



**Jawaharlal Nehru Technological  
University Anantapur**  
*(Established by Govt. of A.P., Act. No. 30 of 2008)*  
**Ananthapuramu–515 002 (A.P) India**

**Four Year B.Tech.**  
**Course Structure and Syllabi under**  
**R20 Regulations**



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
 (Established by Govt. of A.P., ACT No.30 of 2008)  
 ANANTAPUR – 515 002 (A.P) INDIA

## Semester-0

**Induction Program: 3 weeks**  
 (Common for All Branches of Engineering)

| <b>S.No</b> | <b>Course Name</b>  | <b>Category</b> | <b>L-T-P-C</b> |
|-------------|---|-----------------|----------------|
| 1           | Physical Activities -- Sports, Yoga and Meditation, Plantation                | MC              | 0-0-6-0        |
| 2           | Career Counselling  | MC              | 2-0-2-0        |
| 3           | Orientation to all branches -- career options, tools, etc.                    | MC              | 3-0-0-0        |
| 4           | Orientation on admitted Branch -- corresponding labs, tools and platforms     | EC              | 2-0-3-0        |
| 5           | Proficiency Modules & Productivity Tools                                      | ES              | 2-1-2-0        |
| 6           | Assessment on basic aptitude and mathematical skills                          | MC              | 2-0-3-0        |
| 7           | Remedial Training in Foundation Courses                                       | MC              | 2-1-2-0        |
| 8           | Human Values & Professional Ethics  | MC              | 3-0-0-0        |
| 9           | Communication Skills -- focus on Listening, Speaking, Reading, Writing skills | BS              | 2-1-2-0        |
| 10          | Concepts of Programming   | ES              | 2-0-2-0        |



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**Electrical & Electronics Engineering**

| Semester - 1 (Theory - 5, Lab - 4) |           |   |          |         |             |
|------------------------------------|-----------|---|----------|---------|-------------|
| S.No                               | Course No | Course Name                             | Category | L-T-P/D | Credits     |
| 1.                                 | 20A54101  | Linear Algebra and Calculus             | BS       | 3-0-0   | 3           |
| 2.                                 | 20A56201T | Applied Physics                         | BS       | 3-0-0   | 3           |
| 3.                                 | 20A52101T | Communicative English                   | HS       | 3-0-0   | 3           |
| 4.                                 | 20A02102T | Fundamentals of Electrical Circuits     | ES       | 3-0-0   | 3           |
| 5.                                 | 20A03101T | Engineering Drawing                     | ES       | 1-0-0/2 | 2           |
| 6.                                 | 20A03101P | Engineering Graphics Lab                | ES       | 0-0-2   | 1           |
| 7.                                 | 20A56201P | Applied Physics Lab                     | BS       | 0-0-3   | 1.5         |
| 8.                                 | 20A52101P | Communicative English Lab               | HS       | 0-0-3   | 1.5         |
| 9.                                 | 20A02102P | Fundamentals of Electrical Circuits Lab | ES       | 0-0-2   | 1.5         |
| <b>Total</b>                       |           |   |          |         | <b>19.5</b> |

| Semester – 2 (Theory – 5, Lab – 5) |           |  |          |       |             |
|------------------------------------|-----------|--|----------|-------|-------------|
| S.No                               | Course No | Course Name                                | Category | L-T-P | Credits     |
| 1.                                 | 20A54201  | Differential Equations and Vector Calculus | BS       | 3-0-0 | 3           |
| 2.                                 | 20A51101T | Chemistry                                  | BS       | 3-0-0 | 3           |
| 3.                                 | 20A05201T | C-Programming & Data Structures            | ES       | 3-0-0 | 3           |
| 4.                                 | 20A04101T | Electronic Devices & Circuits              | ES       | 3-0-0 | 3           |
| 5.                                 | 20A03202  | Engineering Workshop                       | LC       | 0-0-3 | 1.5         |
| 6.                                 | 20A05202  | IT Workshop                                | LC       | 0-0-3 | 1.5         |
| 7.                                 | 20A05201P | C-Programming & Data Structures Lab        | ES       | 0-0-3 | 1.5         |
| 8.                                 | 20A51101P | Chemistry Lab                              | BS       | 0-0-3 | 1.5         |
| 9.                                 | 20A04101P | Electronic Devices & Circuits Lab          | ES       | 0-0-3 | 1.5         |
| <b>Total</b>                       |           |  |          |       | <b>19.5</b> |

