (CNNs)

Convolutional neural networks: Flattening, subsampling, padding, stride. Convolution layer, pooling layer, loss layer, dense layer, 1x1 convolution, Inception network, input channels, transfer learning, one-shot learning. Dimension reductions, implementation of CNNs (e.g., TensorFlow, Keras).

UNIT IV: Recurrent Neural Networks (RNNs) and Reinforcement Learning

Recurrent neural network, long short-term memory (LSTM), gated recurrent unit (GRU). Translation, beam search and width, BLEU score. Attention model, reinforcement learning (RL) framework. Markov decision process (MDP), Bellman equations. Value iteration and policy iteration, actor-critic model, Q-learning, SARSA

UNIT V: Advanced Machine Learning Topics

Support Vector Machines (SVMs), Bayesian learning, Application of machine learning in computer vision, speech processing, natural language processing, etc, Case Study: ImageNet Competition.

Text Books

1. **Christopher M. Bishop,***Pattern Recognition and Machine Learning*, Springer-Verlag New York Inc., 2nd Edition, 2011.
2. **Aurelien Geon,***Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems*, Shroff/O'Reilly, First edition (2017).

Recommended Books

1. **Tom M. Mitchell,***Machine Learning*, McGraw Hill Education, First edition, 2017.
2. **Andreas Muller,***Introduction to Machine Learning with Python: A Guide for Data Scientists*, Shroff/O'Reilly, First edition (2016).

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA604(C) – Entrepreneurship and IP Strategy

Unit 1: Introduction to Entrepreneurship and Intellectual Property

Definition, concepts, introduction, Relation between entrepreneurship and IP, the role of IP strategy in entrepreneurship

Unit 2: Innovation and Entrepreneurship

Innovation, invention, and creativity, Types of innovation, innovation, market, and IP, Open innovation and IP

Unit 3: IPR – Trademark, Patent, and Entrepreneurship

Trademark – Definition, types of trademark, trademark registration, trademark infringement. Patent – Introduction, patent infringement, patent strategies

Unit 4: IPR – Copyright, Industrial Design, and Entrepreneurship

Copyright – Definition and subject matter, copyright and related rights, copyright registration and entrepreneurship, copyright infringement. Industrial Design – Definition, concept, Industrial Designs Act (key features), industrial design business, industrial design infringement.

Unit 5: IP Strategy and Entrepreneurship

IP strategy for start-ups and MSMEs, IP transaction – Introduction, IP valuation, bank loan, insurance, Success stories and business models of a few start-ups, Incubators, research parks, and various government policies

Textbooks

1. **O. Granstrand**, *The Economic and Management of Intellectual Property*, 1999.
2. **V.K. Narayanan,***Managing Technology and Innovation for Competitive Advantage*, Pearson.
3. **K. Idris,***Intellectual Property: A Power Tool for Economic Growth*, 2nd edition, WIPO publication no. 888, Switzerland.

Reference Books

1. **D. Bosworth & E. Webster,***The Management of Intellectual Property*, Edward Elgar.
2. **R. Dorf and T. Byers,***Multirate Digital Signal Processing: Multirate Systems, Filter Banks, Wavelets*.

Similar NPTEL Courses

1. G. Gargate, *Entrepreneurship and IP Strategy*, NPTEL, 2020. [Online]. Available: https://onlinecourses.nptel.ac.in/noc20_hs66/preview

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA-605 Phase-Locked Loop (PLL) Lab

SUGGESTED LISTOFEXPERIMENTS

1. Introduction to SDR Using GNU Radio.
2. FM Receiver Implementation Using SDR.
3. AM Transmission and Reception.
4. Spectrum Sensing and Signal Analysis.
5. Digital Modulation Schemes (BPSK, QPSK, QAM).
6. Wireless Packet Transmission Using SDR.
7. Cognitive Radio Experiment.
8. Radar System Using SDR.
9. Design and Simulation of a Basic PLL.
10. Frequency Demodulation Using PLL.
11. Clock Recovery in Digital Communication.
12. Phase Noise Measurement in PLL Systems.
13. Frequency Synthesis Using a PLL.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VI Semester

EA606 – Essentials of Machine Learning using Python/MATLAB Lab

SUGGESTED LISTOFEXPERIMENTS

1. How to setup a python environment for Machine Learning with python/MATLAB.
2. Program to implement linear algebra (like Matrix multiplication, transposition etc.).
3. Write a program to implement linear regression.
4. Write a program to build ANN by implementing Back-propagation algorithm using some dataset.
5. Write a program to implement Neural Network in python.
6. Write a program to construct a Bayesian Network considering Medical data.
7. Write a program to implement Support vector machine.
8. Write a program to implement K-Means.
9. Write a program to implement Principal Component Analysis.
10. Write a program to implement of Dimensionality Reduction.

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)

Electronics and Communication (Advanced Communication Technology)

VII Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Term work / Lab Work & Sessional		L	T	P	
1.	EA701	DC	Optical Communication and Networks	70	20	10	30	20	150	2	1	2	4
2.	EA702	DE	Departmental Elective	70	20	10	-	-	100	3	1	-	4
3.	EA703	OE	Open Elective	70	20	10	-	-	100	3	0	0	3
4.	EA704	D Lab	Communication Systems and Exploration Lab	-	-	-	30	20	50	-	-	6	3
5.	EA705	O/E Lab	Internet of Things (IoT) Lab	-	-	-	30	20	50	-	-	6	3
6.	EA706	P	Major Project-I	-	-	-	100	50	150	-	-	8	4
7.	EA607		Evaluation of Internship-III	-	-	-	-	100	100	-	-	6	3
8.	Additional Credits[#]	*[#]Additional credits can be earned through successful completion of credit based MOOC's Courses available on SWAYAM platform (MHRD) at respective UG level.*											
		Total		**210**	**60**	**30**	**190**	**210**	**700**	**8**	**2**	**28**	**24**

