

# **COURSE STRUCTURE AND SYLLABUS**

**For**

**B. TECH ELECTRICAL AND ELECTRONICS ENGINEERING**

*(Applicable for batches admitted from 2019-2020)*



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA**

**KAKINADA - 533 003, Andhra Pradesh, India**

**I Year – II SEMESTER**

<b>Sl. No</b>	<b>Course Code</b>	<b>Subjects</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>
1	BS1202	Mathematics – II	3	0	0	3
2	BS1203	Mathematics – III	3	0	0	3
3	BS1204	Applied Physics	3	0	0	3
4	ES1212	Fundamentals of Computers	3	0	0	3
5	ES1217	Electrical Circuit Analysis - I	3	0	0	3
6	ES1218	Electrical Engineering Workshop	0	0	3	1.5
7	BS1205	Applied Physics Lab	0	0	3	1.5
8	HS1203	Communication Skills Lab	0	1	2	2
9	PR1201	Engineering Exploration Project	0	0	2	1
<b>Total Credits</b>			<b>15</b>	<b>1</b>	<b>10</b>	<b>21</b>



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### COURSE STRUCTURE-R19

<b>I Year - II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>MATHEMATICS - II (BS1202)</b> <b>(Common to all Branch's for I Year B. Tech)</b>					

**Course Objectives:**

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

**Course Outcomes:** At the end of the course, the student will be able to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
- evaluate approximating the roots of polynomial and transcendental equations by different algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)

**Unit I: Solving systems of linear equations, Eigen values and Eigen vectors: (10 hrs)**

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous equations linear equations – Gauss Elimination for solving system of equations – Eigen values and Eigen vectors and their properties.



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**Unit-II: Cayley-Hamilton theorem and Quadratic forms: (10 hrs)**

Cayley-Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.

Singular values of a matrix, singular value decomposition (Ref. Book – 1).

**UNIT III: Iterative methods: (8 hrs)**

Introduction – Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations.

**UNIT IV: Interpolation: (10 hrs)**

Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula – Newton's divide difference formula.

**UNIT V: Numerical integration and solution of ordinary differential equations: (10 hrs)**

Trapezoidal rule – Simpson's  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rule – Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. **David Poole**, Linear Algebra- A modern introduction, 4<sup>th</sup> Edition, Cengage.
2. **Steven C. Chapra**, Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.



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3. **M. K. Jain, S. R. K. Iyengar and R. K. Jain**, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **Lawrence Turyn**, Advanced Engineering Mathematics, CRC Press.



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<b>MATHEMATICS - III (BS1203)</b> <b>(Common to all Branch's for I Year B. Tech)</b>					

**Course Objectives:**

- To familiarize the techniques in partial differential equations
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

**Course Outcomes:** At the end of the course, the student will be able to

- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L5)
- apply the Laplace transform for solving differential equations (L3)
- find or compute the Fourier series of periodic signals (L3)
- know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- identify solution methods for partial differential equations that model physical processes (L3)

**Unit – I: Vector calculus: (10 hrs)**

Vector Differentiation: Gradient – Directional derivative – Divergence – Curl – Scalar Potential.

Vector Integration: Line integral – Work done – Area – Surface and volume integrals – Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

**Unit –II: Laplace Transforms: (10 hrs)**

Laplace transforms of standard functions – Shifting theorems – Transforms of derivatives and integrals – Unit step function – Dirac's delta function – Inverse Laplace transforms – Convolution theorem (with out proof).



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Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

**Unit –III: Fourier series and Fourier Transforms: (10 hrs)**

Fourier Series: Introduction – Periodic functions – Fourier series of periodic function – Dirichlet's conditions – Even and odd functions – Change of interval – Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Sine and cosine transforms – Properties – inverse transforms – Finite Fourier transforms.

**Unit –IV: PDE of first order: (8 hrs)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.

**UNIT V: Second order PDE and Applications: (10 hrs)**

Second order PDE: Solutions of linear partial differential equations with constant coefficients – RHS term of the type  $e^{ax+by}$ ,  $\sin(ax + by)$ ,  $\cos(ax + by)$ ,  $x^m y^n$ .

Applications of PDE: Method of separation of Variables – Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, Wiley-India.
2. **Dean. G. Duffy**, Advanced Engineering Mathematics with MATLAB, 3<sup>rd</sup> Edition, CRC Press.