| Semester– III  |             |  |          |                |   |   |             |
|--|-------------|--|----------|----------------|---|---|-------------|
| S.No.  | Course Code | Course Name  | Category | Hours per week |   |   | Credits     |
|  |             |  |          | L              | T | P |             |
| 1.   | 20A54302    | Complex Variables & Transforms   | BS       | 3              | 0 | 0 | 3           |
| 2.   | 20A02301T   | Electrical Circuit Analysis  | PC       | 3              | 0 | 0 | 3           |
| 3.   | 20A02302T   | DC Machines & Transformers   | PC       | 3              | 0 | 0 | 3           |
| 4.   | 20A04303T   | Digital Logic Design   | PC       | 3              | 0 | 0 | 3           |
| 5.   | 20A52301    | <b>Humanities Elective – I</b><br>Managerial Economics & Financial Analysis      | HS       | 3              | 0 | 0 | 3           |
|  | 20A52302    | Organizational Behavior  |          |                |   |   |             |
|  | 20A52303    | Business Environment   |          |                |   |   |             |
| 6.   | 20A02301P   | Electrical Circuit Analysis Lab  | PC       | 0              | 0 | 3 | 1.5         |
| 7.   | 20A02302P   | DC Machines & Transformers Lab   | PC       | 0              | 0 | 3 | 1.5         |
| 8.   | 20A04303P   | Digital Logic Design Lab   | PC       | 0              | 0 | 3 | 1.5         |
| 9.   | 20A05305    | <b>Skill oriented course – I</b><br>Application development with Python          | SC       | 1              | 0 | 2 | 2           |
| 10   | 20A52201    | Universal Human Values   | MC       | 3              | 0 | 0 | 3           |
| 11   | 20A99301    | NSS/NCC/NSO Activities   | MC       | -              | - | - | 0           |
| <b>Total</b>   |             |  |          |                |   |   | <b>24.5</b> |
| Semester– IV   |             |  |          |                |   |   |             |
| S.No.  | Course Code | Course Name  | Category | Hours per week |   |   | Credits     |
|  |             |  |          | L              | T | P |             |
| 1.   | 20A54402    | Numerical Methods & Probability Theory   | BS       | 3              | 0 | 0 | 3           |
| 2.   | 20A04404T   | Analog Electronic Circuits   | ES       | 3              | 0 | 0 | 3           |
| 3.   | 20A02401T   | Power Electronics  | PC       | 3              | 0 | 0 | 3           |
| 4.   | 20A02402T   | AC Machines  | PC       | 3              | 0 | 0 | 3           |
| 5.   | 20A02403T   | Electromagnetic Field Theory   | PC       | 3              | 0 | 0 | 3           |
| 6.   | 20A04404P   | Analog Electronic Circuits Lab   | PC       | 0              | 0 | 3 | 1.5         |
| 7.   | 20A02401P   | Power Electronics Lab  | PC       | 0              | 0 | 3 | 1.5         |
| 8.   | 20A02402P   | AC Machines Lab  | PC       | 0              | 0 | 3 | 1.5         |
| 9.   | 20A02404    | <b>Skill oriented course – II</b><br>Circuits Simulation & Analysis using PSPICE | SC       | 1              | 0 | 2 | 2           |
| 10   | 20A99401    | <b>Mandatory noncredit course</b><br>Design Thinking for Innovation              | MC       | 3              | 0 | 0 | 0           |
| <b>Total</b>   |             |  |          |                |   |   | <b>21.5</b> |
| Community Service Internship (Mandatory) for 6 weeks duration during summer vacation |             |  |          |                |   |   |             |

**Note:**

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during third semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

| <b>Semester-V</b> |                                     |   |          |          |          |                |
|-------------------|-------------------------------------|---|----------|----------|----------|----------------|
| <b>S.No.</b>      | <b>Course Code</b>                  | <b>Course Name</b>  | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> |
| 1.                | 20A02501                            | Power System Architecture   | 3        | 0        | 0        | 3              |
| 2.                | 20A02502T                           | Control Systems   | 3        | 0        | 0        | 3              |
| 3.                | 20A02503T                           | Measurements & Sensors  | 3        | 0        | 0        | 3              |
| 4.                | 20A02504a<br>20A02504b<br>20A02504c | <b>Professional Elective Course – I</b><br>Switchgear and Protection<br>Power Electronics Drives<br>Power Quality | 3        | 0        | 0        | 3              |
| 5.                |                                     | <b>Open Elective Course – I</b>   | 3        | 0        | 0        | 3              |
| 6.                | 20A02502P                           | Control Systems Lab   | 0        | 0        | 3        | 1.5            |
| 7.                | 20A02503P                           | Measurements & Sensors Lab  | 0        | 0        | 3        | 1.5            |
| 8.                | 20A52401                            | <b>Skill oriented course - III</b><br>Soft Skills   | 1        | 0        | 2        | 2              |
| 9.                | 20A02505                            | Evaluation of Community Service Project   |          |          |          | 1.5            |
| 10.               | 20A99201                            | <b>Mandatory noncredit course</b><br>Environmental Science  | 3        | 0        | 0        | 0              |
| <b>Total</b>      |                                     |   |          |          |          | <b>21.5</b>    |