Departmental Electives	Open Electives
EA702 (A) Microwave Engineering	EA703 (A) Cryptography and Network Security
EA702 (B) Information Theory and Coding	EA703 (B) Game Theory
EA702 (C) Wireless Ad Hoc and Sensor Networks	EA703 (C) Applied Optimization

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA701 – Optical Communication and Networks

Unit 1: Introduction to Optical Communication

Introduction to the nature of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model, and different types of optical fibers. Modal analysis of fiber, Optical fibers: Structure & waveguiding fundamentals, basic optical laws, Signal degradation on optical fiber due to dispersion and attenuation, intermodal and intramodal dispersion, Fabrication of fibers and measurement techniques like OTDR

Unit 2: Optical Sources and Detectors

LEDs, LASER diodes, basic concepts of optical sources, various laser and LED structures, Optical detectors: Basic principle of photo detection, PIN and avalanche photodiode, phototransistor, photo detector noise, and detector response time

Unit 3: Optical Network and Components

First generation optical network, multiplexing technique, second generation optical network, virtual circuit services and datagram, transparency of regenerators, Network components: Couplers, isolators, circulators, multiplexers, filters, fiber Bragg gratings as ADD/Drop multiplexers, Fabry Perot filters, acoustic-optical tunable filters. Characterization of switches: Mechanical, electro-optic, thermo-optic, and SOA switches. Switching architecture

Unit 4: First Generation of Optical Network

SONET, SDH, goals of SONET design, multiplexing in SONET. Elements of SONET/SDH infrastructure, SONET physical layer, computer interconnections, ESCON, fiber channel, FDDI, ATM, IP layered architecture: Physical layer, data link layer, network layer, transport layer.

Unit 5: Wavelength Routing Network

Optical layer, wavelength cross-connect, wavelength reuse reliability, virtual topology and circuit switching, and node design, Degree of wavelength conversion, network design and operation traffic models, and performance criteria, Static and reconfigurable network, classification of light paths

Textbooks

1. **Senior J.M.,** *Optical Fibre Communications, Principles & Practice*, 2nd ed., 2001, PHI.
2. **Keiser G,***Optical Fibre Communication*, 5th ed., 2006, McGrawHill.
3. **R. Ramaswamy and K.N. Shivrajan,***Optical Networks: A Practical Perspective*.

Reference Books

1. **Agrawal Govind P.,***Fibre Optic Communication Systems*, 5th ed., 2001, John Wiley & Sons.
2. **Djfar K Mynbaev & Scheiner,***Fibre Optic Communication Technology*, 5th ed., 2005, Pearson Education.
3. **C.S.R. Murthy and M. Guruswamy,***Optical Networks*, PHI.

Similar NPTEL Courses:

1. **Prof. R.K. Shevagaonkar,***Advanced Optical Communication*, NPTEL, Available: https://archive.nptel.ac.in/courses/117/101/117101002/

Suggested List of Experiments

1. Measurement of Numerical Aperture (NA) of an optical fiber.
2. Measurement of attenuation and bending loss in optical fiber.
3. Study of fiber optic couplers and splitters.
4. Measurement of connector and splicing loss in optical fibers.
5. To plot the characteristics of LED and Laser Diode used in optical communication.
6. Study of characteristics of PIN Photodiode and Avalanche Photodiode (APD).
7. Study of Wavelength Division Multiplexing (WDM) and Demultiplexing in optical networks.
8. Study of analog and digital modulation techniques in optical communication.
9. Study of optical network components (Switches, Amplifiers, Wavelength Converters).
10. Performance analysis of **Optical LAN–** Fiber-based Ethernet and Passive Optical LANs (POLs).
11. Simulation of Optical Network Topologies (Ring, Star, Mesh, Bus).
12. Design and Performance Analysis of Optical Routing Algorithms.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA702(A) – Microwave Engineering

Unit 1: Introduction

Features and applications of microwaves, Wave propagation in striplines and microstrip lines, Slot lines, Limitations of conventional vacuum tubes, Microwave tubes like Two cavity klystron and Reflex klystron, Magnetron, TWT, Backward wave oscillator etc.

Unit 2: Microwave Semiconductor Devices and Sources

Solid state microwave sources, transferred electron devices, Tunnel diode Gunn diode and oscillators, IMPATT diode, TRAPATT diode, Pin diode, Varactor diode, Schottky diode, Parametric amplifiers, Crystal diode, Frequency multipliers, Microwave BJT & FET

Unit 3: Microwave Network Analysis and Measurement Techniques

Scattering matrix, S-parameters & its applications in Network analysis, Matching Network, Detector diodes, detector mounts, detector output indicator, slotted line, measurement of power, impedance & S-parameter, measurement of frequency & VSWR.

Unit 4: Microwave Components and Simulation Techniques

Impedance transformer, Microwave filters, Power dividers and directional couplers, E-plane Tee, H-plane tee, Matched hybrid Tee, Wave propagation in ferrite medium, Isolators, Circulators, YIG resonators, Simulation Techniques for design of Microwave Components.

Unit 5: RF and Microwave Circuit Design and Integration Techniques

Analysis and design of Dielectric resonators; Design of RF and microwave low noise and power amplifiers & oscillators using S-parameter techniques, Mixer and converter design, diode phase shifters, attenuators, Design of hybrid and monolithic, microwave and millimeter wave integrated circuits.

Textbooks:

1. **S.Liao**, *Microwave Devices & Circuits*, 2nd Edition, PHI.
2. **K.C.Gupta**, *Microwave Engg.*,3rd Edition, Wiley Easter Pub.
3. **D. M. Pozar**, *Microwave Engineering*,3rd Edition, Wiley India.

Reference Books:

1. **O.P. Gandhi,***Microwave Engineering & Application*,2nd Edition, McMillan Int. Ed.
2. **H.J. Reich,** *Microwave Principles*, 5th ed. 2009,CBS Publ.
3. **R.E. Collin,** *Foundations for microwave engineering*, 4th Edition, 2001, Wiley Publ.