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3. **Peter O' Neil**, Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia**, Engineering Mathematics, Oxford University Press.





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<b>APPLIED PHYSICS (BS1204)</b>					

**Course Objectives:**

Physics curriculum which is re-oriented to the needs of Circuital branches of graduate engineering courses offered by Jawaharlal Nehru Technological University Kakinada that serves as a transit to understand the branch specific advanced topics. The course is designed to:

- Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution.
- Understand the physics of Semiconductors and their working mechanism for their utility in sensors.
- To impart the knowledge of materials with characteristic utility in appliances.

**UNIT-I**

**(10hrs)**

**WAVE OPTICS:** Principle of Superposition - Interference of light - Conditions for sustained Interference - Interference in thin films (reflected geometry) - Newton's Rings (reflected geometry).

Diffraction - Fraunhofer Diffraction - Diffraction due to Single slit (quantitative), Double slit, N-slits and circular aperture (qualitative) – Intensity distribution curves - Diffraction Grating – Grating spectrum – missing order – resolving power – Rayleigh's criterion – Resolving powers of Microscope, Telescope and grating (qualitative).

**Unit Outcomes:**

*The students will be able to*

- **explain** the need of coherent sources and the conditions for sustained interference.
- **analyze** the differences between interference and diffraction with applications.
- **illustrate** the resolving power of various optical instruments.



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### UNIT-II

(9hrs)

**QUANTUM MECHANICS:** Introduction – Matter waves – de Broglie’s hypothesis – Davisson-Germer experiment – G. P. Thomson experiment – Heisenberg’s Uncertainty Principle –interpretation of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in a potential box.

**Unit Outcomes:**

*The students will be able to*

- **explain** the fundamental concepts of quantum mechanics.
- **analyze** the physical significance of wave function.
- **apply** Schrödinger’s wave equation for energy values of a free particle .

### UNIT-III

(10hrs)

**FREE ELECTRON THEORY & BAND THEORY OF SOLIDS :** Introduction – Classical free electron theory (merits and demerits only) - Quantum Free electron theory – electrical conductivity based on quantum free electron theory – Fermi Dirac distribution function – Temperature dependence of Fermi-Dirac distribution function - expression for Fermi energy - Density of states .

Bloch’s theorem (qualitative) – Kronig-Penney model(qualitative) – energy bands in crystalline solids – E Vs K diagram – classification of crystalline solids – effective mass of electron –  $m^*$  Vs K diagram - concept of hole.

**Unit Outcomes:**

*The students will be able to*

- **explain** the various electron theories.
- **calculate** the Fermi energy.
- **analyze** the physical significance of wave function .
- **interpret** the effects of temperature on Fermi Dirac distribution function.
- **summarise** various types of solids based on band theory.

### UNIT-IV

(9hrs)

**SEMICONDUCTOR PHYSICS:** Introduction – Intrinsic semi conductors - density of charge carriers - Electrical conductivity – Fermi level – extrinsic semiconductors - p-type & n-type - Density of charge carriers - Dependence of Fermi energy on carrier concentration and



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### COURSE STRUCTURE-R19

temperature – Hall effect- Hall coefficient - Applications of Hall effect - Drift and Diffusion currents – Einstein’s equation.

#### **Learning Outcomes:**

*The students will be able to*

- **classify** the energy bands of semiconductors.
- **outline** the properties of n-type and p-type semiconductors.
- **identify** the type of semiconductor using Hall effect.

#### **UNIT-V**

(10 hrs)

**MAGNETISM & DIELECTRICS:** Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr magneton – Classification of magnetic materials: Dia, para & Ferro – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – applications of Ferromagnetic material.

Introduction - Dielectric polarization – Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation - Frequency dependence of polarization – Applications of dielectrics.

#### **Unit Outcomes:**

*The students will be able to*

- **explain** the concept of polarization in dielectric materials.
- **summarize** various types of polarization of dielectrics .
- **interpret** Lorentz field and Claussius- Mosotti relation in dielectrics.
- **classify** the magnetic materials based on susceptibility and their temperature dependence.
- **explain** the applications of dielectric and magnetic materials .
- **Apply** the concept of magnetism to magnetic devices.