**Open Elective Course – I**

| <b>S.No.</b> | <b>Course Code</b> | <b>Course Name</b>                           | <b>Offered by the Dept.</b> |
|--------------|--------------------|--|-----------------------------|
| 1            | 20A01505           | Building Technology                          | CE                          |
| 2            | 20A03505           | 3D Printing Technology                       | ME                          |
| 3            | 20A04506           | Principles of Communication Systems          | ECE                         |
| 4            | 20A05505a          | Java Programming                             | CSE & Allied/IT             |
| 5            | 20A05502T          | Artificial Intelligence                      |                             |
| 6            | 20A12502           | Mobile Application Development using Android |                             |
| 7            | 20A27505           | Computer Applications in Food Processing     | FT                          |
| 8            | 20A54501           | Optimization Techniques                      | Mathematics                 |
| 9            | 20A56501           | Materials Characterization Techniques        | Physics                     |
| 10           | 20A51501           | Chemistry of Energy Materials                | Chemistry                   |

**Note:**

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline

| <b>Semester-VI</b>  |                                     |  |          |          |          |                |
|---|-------------------------------------|--|----------|----------|----------|----------------|
| <b>S.No.</b>  | <b>CourseCode</b>                   | <b>Course Name</b>   | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> |
| 1.  | 20A02601T                           | Power System Analysis  | 3        | 0        | 0        | 3              |
| 2.  | 20A02602T                           | Digital Computing Platforms  | 3        | 0        | 0        | 3              |
| 3.  | 20A04502T                           | Digital Signal Processing  | 3        | 0        | 0        | 3              |
| 4.  | 20A02604a<br>20A02604b<br>20A02604c | <b>Professional Elective Course– II</b><br>HVDC and FACTS<br>Nonlinear System Analysis<br>Design of Photovoltaic Systems | 3        | 0        | 0        | 3              |
| 5.  |                                     | <b>Open Elective Course – II</b>   | 3        | 0        | 0        | 3              |
| 6.  | 20A02601P                           | Power Systems Analysis Lab   | 0        | 0        | 3        | 1.5            |
| 7.  | 20A02602P                           | Digital Computing Platforms Lab  | 0        | 0        | 3        | 1.5            |
| 8.  | 20A04502P                           | Digital Signal Processing Lab  | 0        | 0        | 3        | 1.5            |
| 9.  | 20A02606                            | <b>Skill oriented course - IV</b><br>Applications of Soft Computing Tools in Electrical Engineering                      | 1        | 0        | 2        | 2              |
| 10.   | 20A99601                            | <b>Mandatory Non-credit Course</b><br>Intellectual Property Rights & Patents   | 2        | 0        | 0        | 0              |
| <b>Total</b>  |                                     |  |          |          |          | <b>21.5</b>    |
| Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation |                                     |  |          |          |          |                |

**Open Elective Course – II**

| <b>S.No.</b> | <b>Course Code</b> | <b>Course Name</b>                           | <b>Offeredby the Dept.</b> |
|--------------|--------------------|--|----------------------------|
| 1            | 20A01605           | Environmental Economics                      | CE                         |
| 2            | 20A03605           | Introduction to Robotics                     | ME                         |
| 3            | 20A04606           | Basic VLSI Design                            | ECE                        |
| 4            | 20A04701b          | Introduction to Internet of Things           | ECE/CSE                    |
| 5            | 20A05605a          | Principles of Operating Systems              | CSE & Allied/IT            |
| 6            | 20A05605b          | Foundations of Machine Learning              |                            |
| 7            | 20A05605c          | Data Analytics Using R                       |                            |
| 8            | 20A27605           | Food Refrigeration and Cold Chain Management | FT                         |
| 9            | 20A54701           | Wavelet Transforms & its applications        | Mathematics                |
| 10           | 20A56701           | Physics Of Electronic Materials and Devices  | Physics                    |
| 11           | 20A51701           | Chemistry of Polymers and its Applications   | Chemistry                  |