Similar NPTEL courses:

1. **R. Bhattacharjee,***Microwave Engineering*, NPTEL, Available: https://archive.nptel.ac.in/courses/108/103/108103141/

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA702(B) – Information Theory and Coding

Unit 1: Introduction

Information Theory: Introduction to uncertainty, entropy and its properties, entropy of binary memoryless source and its extension to discrete memory-less source, Measure of information, Information content ofmessage, Average Information content of symbols. Self-information, Mutual information and its properties

Unit 2: Source Coding Theorems and Compression Techniques

Coding theorem:Source coding theorem, prefix coding, Shannon's Encoding Algorithm, Shannon Fano Encoding Algorithm,Huffman coding, Extended Huffman coding,Arithmetic Coding, Lempel-Ziv Coding, Run Length Encoding.

Unit 3: Channel Models and Capacity Theorems

Information Channels: Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, Discrete memory less channels, Binary symmetric channeland its channel capacity, channel coding theorem, and its application to Binary Erasure Channel, Shannon's theorem on channel capacity, capacity of channel of infinite bandwidth, Continuous Channels.

Unit 4: Error Control Coding: Techniques, Codes, and Applications

Error Control Coding:Introduction, Examples of Error control coding, methods of Controlling Errors, Typesof Errors, types of Codes, Linear Block Codes: matrix description of Linear BlockCodes, Error Detection and Error Correction Capabilities of Linear Block Codes, Probability of undetected error for linear block code in BSC, hamming Codes and their applications

Cyclic Codes:Cyclic codes and its basic properties, Encoding using an (n-k) BitShift register, Generator & parity check matrix of cyclic codes, encoding & decoding circuits, syndrome computation, error detection and correction

Unit 5: BCH and Convolutional Codes

Introduction to BCH codes, its encoding & decoding, error location & correction. Convolution Codes:Introduction to convolution codes, its construction, Convolution Encoder, Time domain approach, Transform domainapproach, Code Tree, Trellis and State Diagram, Viterbi algorithm: Introduction of theorem for maximum likelihood decoding

Textbooks:

1. **T. M. Cover and J.A. Thomas,** *Elements of Information Theory,*John Wiley & Sons John Wiley & Sons
2. **S. Lin and Cosstlello,** *Error control Coding: Theory and Application,*PHI
3. **S. Haykin**, *Digital Communication,* Wiley Publ.

Reference Books:

1. **B. Sklar,** *Digital Communication*, Pearson Education
2. **Singh and Sapre,** *Communication Systems*, TMH
3. **W. Peterson,** *Error Correcting Codes*, MIT Press
4. **R. Bose,** *Information Theory, Coding and Cryptography*, TMH.

Similar NPTEL courses:

2. **S.N. Merchant,** *Information Theory and Coding*, NPTEL, Available: https://nptel.ac.in/courses/117101053

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA702(C) – Wireless AdHoc and Sensor Networks

Unit 1: Introduction to Ad Hoc Networks

Introduction, Mobile Ad Hoc Networks, Technologies for Ad Hoc Network, Issues in Ad hoc wireless Networks, IEEE 802.11 Architecture and protocols, Protocol for AD HOC Wireless Networks, Need for MAC protocols for MANETs, Issues and classification of MAC protocol, other MAC protocols, Dynamic Source Routing (DBR), Adhoc Distance Vector (AoDV) routing, Routing Protocols, Multicasting Routing issues.

Unit 2: Transport Layer Protocols and Network Security

Issues in designing transport layer protocols, TCP over Ad Hoc Wireless Networks, Network Security Attacks, Key management.

Unit 3: Sensor Architecture and Challenges

Basic Sensor Network Architectural Elements, Applications of Sensor Networks, Comparison with Ad Hoc Wireless Networks, Challenges and Hurdles. Architecture of WSNs Hardware components, Operating systems and execution environments, Network Architecture, Sensor networks scenarios, Optimization goals and figures of merit, Design principles for WSNs

Unit 4: Protocol Strategies in Wireless Sensor Networks

Physical Layer and Transceiver design considerations in WSNs, Fundamentals of (wireless) MAC protocol, Address and name management in wireless sensor networks, Localization and positioning, Routing protocols, Data Dissemination and Gathering, Routing Challenges and design Issues in Wireless, Routing Strategies in Wireless Sensor Networks, QoS in wireless sensor networks, Coverage and deployment.

Unit 5: Congestion and Security in WSNs and UWSNs

Sources of congestion in sensor networks, Congestion control scenarios, Different protocols for congestion and flow control in sensor networks, Introduction to UWSN, Physical effects, Deployment, Architecture, Energy issues, Localization, Mobility, Security requirements in WSNs, Different types of attacks in WSNs, Security protocols for WSNs

Textbooks:

1. **C.S. Ram Murty & B.S. Manoj**, *Ad HOC Wireless Networks: Architectures &Protocols,* Prentice Hall
2. **Adleshein and Gupta,** *Fundamentals of Mobile and Pervasive Computing,* McGraw-Hill
3. **M. Illayas**, *Handbook of Ad Hoc wireless network,* CRC Press

Reference Books:

3. **H. Karl,** *Wireless Sensor Networks,Protocols and Architectures*
4. **K. Sohraby and D. Minoli,** *Wireless Sensor Networks Technology, Protocols, and applications*

Similar NPTEL courses:

1. S. Misra, *Wireless Ad Hoc and Sensor Networks,* NPTEL, Available:https://archive.nptel.ac.in/courses/106/105/106105160/

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA703(A) – Cryptography and Network Security

Unit 1: Introduction

Introduction to Network Security, Computer Security and Cyber Security, Security terminologies and principles, security threats, types of attacks (active attacks, passive attacks), Basics of mathematical background for cryptography, Introduction to intrusion, terminologies, Intrusion Detection System (IDS), indications of intrusion: system indications, file system indications, network indications. Intrusion detection tools, post-attack IDS measures & evading IDS systems, Penetration testing, categories of security assessments, vulnerability assessment, types of penetration testing, Risk management