#### **TEXT BOOKS:**

1. “A Text book of Engineering Physics” by M.N. Avadhanulu, P.G.Kshirsagar - S.Chand Publications, 2017.
2. “Engineering Physics” by D.K.Bhattacharya and Poonam Tandon, Oxford press (2015).
3. “Engineering Physics” by R.K Gaur. and S.L Gupta., - Dhanpat Rai publishers, 2012.

#### **REFERENCE BOOKS:**

1. “Engineering Physics” by M. R. Srinivasan, New Age international publishers (2009).



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2. “Optics” by Ajoy Ghatak, 6<sup>th</sup> Edition McGraw Hill Education, 2017.
3. “Solid State Physics” by A. J. Dekker, Mc Millan Publishers (2011).



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>FUNDAMENTALS OF COMPUTER SCIENCE (ES1212)</b>					

#### **COURSE OBJECTIVES:**

This course is designed to:

1. Explain the concepts of computers and classify based on type and generation.
2. Demonstrate the techniques of writing algorithms pseudo codes & schematic flow of logic in software development process.
3. Teach about the purpose of networks and types of networks and media to connect the computers
4. Teach about Operating Systems and its concepts.
5. Illustrate about database architecture and its components
6. Illustrate about distributed computing, peer to peer, grid, cloud on demand and utility computing.

#### **UNIT I:**

**A Simple Computer System:** Central processing unit, the further need of secondary storage, Types of memory, Hardware, Software and people.

**Peripheral Devices:** Input, Output and storage, Data Preparation, Factors affecting input, Input devices, Output devices, Secondary devices, Communication between the CPU and Input/ Output devices. (Text Book 1)

#### **UNIT II:**

**Problem Solving and Programming:** Algorithm development, Flowcharts, Looping, some programming features, Pseudo code, the one-zero game, some structured programming concepts, documents.

**Programming Languages:** Machine Language and assembly language, high -level and low level languages, Assemblers, Compilers, and Interpreters (Text Book 1)

#### **UNIT III:**

**Computer Networks :** Introduction to computer Networks, Network topologies-Bus topology, star topology, Ring topology, Mesh topology, Hybrid topology, Types of Networks: Local area Network, Wide Area Networks, Metropolitan Networks, Campus/ Corporate Area Network, Personal Area Network, Network Devices- Hub, Repeater, Switch, Bridge, Router, Gateway, Network interface Card, Open System Inter connection Model (Text Book 2)



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### **COURSE STRUCTURE-R19**

**Operating systems:** Introduction, Evolution of operating systems, Process Management-Process control block, Process operations, Process scheduling, Command Interpreter, Popular operating systems- Microsoft DOS, Microsoft Windows, UNIX and Linux. (Text Book 2)

#### **UNIT IV:**

**Database Systems:** File-Oriented Approach, Database-oriented Approach-Components of Database system, Advantages & Disadvantages of Database approach, Applications of Database systems, Database views, Three-schema architecture, Database models-Hierarchical model, Network Model, relational Model, Object-oriented Data Model, Components of database management systems, Retrieving Data through Queries (Text Book 2)

**Computer Systems and Development:** Investigation, Analysis, Design, system processing and general program design, Presentation to management and users, Implementation, Documents. (Text Book 1)

#### **UNIT V:**

**Emerging Computer Technologies:** Distributed Networking, Peer-to-peer Computing, Categorization of Peer-to-peer system Applications of Peer-to-peer networks, Grid Computing-components of Grid computing, Applications of Grid computing,, Cloud Computing-characteristics of cloud computing systems, cloud computing services, cloud computing architecture, cloud computing applications, Cloud computing concerns

**Wireless Networks:** Wireless network operations, Types of wireless networks, security in wireless Networks, Limitations of wireless Networks, Bluetooth – Bluetooth Piconets, Avoiding Interference in Bluetooth Devices, Bluetooth Security, Differences between Bluetooth and Wireless Networks. (Text Book 2)

#### **TEXT BOOKS:**

1. An Introduction to Computer studies –Noel Kalicharan-Cambridge
2. Fundamentals of Computers –Reema Thareja-Oxford higher education

#### **REFERENCES:**

1. Introduction to Information Technology – IITL education Solution Limited, Pearson
2. Computer Science and overview-J. Glenn Brookshear, Dennis Brylow-Pearson



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**COURSE STRUCTURE-R19**

**COURSE OUTCOMES:**

On completion of the course the student will be able to

1. Explain the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
2. Recognize the Computer networks, types of networks and topologies.
3. Summarize the concepts of Operating Systems and Databases.
4. Recite the Advanced Computer Technologies like Distributed Computing & Wireless Networks.