| <b>Semester-VII</b> |                                     |  |          |          |          |                |
|---------------------|-------------------------------------|--|----------|----------|----------|----------------|
| <b>S.No.</b>        | <b>Course Code</b>                  | <b>Course Name</b>   | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> |
| <b>1.</b>           | 20A02701a<br>20A02701b<br>20A02701c | <b>Professional Elective Course– III</b><br>Power System Operation & Control<br>Switched Mode Power Converters<br>Electrical & Electronics Instrumentation | 3        | 0        | 0        | 3              |
| <b>2.</b>           | 20A02702a<br>20A02702b<br>20A02702c | <b>Professional Elective Course– IV</b><br>Electrical Distribution System & Automation<br>FPGA based Controller Design<br>Intelligent Control Techniques   | 3        | 0        | 0        | 3              |
| <b>3.</b>           | 20A02703a<br>20A04403T<br>20A02703c | <b>Professional Elective Course– V</b><br>Programmable Logic Controllers<br>Linear & Digital IC Applications<br>Electric Vehicle Technologies              | 3        | 0        | 0        | 3              |
| <b>4.</b>           | 20A52701a<br>20A52701b<br>20A52701c | <b>Humanities Elective – II</b><br>Entrepreneurship and Incubation<br>Management Science<br>Enterprise Resource Planning                                   | 3        | 0        | 0        | 3              |
| <b>5.</b>           |                                     | <b>Open Elective Course – III</b>  | 3        | 0        | 0        | 3              |
| <b>6.</b>           |                                     | <b>Open Elective Course – IV</b>   | 3        | 0        | 0        | 3              |
| <b>7.</b>           | 20A02706                            | <b>Skill oriented course – V</b><br>Energy Conservation and Audit  | 1        | 0        | 2        | 2              |
| <b>8.</b>           | 20A02707                            | Evaluation of Industry Internship  |          |          |          | 3              |
| <b>Total</b>        |                                     |  |          |          |          | <b>23</b>      |

**Open Elective Course – III**

| <b>S.No</b> | <b>Course Code</b> | <b>Course Name</b>                                 | <b>Offered by the Dept.</b> |
|-------------|--------------------|--|-----------------------------|
| 1           | 20A01704           | Cost Effective Housing Techniques                  | CE                          |
| 2           | 20A03704           | Product Design & Development                       | ME                          |
| 3           | 20A04704           | Electronic Sensors                                 | ECE                         |
| 4           | 20A05704a          | Web Technologies                                   | CSE & Allied/IT             |
| 5           | 20A05704b          | VR & AR for Engineers                              |                             |
| 6           | 20A05704c          | Software Engineering                               |                             |
| 7           | 20A27704           | Human Nutrition                                    | FT                          |
| 8           | 20A54702           | Numerical Methods for Engineers                    | Mathematics                 |
| 9           | 20A56702           | Sensors And Actuators for Engineering Applications | Physics                     |
| 10          | 20A51702           | Chemistry of Nanomaterials and Applications        | Chemistry                   |

**Open Elective Course – IV**

| <b>S.No</b> | <b>Course Code</b> | <b>Course Name</b>  | <b>Offering by the Dept.</b> |
|-------------|--------------------|---|------------------------------|
| 1           | 20A01705           | Health, Safety & Environmental management                 | CE                           |
| 2           | 20A03705           | Introduction to Composite Materials                       | ME                           |
| 3           | 20A04706           | Principles of Cellular & Mobile Communications            | ECE                          |
| 4           | 20A05705a          | Cyber Security  | CSE & Allied/IT              |
| 5           | 20A05705b          | Introduction to Full Stack Development                    |                              |
| 6           | 20A05705c          | Industrial IoT  |                              |
| 7           | 20A27705           | Waste and Effluent Management                             | FT                           |
| 8           | 20A54703           | Number theory & its applications                          | Mathematics                  |
| 9           | 20A56703           | Smart Materials and Devices                               | Physics                      |
| 10          | 20A51703           | Green Chemistry and Catalysis for Sustainable Environment | Chemistry                    |

| <b>Semester-VIII</b> |                    |                                |                 |          |          |          |                |
|----------------------|--------------------|--------------------------------|-----------------|----------|----------|----------|----------------|
| <b>S.No.</b>         | <b>Course Code</b> | <b>Course Name</b>             | <b>Category</b> | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> |
| 1.                   | 20A02801           | Full Internship & Project work | PR              |          |          |          | 12             |
| <b>Total</b>         |                    |                                |                 |          |          |          | <b>12</b>      |