Unit 2:Cryptographic Techniques

Cryptography, classical cryptographic techniques, block cipher, encryption, decryption, code breaking: methodologies, cryptanalysis, cryptography attacks, brute-force attack, use of cryptography. Advanced Encryption Standard (AES), Public key cryptography, principles of public key cryptosystems, cryptographic algorithms RSA, Data Encryption Standard (DES), RC4, RC5, Blowfish, key management, Diffie-Hellman key exchange, elliptic curve cryptography

Unit 3:Secure Communication

Hash functions, two simple hash functions, SHA (Secure Hash Algorithm), authentication requirements, authentication functions, Kerberos. Message authentication codes, SSL (Secure Sockets Layer), SSH (Secure Shell), algorithms and security, disk encryption, digital signature: analysis, components, method, applications, standard, algorithm: signature generation/verification, ECDSA, Elgamal signature scheme, X.509 certificates

Unit 4:Cybersecurity Threats and Attack Mechanisms

Trojans and Backdoors: Overt and covert channels, working, types (remote access Trojans, data-sending Trojans, destructive Trojans, Trojans, proxy Trojans, FTP Trojans, security software disablers). Viruses and worms: characteristics, working, infection phase, attack phase. Sniffers: definition, spoofing, sniffing, vulnerable protocols, types. Phishing: methods, process, attack types (man-in-the-middle attacks, URL obfuscation attacks, hidden attacks, client-side vulnerabilities, deceptive phishing, malware-based phishing, DNS-based phishing, content-injection phishing, search engine phishing). Web application security: secured authentication mechanisms, secured session management, cross-site scripting, SQL injection, and other vulnerabilities. Denial-of-service attacks: types of attacks (smurf attack, buffer overflow attack, ping of death attack, teardrop attack, SYN attack, SYN flooding), DDoS attack (distributed DoS attack), session hijacking, spoofing vs hijacking, TCP/IP hijacking, CAPTCHA protection.

Unit 5:IP Security, Firewalls, and Cyber Forensics

IP security, web security, firewalls: types, operation, design principles, trusted systems. Computer forensics: need, objectives, stages & steps of forensic investigation in tracking cyber criminals, incident handling. Hacking, classes of hackers (black hats, grey hats, white hats, suicide hackers), footprinting, scanning (types: port, network, vulnerability), e-mail spiders, overview of system hacking cycle.

Textbooks

1. **William Stallings,***Cryptography and Network Security: Principles and Practice*, Pearson.
2. **Charlie Kaufman, Radia Perlman, Mike Speciner, Michael Speciner,***Network Security: Private Communication in a Public World*, TMH.
3. **Fourozon,***Cryptography & Network Security*, TMH.
4. **Atul Kahate,***Cryptography and Network Security*, McGraw Hill.

Reference Books

1. **Joseph Migga Kizza,***Computer Network Security*, Springer International Edition.
2. **Carl Endorf, Eugene Schultz, Jim Mellander,***Intrusion Detection & Prevention*, TMH.
3. **Neal Krawetz**, *Introduction to Network Security*, Cengage Learning.
4. **John R. Schau,***Cybersecurity Fundamentals*.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA703 (B) – Game Theory

Unit 1: Introduction to Game Theory

Non-cooperative game theory, Zero sum and general sum games. Dominance, Nash equilibrium, Maxmin strategies, elimination of dominated strategies, preservation of pure Nash equilibrium (PSNE), matrix games, relation between maxmin and PSNE in matrix games.

Unit 2:Strategies

Mixed strategies, mixed strategy Nash equilibrium (MSNE), finding MSNE, MSNE characterization theorem, algorithm to find MSNE. Correlated equilibrium (CE), computing CE, extensive form games, subgame perfection, limitations of subgame perfect Nash equilibrium.

Unit 3: Imperfect Information Extensive Form Games (IIEFG)

Strategies in IIEFGs, equivalence of strategies in IIEFGs, perfect recall. Equilibrium in IIEFG, game theory in practice: P2P file sharing, Bayesian games, strategy and utility in Bayesian games, equilibrium in Bayesian games.

Unit 4: Mechanism Design

Introduction to mechanism design, revelation principle, introduction and proof of Arrow's impossibility result, Introduction and proof of Gibbard-Satterthwaite theorem, domain restriction, median voter theorem

Unit 5: VCG Mechanism

Introduction to VCG mechanism, VCG in Combinatorial allocations, applications to Internet advertising, slot allocation and payments in position auctions, pros and cons of VCG mechanism. Affine maximizers, single object allocation, Myerson's lemma, optimal mechanism design. Single and multi-agent optimal mechanism design, examples of optimal mechanisms.

Textbooks:

1.**Steven Tadelis**, *Game Theory: An Introduction*, Princeton University Press.
2.**Joel Watson**, *Strategy: An Introduction to Game Theory*, W.W. Norton & Company.

Reference Books:

1. **Drew Fudenberg & Jean Tirole**, *Game Theory*, MIT Press.
2. **Martin J. Osborne & Ariel Rubinstein**, *A Course in Game Theory*, MIT Press.

Similar NPTEL Courses:

1. **Prof. Swaprava Nath,** *Introduction To Game Theory AndMechanism Design*, NPTEL, Available: https://archive.nptel.ac.in/courses/106/101/106101237

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA703(C) – Applied Optimization

Unit 1: Vectors

Introduction to properties of Vectors, Norms, Positive Semi-Definite matrices, Gaussian Random Vectors, Introduction to Convex Optimization – Convex sets, Hyperplanes/Half-spaces etc.
Application: Power constraints in Wireless Systems.

Unit 2: Convex/Concave Functions

Examples, Conditions for Convexity

Application: Beamforming in Wireless Systems, Multi-User Wireless, Cognitive Radio Systems, Convex Optimization problems, Linear Program.

Application: Power allocation in Multi-cell cooperative OFDM.