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**COURSE STRUCTURE-R19**

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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ELECTRICAL CIRCUIT ANALYSIS - I (ES1217)</b>					

**Preamble:**

This course introduces the basic concepts of circuit analysis which is the foundation for all subjects of the Electrical Engineering discipline. The emphasis of this course is laid on the basic analysis of circuits which includes single phase circuits, magnetic circuits, network theorems, transient analysis and network topology.

**Learning Objectives:**

- To study the concepts of passive elements, types of sources and various network reduction techniques.
- To understand the applications of network topology to electrical circuits.
- To study the concept of magnetic coupled circuit.
- To understand the behavior of RLC networks for sinusoidal excitations.
- To study the performance of R-L, R-C and R-L-C circuits with variation of one of the parameters and to understand the concept of resonance.
- To understand the applications of network theorems for analysis of electrical networks.

**UNIT-I**

**Introduction to Electrical Circuits**

Basic Concepts of passive elements of R, L, C and their V-I relations, Sources (dependent and independent), Kirchoff's laws, Network reduction techniques (series, parallel, series - parallel, star-to-delta and delta-to-star transformation), source transformation technique, nodal analysis and mesh analysis to DC networks with dependent and independent voltage and current sources.

**UNIT-II**

**Magnetic Circuits**

Basic definition of MMF, flux and reluctance, analogy between electrical and magnetic circuits, Faraday's laws of electromagnetic induction – concept of self and mutual inductance, Dot convention – coefficient of coupling and composite magnetic circuit, analysis of series and parallel magnetic circuits.





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## COURSE STRUCTURE-R19

### UNIT-III

#### Single Phase A.C Systems

Periodic waveforms (determination of rms, average value and form factor), concept of phase angle and phase difference – waveforms and phasor diagrams for lagging, leading networks, complex and polar forms of representations.

Steady state analysis of R, L and C circuits, power factor and its significance, real, reactive and apparent power, waveform of instantaneous power and complex power

### UNIT-IV

#### Analysis of AC Networks

Extension of node and mesh analysis to AC networks, series and parallel resonance, selectivity band width and Quality factor, introduction to locus diagram.

### UNIT-V

#### Network theorems (DC & AC Excitations)

Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Reciprocity theorem, Millman's theorem and compensation theorem.

#### Learning Outcomes:

The Student should be able to solve

- Various electrical networks in presence of active and passive elements.
- Electrical networks with network topology concepts.
- Any magnetic circuit with various dot conventions.
- Any R, L, C network with sinusoidal excitation.
- Any R, L, network with variation of any one of the parameters i.e R, L, C and f.
- Electrical networks by using principles of network theorems.

#### Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E. Kemmerley, Mc Graw Hill Company, 6th edition
2. Network Analysis: Van Valkenburg; Prentice-Hall of India Private Ltd

#### Reference Books:

1. Fundamentals of Electrical Circuits by Charles K. Alexander and Mathew N.O. Sadiku, Mc Graw Hill Education (India)
2. Linear Circuit Analysis by De Carlo, Lin, Oxford publications



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3. Electric Circuits – (Schaum’s outlines) by Mahmood Nahvi & Joseph Edminister, Adapted by Kuma Rao, 5<sup>th</sup> Edition – Mc Graw Hill.
4. Electric Circuits by David A. Bell, Oxford publications
5. Introductory Circuit Analysis by Robert L Boylestad, Pearson Publications
6. Circuit Theory(Analysis and Synthesis) by A.Chakrabarthy,Dhanpat Rai&Co.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ELECTRICAL ENGINEERING WORKSHOP (ES1218)</b>					

**Learning Objectives:**

- To demonstrate the usage of measuring equipment
- To train the students in setting up simple wiring circuits
- To impart methods in electrical machine wiring

Any 10 of the following experiments are to be conducted

1. Study of various electrical tools and symbols.
2. Identify different types of cables/wires and switches, fuses & fuse carriers, MCB and ELCB, MCCB with ratings and usage.
3. Identification of types of resistors and capacitors.
4. Wiring of light/fan circuit using two way/ three way control (stair case wiring)
5. Go-down wiring/Tunnel wiring
6. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and energy.
7. Measurement of voltage, current, resistance in DC circuit.
8. Measurement of voltage, calculate the power factor of the circuit.
9. Wiring of backup power supply including inverter, battery and load for domestic.
10. Types of earthing, physical implementation.
11. Identification of terminals of different semiconductor devices.
12. Identification of the peripherals of a computer. To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O devices, power rating of computers.
13. A practice on disassembling the components of a PC and Assembling them to back to working condition.
14. Hardware trouble shooting (Demonstration): Identification of a problem and fixing a defective PC (improper assembly of peripherals).
15. Software troubleshooting (Demonstration): Identification of a problem and fixing the PC for any software issues.