### COURSES OFFERED FOR HONOURS DEGREE IN EEE

| <b>S.No.</b>           | <b>Course Code</b> | <b>Course Name</b>  | <b>Contact Hours per week</b> |          | <b>Credits</b> |
|------------------------|--------------------|---|-------------------------------|----------|----------------|
|                        |                    |   | <b>L</b>                      | <b>T</b> |                |
| 1                      | 20A02H01           | Electric Vehicle Technology & Mobility                    | 3                             | 1        | 4              |
| 2                      | 20A02H02           | Battery Management Systems                                | 3                             | 1        | 4              |
| 3                      | 20A02H03           | Special Machines for Electric Vehicles                    | 3                             | 1        | 4              |
| 4                      | 20A02H04           | Grid Interface of Electric Vehicles                       | 3                             | 1        | 4              |
| <b>SUGGESTED MOOCs</b> |                    |   |                               |          |                |
| 5                      | 20A02H05           | Introduction to Hybrid and Electric Vehicles (MOOC-NPTEL) | --                            | --       | 2              |
| 6                      | 20A02H06           | Electric Vehicles and RenewableEnergy(MOOC-NPTEL)         | --                            | --       | 2              |

### LIST OF MINORS OFFERED TO EEE

| <b>S.No.</b> | <b>Minor Title</b>                      | <b>Department offering the Minor</b> |
|--------------|---|--------------------------------------|
| 1.           | Construction Technology                 | Civil Engineering                    |
| 2.           | Environmental Geotechnology             | Civil Engineering                    |
| 3.           | 3D Printing                             | ME                                   |
| 4.           | Industrial Engineering                  | ME                                   |
| 5.           | Internet of Things                      | ECE                                  |
| 6.           | Food Science                            | Food Technology                      |
| 8.           | Artificial Intelligence & Data Science  | CSE& Allied/ IT                      |
| 9.           | Virtual & Augmented Reality             |                                      |
| 10.          | Cyber Security &Blockchain Technologies |                                      |

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– I Sem**

|          |          |          |          |
|----------|----------|----------|----------|
| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
| <b>3</b> | <b>0</b> | <b>0</b> | <b>3</b> |

**(20A54101) LINEAR ALGEBRA & CALCULUS**  
 (Common to All Branches of Engineering)

**Course Objectives:**

- This course will illuminate the students in the concepts of calculus and linear algebra.
- 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.

**UNIT -1**

**Matrices**

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (L3)

**UNIT -2**

**Mean Value Theorems**

Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

**UNIT -3**

**Multivariable Calculus**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

### Learning Outcomes:

At the end of this unit, the student will be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

### UNIT -4

#### Multiple Integrals

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

### Learning Outcomes:

At the end of this unit, the student will be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

### UNIT -5

#### Beta and Gamma functions

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

### Learning Outcomes:

At the end of this unit, the student will be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

### Text Books:

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

### Reference Books:

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
4. Micheael Greenberg, Advanced Engineering Mathematics, 9<sup>th</sup> edition, Pearson edn
5. Dean G. Duffy, Advanced Engineering Mathematics with MATLAB, CRC Press
6. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
7. R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
8. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education

9. H. k Das, Er. RajnishVerma, Higher Engineering Mathematics, S. Chand.
10. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

**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)
- Utilize mean value theorems to real life problems (L3)
- Familiarize with functions of several variables which is useful in optimization (L3)
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5)
- Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– I Sem****L T P C**  
**3 0 0 3****20A56201T APPLIED PHYSICS**

(ECE, EEE, CSE, AI &amp; DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI &amp; ML), IT)

**Course Objectives**

- To make a bridge between the physics in school and engineering courses.
- To identify the importance of the optical phenomenon i.e. interference, diffraction and polarization related to its Engineering applications
- To understand the mechanisms of emission of light, the use of lasers as light sources for low and high energy applications, study of propagation of light wave through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To enlighten the concepts of Quantum Mechanics and to provide fundamentals of de'Broglie waves, quantum mechanical wave equation and its applications, the importance of free electron theory and band theory of solids.
- Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of charge carriers in semiconductors. To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications.

**Unit-I:****Wave Optics**

**Interference-** Principle of superposition – Interference of light – Conditions for sustained interference - Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index.