Unit 3: QCQP, SOCP Problems

Application: Channel shortening for Wireless Equalization, Robust Beamforming in Wireless Systems, Duality Principle and KKT Framework for Optimization.

Application: Water-filling power allocation, Optimization for MIMO Systems, OFDM Systems and MIMO-OFDM systems.

Unit 4: Optimization for Signal Estimation
LS, WLS, Regularization.
Application: Wireless channel estimation, Image Reconstruction-Deblurring.
Application: Convex optimization for Machine Learning, Principal Component Analysis (PCA), Support Vector Machines.
Application: Cooperative Communication, Optimal Power Allocation for cooperative Communication, Geometric Program.

Unit 5: Application Areas

Compressive Sensing, Sparse Signal Processing, OMP (Orthogonal Matching Pursuit), LASSO (Least Absolute Shrinkage and Selection Operator) for signal estimation.

Application: Radar for target detection, Array Processing, MUSIC, MIMO-Radar Schemes for Enhanced Target Detection.

Application: Convex optimization for Big Data Analytics, Recommender systems, User Rating Prediction, Optimization for Finance.

Text Books

1. **S. Boyd and L. Vandenberghe,***Convex Optimization*, Cambridge University Press.
2. **Daniel P. Palomar & Yonina C. Eldar,***Convex Optimization in Signal Processing and Communications*

Reference Books

1. **Mohammad Garzon, Julian Cheng, Victor C.M. Leung**,*Optimization Methods in Wireless Networks*
2. **Ying-Jun Angela Zhang, Chau Yuen,***Mathematical Optimization for Efficient Wireless Networks*
3. **Ekram Hossain, Mehdi Rasti, Long Bao Le, Dong In Kim**,*Radio Resource Management in Wireless Networks: An Engineering Approach*

Similar NPTEL Course:

1. **Prof. Aditya K. Jagannatham**, *Applied Optimization for Wireless, Machine Learning, Big Data*

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA704– Communication Systems and Exploration Lab

Objectives:

1. To explore the historical evolution of communication technologies through seminal research papers and biographies of key contributors.
2. To develop students' ability to critically analyze, present, and implement important research findings in communication engineering.
3. To inspire research-oriented thinking by understanding how fundamental problems were identified and solved.
4. To strengthen technical and analytical skills through implementation-based assignments.

Outline:

Introduction to Research in Communications: Evolution of communication engineering: From telegraphy to 6G; Importance of historical context in technological advancements; How to read and analyze research papers.

Pioneers of Communication Engineering: Biographies and contributions of Shannon, Hartley, Nyquist, Wiener, Hertz, Maxwell, Hamming, Galois, Armstrong, Alamouti, and others; Key theoretical developments and their applications.

Seminal Papers and Their Impact: Selected research papers that shaped communication engineering.Topics may include: Shannon's Information Theory and Capacity Theorem, Nyquist and Sampling Theorem, Hartley's Work on Signal Transmission, Wiener's Contributions to Adaptive Filtering, Armstrong's Superheterodyne Receiver, Alamouti's Space-Time Block Code, Other milestone papers in modulation, coding, and wireless communication.

Student Research and Presentations:

- Students will select, study, and present a seminal paper.
- Discussions on the problem statement, methodology, and impact.

Hands-on Implementation: Simulating key concepts using MATLAB/Python; Group projects based on practical applications of classic theories.

Research Synthesis & Future Directions: Reflection on past research and its relevance to current challenges; Identifying open research problems; Writing a research summary or mini-review based on studied papers.

Assessment:

1. **Paper Presentations (30%)** - Clarity, depth of understanding, and discussion.
2. **Implementation Assignments (30%)** - Correctness and depth of simulation/implementation.
3. **Final Report (20%)** - A research-based write-up connecting historical breakthroughs with modern trends.
4. **Class Participation & Discussions (20%)** - Active engagement and contribution.

Expected Outcomes:

- Deeper appreciation of communication theory and its historical development.
- Improved research skills, including paper reading, analysis, and implementation.
- Enhanced technical competency in communication simulations and modeling.
- Inspiration for further research and innovation in the field of communication engineering.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VII Semester

EA705 – Internet of Things (IoT) Lab

List of Experiments LAB INDEX Design, Developed and implement following using Arduino, Raspberry Pi compiler and Python language in Linux/Windows environment

1. Study and Install IDE of Arduino and different types of Arduino.
2. Write program using Arduino IDE for Blink LED.
3. Write Program for RGB LED using Arduino.
4. Study the Temperature sensor and Write Program foe monitor temperature using Arduino.
5. Study and Implement RFID, NFC using Arduino.
6. Study and Configure Raspberry Pi.
7. WAP for LED blink using Raspberry Pi.
8. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
9 . Study and implement MQTT protocol using Arduino.
10. Study and implement CoAP protocol using Arduino.
11. Interfacing of sensors with STM32.
12. Study and Configure jetson Nano developer kit.

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)

Electronics and Communication (Advanced Communication Technology)

VIII Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Term work / Lab Work & Sessional		L	T	P	
1.	EA801	DC	Advance Communications	70	20	10	30	20	150	2	1	2	4
2.	EA802	DE	Departmental Elective	70	20	10	-	-	100	3	1	-	4
3.	EA803	OE	Open Elective	70	20	10	-	-	100	3	-	-	3
4.	EA804	D/O/E Lab	Advance Signal Processing Lab	-	-	-	30	20	50	-	-	6	3
5.	EA805	P	Major Project-II	-	-	-	70	30	100	-	-	8	4
6.	Additional Credits[#]	[#]*Additional credits can be earned through successful completion of credit based MOOC's Courses available on SWAYAM platform (MHRD) at respective UG level.*											
		Total		**210**	**60**	**30**	**130**	**70**	**500**	**8**	**2**	**16**	**18**

Departmental Electives	Open Electives
EA802 (A) RF Circuit Design	EA803 (A) Speech Processing
EA802 (B) Adaptive Signal Processing	EA803 (B) Principles of Management and Managerial Economics
EA802 (C) Satellite Communication	EA803 (C) Artificial Neural Networks

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

EA801– Advance Communications

Unit 1: Advance Wireless Communication

6G and Beyond: Key Technologies, Challenges, and Future Trends, Terahertz (THz) and Millimeter-Wave (mmWave) Communication: Propagation, Hybrid Beamforming, and Applications, Massive MIMO and Intelligent Reflecting Surfaces (IRS) for Network Optimization, Full-Duplex Communication: Self-Interference Cancellation and Applications, Cooperative Communication: Relay Networks, Distributed MIMO, and Network Coding.