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**COURSE STRUCTURE-R19**

**Learning Outcomes:**

- Explain the limitations, tolerances, safety aspects of electrical systems and wiring.
- Select wires/cables and other accessories used in different types of wiring.
- Make simple lighting and power circuits.
- Measure current, voltage and power in a circuit.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>APPLIED PHYSIC LAB (ES1205)</b>					

**(Any 10 of the following listed 15 experiments)**

**LIST OF EXPERIMENTS:**

1. Determination of wavelength of a source-Diffraction Grating-Normal incidence.
2. Newton's rings – Radius of Curvature of Plano - Convex Lens.
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus.
5. Energy Band gap of a Semiconductor p - n junction.
6. Characteristics of Thermistor – Temperature Coefficients
7. Determination of dielectric constant by charging and discharging method
8. Determination of resistivity of semiconductor by Four probe method.
9. Study the variation of B versus H by magnetizing the magnetic material ( B-H curve).
- 10 Measurement of magnetic susceptibility by Gouy's method.
11. Dispersive power of diffraction grating.
12. Resolving Power of telescope
13. Resolving power of grating
14. Determination of Hall voltage and Hall coefficients of a given semiconductor using Hall effect.
15. Variation of dielectric constant with temperature.



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**KAKINADA – 533 003, Andhra Pradesh, India**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**COURSE STRUCTURE-R19**

I Year - II Semester		L	T	P	C
		<b>0</b>	<b>1</b>	<b>2</b>	<b>2</b>
<b>COMMUNICATION SKILLS LAB (HS1203)</b>					

**UNIT I:**

Oral Activity: JAM, Hypothetical Situations, Self/Peer Profile  
 Common Errors in Pronunciation, Neutralising Accent

**UNIT II:**

Oral Activity: Telephonic Etiquette, Role Plays  
 Poster Presentations

**UNIT III:**

Oral Activity: Oral Presentation skills, Public speaking  
 Data Interpretation

**UNIT IV:**

Oral Activity: Group Discussions: Do's and Don'ts- Types, Modalities

**UNIT V:**

Oral Activity: Interview Skills: Preparatory Techniques, Frequently asked questions, Mock Interviews.  
 Pronunciation: Connected speech (Pausing, Tempo, Tone, Fluency etc.,)

**References:**

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
8. Technical Communication- Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
9. Technical Communication- Gajendra Singh Chauhan, Smita Kashiramka, Cengage Publications.



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### COURSE STRUCTURE-R19

<b>I Year - II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>ENGINEERING EXPLORATION PROJECT (PR1201)</b>					

#### **COURSE OBJECTIVES:**

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating illdefined problems.
- Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

#### **HOW TO PURSUE THE PROJECT WORK?**

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.



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## COURSE STRUCTURE-R19

### TASKS TO BE DONE:

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this
- Foster team collaboration, find inspiration from the environment and learn how to identify problems

Task 4: Empathizing

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

Task 5: Ideating

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

Task 6: Prototyping

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

Task 7: Testing

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

Task 8:

- Final Report Submission and Presentation





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### COURSE STRUCTURE-R19

**Note:** The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

#### REFERENCES:

1. Tom Kelly, The Art of Innovation: Lessons in Creativity From IDEO, America’s Leading Design Firm (Profile Books, 2002)
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia Business School Publishing, 2017)

#### OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:

- Human-Centered Design Toolkit (IDEO); <https://www.ideo.com/post/design-kit>
- Design Thinking Boot Camp Bootleg (Stanford D-School); <https://dschool.stanford.edu/resources/the-bootcamp-bootleg>
- Collective Action Toolkit (frogdesign); [https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT\\_2.0\\_English.pdf](https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT_2.0_English.pdf)
- Design Thinking for Educators (IDEO); <https://designthinkingforeducators.com/>



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