**Diffraction-** Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

**Polarization-** Introduction – Types of polarization – Polarization by reflection, refraction and double refraction - Nicol's Prism - Half wave and Quarter wave plates with applications.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the need of coherent sources and the conditions for sustained interference (L2)
- Identify engineering applications of interference (L3)
- Analyze the differences between interference and diffraction with applications (L4)
- Illustrate the concept of polarization of light and its applications (L2)
- Classify ordinary polarized light and extraordinary polarized light (L2)

## Unit-II:

### **Lasers and Fiber optics**

**Lasers-** Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

**Fiber optics-** Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (qualitative) – Applications.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

## Unit-III:

### **Dielectric and Magnetic Materials**

**Dielectric Materials-** Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

**Magnetic Materials-** Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

### **Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius-Mosotti relation in dielectrics(L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
- Explain the applications of dielectric and magnetic materials (L2)
- Apply the concept of magnetism to magnetic devices (L3)

## Unit IV:

### **Quantum Mechanics, Free Electron Theory and Band theory of Solids**

**Quantum Mechanics-** Dual nature of matter – Schrodinger's time independent and dependent wave equation – Significance of wave function – Particle in a one-dimensional infinite potential well.

**Free Electron Theory-** Classical free electron theory (Merits and demerits only) – Quantum free electron theory – Equation for electrical conductivity based on quantum free electron theory – Fermi-Dirac distribution – Density of states – Fermi energy.

**Band theory of Solids-** Bloch's Theorem (Qualitative) – Kronig-Penney model (Qualitative) – E vs K diagram – Classification of crystalline solids – Effective mass of electron –  $m^*$  vs K diagram – Concept of hole.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Explain the concept of dual nature of matter (L2)
- Understand the significance of wave function (L2)
- Interpret the concepts of classical and quantum free electron theories (L2)
- Explain the importance of K-P model
- Classify the materials based on band theory (L2)
- Apply the concept of effective mass of electron (L3)

**Unit – V:**

**Semiconductors and Superconductors**

**Semiconductors-** Introduction – Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors – Density of charge carriers – Dependence of Fermi energy on carrier concentration and temperature – Drift and diffusion currents – Einstein's equation – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applications of Hall effect.

**Superconductors-** Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory – Josephson effects (AC and DC) – High  $T_c$  superconductors – Applications of superconductors.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)
- Explain how electrical resistivity of solids changes with temperature (L2)
- Classify superconductors based on Meissner's effect (L2)
- Explain Meissner's effect, BCS theory & Josephson effect in superconductors (L2)

**Text books:**

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics – B.K. Pandey and S. Chaturvedi, Cengage Learning.

**Reference Books:**

1. Engineering Physics – Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
4. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill

### Course Outcomes

- Study the different realms of physics and their applications in both scientific and technological systems through physical optics. (L2)
- Identify the wave properties of light and the interaction of energy with the matter (L3).
- Asses the electromagnetic wave propagation and its power in different media (L5).
- Understands the response of dielectric and magnetic materials to the applied electric and magnetic fields. (L3)
- Study the quantum mechanical picture of subatomic world along with the discrepancies between the classical estimates and laboratory observations of electron transportation phenomena by free electron theory and band theory. (L2)
- Elaborate the physical properties exhibited by materials through the understanding of properties of semiconductors and superconductors. (L5)

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**B.Tech (EEE)– I Sem**

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**(20A52101T) COMMUNICATIVE ENGLISH**  
 (Common to All Branches of Engineering)

### Course Objectives

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

### UNIT -1

#### Lesson: On the Conduct of Life: William Hazlitt

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing :** Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Parts of Speech, Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

#### Learning Outcomes

At the end of the module, the learners will be able to

- Understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- Ask and answer general questions on familiar topics and introduce oneself/others
- Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- Recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- Form sentences using proper grammatical structures and correct word forms

### UNIT -2

#### Lesson: The Brook: Alfred Tennyson

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/small groups on specific topics followed by short structured talks. **Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas

in a paragraph together. **Writing:** Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters. **Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions.

### Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend short talks on general topics
- Participate in informal discussions and speak clearly on a specific topic using suitable discourse markers
- Understand the use of cohesive devices for better reading comprehension
- Write well structured paragraphs on specific topics
- Identify basic errors of grammar/ usage and make necessary corrections in short texts

## UNIT -3

### Lesson: The Death Trap: Saki

**Listening:** Listening for global comprehension and summarizing what is listened to. **Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed **Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing, Paragraph Writing **Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

### Learning Outcomes

At the end of the module, the learners will be able to

- Comprehend short talks and summarize the content with clarity and precision
- Participate in informal discussions and report what is discussed
- Infer meanings of unfamiliar words using contextual clues
- Write summaries based on global comprehension of reading/listening texts
- Use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

## UNIT-4

### Lesson: Innovation: Muhammad Yunus

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:** Letter Writing: Official Letters/Report Writing **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; Voice - Active & Passive Voice

## Learning Outcomes

At the end of the module, the learners will be able to

- Infer and predict about content of spoken discourse
- Understand verbal and non-verbal features of communication and hold formal/informal conversations
- Interpret graphic elements used in academic texts
- Produce a coherent paragraph interpreting a figure/graph/chart/table
- Use language appropriate for description and interpretation of graphical elements

## UNIT -5

### Lesson: Politics and the English Language: George Orwell

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. Speaking: Formal oral presentations on topics from academic contexts - without the use of PPT slides. Reading: Reading for comprehension. Writing: Writing structured essays on specific topics using suitable claims and evidences. Grammar and Vocabulary: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

## Learning Outcomes

At the end of the module, the learners will be able to

- Take notes while listening to a talk/lecture and make use of them to answer questions
- Make formal oral presentations using effective strategies
- Comprehend, discuss and respond to academic texts orally and in writing
- Produce a well-organized essay with adequate support and detail
- Edit short texts by correcting common errors

## Text Book:

1. Language and Life: A Skills Approach- I Edition 2019, Orient Black Swan

## Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. Oxford Learners Dictionary, 12<sup>th</sup> Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)
7. Speed Reading with the Right Brain: Learn to Read Ideas Instead of Just Words by David Butler

## Course Outcomes

- Retrieve the knowledge of basic grammatical concepts
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
- Create a coherent paragraph interpreting a figure/graph/chart/table

## Web links

[www.englishclub.com](http://www.englishclub.com)

[www.easyworldofenglish.com](http://www.easyworldofenglish.com)

[www.languageguide.org/english/](http://www.languageguide.org/english/)

[www.bbc.co.uk/learningenglish](http://www.bbc.co.uk/learningenglish)

[www.eslpod.com/index.html](http://www.eslpod.com/index.html)

[www.myenglishpages.com](http://www.myenglishpages.com)

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**(20A02102T) FUNDAMENTALS OF ELECTRICAL CIRCUITS**

**Course Objectives:**

To make the student learn about

- Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters.
- The Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference
- Series and parallel resonances, bandwidth, current locus diagrams
- Network theorems and their applications
- Network Topology and concepts like Tree, Cut-set , Tie-set, Loop, Co-Tree

**Unit- 1**

**Introduction to Electrical & Magnetic Circuits**

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage - Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques- Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation. Examples

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits, MMF Calculations.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To know about Kirchhoff's Laws in solving series, parallel, non-series-parallel configurations in DC networks
- To know about voltage source to current source and vice-versa transformation in their representation
- To understand Faraday's laws
- To distinguish analogy between electric and magnetic circuits
- To understand analysis of series and parallel magnetic circuits

**Unit- 2**

**Network Topology**

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – Loop and Nodal Methods of Analysis of Networks & Independent Voltage and Current Sources – Duality & Dual Networks. Nodal Analysis, Mesh Analysis.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- To understand basic graph theory definitions which are required for solving electrical circuits
- To understand about loop current method

- To understand about nodal analysis methods
- To understand about principle of duality and dual networks
- To identify the solution methodology in solving electrical circuits based on the topology

### Unit- 3

#### Single Phase A.C Circuits

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, j-Notation, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation- Resonance - Phasor diagrams - Concept of Power Factor- Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.

#### Learning Outcomes:

At the end of this unit, the student will be able to

- To understand fundamental definitions of 1- $\phi$  AC circuits
- To distinguish between scalar, vector and phasor quantities
- To understand voltage, current and power relationships in 1- $\phi$  AC circuits with basic elements R, L, and C.
- To understand the basic definitions of complex immittances and complex power
- To solve 1- $\phi$  AC circuits with series and parallel combinations of electrical circuit elements R, L and C.