Unit 2: UWB Communication

Ultra wideband (UWB) communication systems: UWB concepts, advantages and challenges, single band versus multiband, FCC emission limits, UWB applications; UWB sources and antennas: UWB pulse generation, UWB antennas; Pulse-detection and multiple-access techniques: Conventional pulse-detection techniques, pulse modulation and detection techniques, UWB multiple-access techniques.

Unit 3: Cognitive and Green Communication

Cognitive Radio Networks (CRN): Spectrum Sensing, Sharing, and AI-Enabled Dynamic Spectrum Access, AI and Machine Learning in Cognitive Communication: Adaptive Resource Allocation and Network Optimization, Green Communication: Energy-Efficient Wireless Networks and RF Energy Harvesting, Blockchain for Secure IoT and Wireless Networks.

Unit 4: IoT, AI, and Emerging Technologies

Internet of Things (IoT) and Industry 4.0 Communication: LPWAN, Edge Computing, and Wireless Sensor Networks, AI-Driven Wireless Communication: Predictive Analytics, Channel Estimation, and Network Optimization, Reconfigurable Intelligent Surfaces (RIS): Enhancing Signal Coverage and Energy Efficiency, Brain-Computer Interface (BCI) Communication: Neural Interfaces and Future Wireless Applications.

Unit 5: Communication Networks

Computation Oriented Communications, Machine Learning for Communications, Pervasive and Ubiquitous Computing, Real-Time Communications, Delay Tolerant Networks, Cognitive Internet of Vehicles, Hardware-Aware Communications, Intelligent techniques for spectrum sensing, spectrum access and spectrum sharing, Use of AI and ML in network management, applications and services.

Textbooks

1. **A. Goldsmith,** *Wireless Communications*, 1st Edition, Cambridge University Press.
2. **T.S. Rappaport,** *Wireless Communications: Principles and Practice*, 2nd Edition, Pearson Education.
3. **E. Björnson and E.G. Larsson,** *Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency*, 1st Edition, Now Publishers.
4. **A.M. Wyglinski, M. Nekovee, and T. Hou**, *Cognitive Radio Communications and Networks: Principles and Practice*, 1st Edition, Academic Press.

Reference Books

1. **Y. Wu, F. Li, and Y. Zhang,** *6G Mobile Wireless Networks: Vision, Challenges, and Key Technologies*, 1st Edition, Springer.
2. **K.J.R. Liu and A.K. Sadek,** *Cooperative Communications and Networking*, 1st Edition, Cambridge University Press.
3. **M. Di Renzo, F. H. Tseng, and J. Yuan,** *Reconfigurable Intelligent Surfaces for Wireless Communications*, 1st Edition, Wiley.
4. **S. Glisic,** *Artificial Intelligence for Cognitive Communication*, 1st Edition, Wiley.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

EA802 (A) - RF Circuit Design

Unit 1: RF Circuit Fundamentals and Noise Analysis

Classification of wireless systems, Design and performance issues: frequency, selection, switching, propagation, Noise in RF circuits: Noise figure (NF), noise temperature, lossy lines, NF of cascade and passive networks, Linearity, intermodulation, SFDR, dynamic range, Receiver front-end circuits and architectures

Unit 2: RF Active Devices and Models

Active Device:Comparison of active devices such as BJT, MOSFET, MESFET, HEMT, and HBT; Circuit models for FETs and BJTs; Basic parameters of active devices such as ft/fmax, transconductance, capacitance, resistance, etc.

Passive Components and Impedance Matching: On-chip Inductor, capacitor, resistor, resonant circuit and its application in RF IC. Various impedance matching techniques

Unit 3: RF Amplifier Design

Amplifier Design:Transistor Theory, Transistor S-parameters, gain & Stability, Unilateral and bilateral design, low noise amplifier (LNA Design), Various LNA topologies: CS/CE stage with inductive load, CS/CE stage with resistive feedback, CG/CB topologies, noise cancellation techniques, differential LNA, Broadband amplifier design, Biasing in RF & microwave circuits.

Unit 4: Mixers and its types

Mixers:Mixer characteristics: Image frequency, conversion loss, noise figure; Devices for mixers: p-n junctions, Schottky barrier diode, FETs; Diode mixers: Small-signal characteristics of diode, single-ended mixer, large-signal model, switching model; FET/MOSFET Mixers: Single-ended mixer, other FET mixers; Balanced mixers; Image reject mixers.

Unit 5: Oscillators and its types

Oscillators and Frequency Synthesizers:General analysis of RF oscillators, transistor oscillators, voltage-controlled oscillators, dielectric resonator oscillators, frequency synthesis methods, analysis of first and second order phase-locked loop, oscillator noise and its effect on receiver performance.

Reference Books

1. **B. Razavi,** *RF Microelectronics*, 2nd Ed, Pearson, 2020.
2. **Thomas H. Lee,** *The Design of CMOS Radio-Frequency Integrated Circuits*, Cambridge University Press, 2004.
3. **Pozar, D.M.,** *Microwave and RF Design of Wireless Systems*, John Wiley & Sons, 2001.
4. **Gonzalez, G.,** *Microwave Transistor Amplifiers: Analysis and Design*, 2nd Ed., Prentice-Hall, 1997.

Similar NPTEL Courses:

1. **Prof. Darshak Bhatt,** *RF Transceiver Design, IIT Roorkee*, NPTEL, Available: https://nptel.ac.in/courses/108107379

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

EA 802(B) –Adaptive Signal Processing

Unit 1:Introduction

Basic principle of adaptive filtering and estimation; probability, random variables, conditional and joint probability densities, statistical independence, correlation and covariance, Complex random variables, random vectors, correlation and covariance matrices, properties of Hermitian matrices (e.g., correlation / covariance matrices), positive definite forms, multivariate Gaussian density

Unit 2:Random Processes

Concepts of random processes, wide sense stationary (WSS) processes and their correlation structures, power spectral density, parametric modeling of WSS processes – AR, MA and ARMA process, Optimal FIR filters, real and complex valued optimal filters, method of steepest descent

Unit 3:Least mean square (LMS) algorithm

Least mean square (LMS) algorithm; convergence of LMS algorithm; normalized LMS, affine projection, Examples of adaptive filters: channel equalization, echo cancellation, interference cancellation, line enhancement, beamforming etc.

Unit 4:RLS (Recursive Least Squares) adaptive filters

Limitations of LMS algorithm, formulation of recursive least squares (RLS) based adaptive filters, Moore-Penrose pseudo inverse, matrix inversion lemma

Unit 5: RLS transversal adaptive filter and its properties

Development of the RLS transversal adaptive filter, properties, variants of the RLS family

Text Books:

1. **S. Haykin,***Adaptive Filters*, Prentice-Hall India.
2. **A. H. Sayed,***Adaptive Filters*, Wiley-Interscience, New York, USA

Reference Books:

1. **B. Farhang-Boroujeny,** *Adaptive Filters : Theory and Applications*, Wiley, New York, USA

Similar NPTEL Course:

1. **Prof. Mrityunjoy Chakraborty,***Introduction To Adaptive Signal Processing*, IIT Kharagpur, NPTEL, Available: https://onlinecourses.nptel.ac.in/noc23_ee138/preview

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

EA802(C) – Satellite Communication

Unit 1: Overview of satellite systems

Introduction, Frequency allocations for satellite systems, Orbits and launching methods: Kepler's three laws of planetary motion, terms used for earth orbiting satellites, orbital elements, apogee and perigee heights, orbit perturbations, inclined orbits, local mean solar point and sun-synchronous orbits, standard time.

Unit 2: Geostationary orbit

Introduction, antenna look angles, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage, launching orbits. Polarization: antenna polarization, polarization of satellite signals, cross polarization discrimination. Depolarization: ionospheric, rain, ice.

Unit 3: Space segments

Introduction, power supply, attitude control, station keeping, thermal control, TT&C subsystem, transponders, antenna subsystem, Morelos and Satmex 5, Aniksatellites, Advanced Tiros-N spacecraft. The Earth segment: introduction, receive-only home TV systems, master antenna TV system, Community antenna TV system, transmit-receive earth station.

Unit 4: Space links

Introduction, Equivalent isotropic radiated power (EIPR), transmission losses, the link power budget equation, system noise, carrier-to-noise ratio (C/N), the uplink, the downlink, effects of rain, combined uplink and downlink C/N ratio, inter modulation noise, intersatellite links. Interference between satellite circuits.

Unit 5: Satellite services

VSAT (very small aperture terminal) systems: overview, network architecture, access control protocols, basic techniques, VSAT earth station, calculation of link margins for a VSAT star network. Direct broadcast satellite (DBS) Television and radio: digital DBS TV, BDS TV system design and link budget, error control in digital DBS-TV, installation of DBS-TV antennas, satellite radio broadcasting

Textbooks:

1. Roddy, *Satellite Communications*, TMH
2. T. Prattt, *Satellite Communications*, Wiley India.

Reference Books:

1. Pritchard, Suyderhoud and Nelson, *Satellite Communication Systems Engineering,*Pearson Education.
2. Agarwal, *Satellite Communications,*Khanna Publishers.
3. Gangliardi, *Satellite Communications,* CBS Publishers.
4. R.Rao, *Fundamentals of Satellite communications,* PHI Learning.

Similar NPTEL Courses:

1. **Prof. KalyankumarBandyopadhyay,***Satellite Communication Systems, IIT Kharagpur,* NPTEL, Available: https://nptel.ac.in/courses/108107379

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

EA803 (A) – Speech Processing

Unit 1: Basic Concepts of Speech Processing

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

Unit 2: Speech Analysis

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

Unit 3: Speech Modeling

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, Implementation issues.

Unit 4: Speech Recognition

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – ngrams, context dependent sub-word units; Applications and present status.

Unit 5: Speech Synthesis

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, subword units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Textbooks:

1. L. Rabinerand, B. Juang and B. Yegnararayana,*Fundamentals of Speech Recognition*, Pearson Education, 2003
2. D. Jurafsky and J. H. Martin, *Speech and Language Processing – An Introductionto Natural Language Processing, Computational Linguistics, and Speech Recognition*, Pearson Education

Reference Books:

1. C. Becchetti and L. Ricotti, *Speech Recognition*,John Wiley and Sons, 1999
2. B. Gold and N. Morgan, *Speech and audio signal processing, processing andperception of speech and music*,Wiley- India Edition, 2006

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

EA803 (B) – Principles of Management and Managerial Economics

Unit 1: Fundamentals of Management

Definition, Nature, and Importance of Management, Functions of Management: Planning, Organizing, Leading, and Controlling, Evolution of Management Theories: Classical, Behavioral, and Modern Approaches, Organizational Structure and Design: Functional, Divisional, Matrix, and Network Structures

Unit 2: Planning, Decision Making, and Leadership

Importance and Types of Planning, Strategic, Tactical, and Operational Planning, Decision-Making Process and Techniques, Leadership Theories and Styles (Trait, Behavioral, and Contingency Theories), Motivation Theories: Maslow's Hierarchy, Herzberg's Two-Factor Theory, McGregor's Theory X & Y

Unit 3: Managerial and Interpersonal Skills

Effective Communication: Verbal, Non-verbal, Written, and Digital Communication, Team Building and Conflict Management, Time and Stress Management: Prioritization Techniques (Eisenhower Matrix, Pareto Principle), Emotional Intelligence and Resilience in Management, Negotiation and Persuasion Skills

Unit 4: Total Quality Management (TQM) and Performance Management

Introduction to TQM: Concepts and Principles, Key Performance Indicators (KPIs) and Performance Measurement, Quality Control and Continuous Improvement (TQM, Six Sigma, Kaizen), Business Excellence Models and ISO Standards, Ethics, Corporate Social Responsibility (CSR), and Sustainable Management Practices

Unit 5: Managerial Economics and Financial Analysis

Introduction to Managerial Economics: Demand and Supply Analysis, Cost Concepts and Pricing Strategies, Break-even Analysis: Concept, Applications, and Decision Making, Investment Analysis: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR), Risk Analysis and Capital Budgeting Techniques

Textbooks:

1. **H. Koontz and H. Weihrich**, *Essentials of Management: An International and Leadership Perspective*, McGraw Hill
2. **P. Samuelson and W. Nordhaus** – *Economics*, McGraw Hill
3. **D. H. Besterfield**, *Total Quality Management (TQM),*Pearson Education

Reference Books:

1. **P. M. Ghare and B. L. Hansen,** *Quality Control and Application*, Prentice Hall
2. **P.L. Mehta**, *Managerial Economics: Analysis, Problems, and Cases*, Sultan Chand & Sons

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

Semester – EA803 (C) Artificial Neural Networks

Unit-1: Introduction to Artificial Neural Networks and Deep Learning

Biological inspiration: Human brain, models of a neuron, Artificial neural communication and signal flow, ANNs as directed graphs; architectures: feed-forward, feedback, Knowledge representation in ANNs, Learning paradigms: supervised, unsupervised, reinforcement, Modeling through regression: linear and logistic regression for classification

Unit-2: Perceptron

Perceptron convergence theorem, relationship between perceptron and Bayes classifiers, Batch perceptron algorithm, Multilayer perceptron, Batch and online learning, derivation of the back propagation algorithm, XOR problem

Unit-3: Approximations of functions

Cross-validation, Network pruning and complexity regularization, convolution networks, non-linear filtering, Cover's theorem and Pattern separability, The interpolation problem, RBF networks, Hybrid learning procedure for RBF networks.

Unit-4: Support Vector Machines (SVM)

Optimal hyperplane for linear separability, Optimal hyperplane for nonseparable patterns, SVM as a kernel machine, Design of SVMs, robustness considerations for regression. Optimal solution of the linear regression problem

Unit-5: Principal Component Analysis (PCA)

Hebbian based PCA, Kernel based PCA, Kernel Hebbian algorithm. Deep multi-layer perceptrons, Deep autoencoders and stacked denoising auto-encoders.

Textbooks

1. **Simon Haykin,***Neural Networks: A Comprehensive Foundation*, Second Edition, Pearson Education Asia.
2. **Bart Kosko,***Neural Networks for Signal Processing*, Prentice Hall.

Reference Books

1. **A. V. Oppenheim, R. W. Schafer,***Deep Learning for Signal Processing: Applications with MATLAB*, Wiley.
2. **Anthony Zaknich**, *Neural Networks for Signal Processing: Applications and Learning*, World Scientific.

Similar NPTEL Course:

1. **Prof. Shayan Srinivasa Garani,***Neural Networks For Signal Processing*, IISc Bangalore, NPTEL, Available: https://archive.nptel.ac.in/courses/108/108/108108148/

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New Scheme Based On AICTE Flexible Curricula

Electronics and Communication (Advanced Communication Technology), VIII Semester

EA804 – Advance Signal Processing Lab

Suggested List of Experiments:
(The experiments will be performed using MATLAB/Octave/Python.)

1. **Adaptive Filtering using LMS (Least Mean Square) Algorithm** – Implement and analyze the LMS adaptive filter for noise cancellation in signals.
2. **Adaptive Filtering using RLS (Recursive Least Square) Algorithm** – Compare the performance of the RLS algorithm with LMS in terms of convergence speed and stability.
3. **System Identification**– Use adaptive filters to identify an unknown system based on input-output data.
4. **Echo Cancellation**– Design an adaptive filter for echo cancellation in communication systems.
5. **Noise Cancellation in Speech Signals** – Apply adaptive filtering to speech signals for noise reduction in a noisy environment.
6. **Frequency Domain Adaptive Filters** – Implement adaptive filters in the frequency domain and analyze their performance.
7. **Beamforming for Signal Reception** – Implement adaptive beamforming techniques (like the MVDR or LMS beamformer) for directional signal reception.
8. **Adaptive Equalization for Communication Systems** – Implement adaptive equalizers (LMS, RLS) to mitigate intersymbol interference (ISI) in digital communication systems.
9. **Kalman Filter for Signal Estimation** – Implement a Kalman filter for estimating the state of a dynamic system in noisy environments.
10. **Application of Adaptive Filters for Adaptive Noise Cancelling in Audio Signals** – Use adaptive filtering techniques to improve the quality of audio signals by cancelling out unwanted noise.
11. **Signal Detection using Adaptive Thresholding** – Implement an adaptive thresholding technique for detecting signals in the presence of noise.
12. **Speech Enhancement using Adaptive Filtering Techniques** – Implement adaptive filters to enhance speech quality by removing background noise.
13. **Adaptive Filtering for Non-Stationary Signals** – Work on filtering techniques for non-stationary signals, focusing on applications like biomedical signals or radar.
14. **Prediction of Signals using Adaptive Filters** – Implement an adaptive filter for predicting future values of a signal based on its past values.
15. **Adaptive Line Enhancer for Narrowband Interference Suppression** – Use adaptive filters to suppress narrowband interference in communication systems.