### Unit- 4

#### Network Theorems

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

#### Learning Outcomes:

At the end of this unit, the student will be able to

- To know that electrical circuits are 'heart' of electrical engineering subjects and network theorems are main part of it.
- To distinguish between various theorems and inter-relationship between various theorems
- To know about applications of certain theorems to DC circuit analysis
- To know about applications of certain theorems to AC network analysis
- To know about applications of certain theorems to both DC and AC network analysis

### Unit- 5

#### Three Phase A.C. Circuits

Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

### Learning Outcomes:

At the end of this unit, the student will be able to

- To know about advantages of 3- $\phi$  circuits over 1- $\phi$  circuits
- To distinguish between balanced and unbalanced circuits
- To know about phasor relationships of voltage, current, power in star and delta connected balanced and unbalanced loads
- To know about measurement of active, reactive powers in balanced circuits
- To understand about analysis of unbalanced circuits and power calculations

### Text Books:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.

### Reference Books:

1. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018.
2. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
3. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
4. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
5. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

### Course Outcomes:

After completing the course, the student should be able to do the following

- Given a network, find the equivalent impedance by using network reduction techniques and determine the current through any element and voltage across and power through any element.
- Given a circuit and the excitation, determine the real power, reactive power, power factor etc.,
- Apply the network theorems suitably
- Determine the Dual of the Network, develop the Cut Set and Tie-set Matrices for a given Circuit. Also understand various basic definitions and concepts.

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**(20A03101T) ENGINEERING DRAWING**

(Common to All Branches of Engineering)

**Course Objectives:**

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

**Unit: I**

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance- Conventions in drawing-lettering - BIS conventions.

- a) Conic sections including the rectangular hyperbola- general method only,
- b) Cycloid, epicycloids and hypocycloid c) Involute

**Learning Outcomes:**

At the end of this unit the student will be able to

- Understand the significance of engineering drawing
- Know the conventions used in the engineering drawing
- Identify the curves obtained in different conic sections
- Draw different curves such as cycloid, involute and hyperbola

**Unit: II**

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

**Learning Outcomes:**

At the end of this unit the student will be able to

- Understand the meaning of projection
- Know how to draw the projections of points, lines
- Differentiate between projected length and true length
- Find the true length of the lines

**Unit: III**

**Projections of solids:** Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

### Learning Outcomes:

At the end of this unit the student will be able to

- Understand the procedure to draw projection of solids
- Differentiate between rotational method and auxiliary view method.
- Draw the projection of solid inclined to one plain
- Draw the projection of solids inclined to both the plains

### Unit: IV

**Sections of solids:** Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

### Learning Outcomes:

At the end of this unit the student will be able to

- Understand different sectional views of regular solids
- Obtain the true shapes of the sections of prism
- Draw the sectional views of prism, cylinder, pyramid and cone

### Unit: V

**Development of surfaces:** Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

### Learning Outcomes:

At the end of this unit the student will be able to

- Understand the meaning of development of surfaces
- Draw the development of regular solids such as prism, cylinder, pyramid and cone
- Obtain the development of sectional parts of regular shapes

### Text Books:

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

### Reference Books:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

### Course Outcomes:

After completing the course, the student will be able to

- Draw various curves applied in engineering. (12)
- Show projections of solids and sections graphically. (12)
- Draw the development of surfaces of solids. (13)

### Additional Sources

Youtube: [http://sewor,Carleton.ca/g/kardos/88403/drawings.html](http://sewor.Carleton.ca/g/kardos/88403/drawings.html) conic sections-online, red woods.edu

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**(20A03101P) Engineering Graphics Lab**  
**(Common to all Engineering Branches)**

**Course Objectives:**

- Instruct the utility of drafting & modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling.
- Instruct graphical representation of machine components.

**Computer Aided Drafting:**

**Introduction to AutoCAD:** Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.

Dimensioning principles and conventional representations.

**Orthographic Projections:** Systems of projections, conventions and application to orthographic projections - simple objects.

**Isometric Projections:** Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

**Text Books:**

1. K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
2. Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

**Reference Books:**

1. T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
2. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
3. Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

**Course Outcomes:**

After completing the course, the student will be able to

- Use computers as a drafting tool. (L2)
- Draw isometric and orthographic drawings using CAD packages. (L3)

**Additional Sources**

1. Youtube: <http://sewor,Carleton.cag,kardos/88403/drawings.html> conic sections-online, red woods.edu

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– I Sem****L T P C**  
**0 0 3 1.5****(20A56201P) APPLIED PHYSICS LAB**

(ECE, EEE, CSE, AI &amp; DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI &amp; ML), IT)

**Course Objectives:**

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and dielectric materials applications.
- Apply the principles of semiconductors in various electronic devices.

**Note: In the following list, out of 15 experiments, any 12 experiments (minimum 10) must be performed in a semester**

**List of Applied Physics Experiments**

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. Determination of particle size using LASER.
7. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
8. Determination of dielectric constant by charging and discharging method.
9. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
10. Measurement of magnetic susceptibility by Gouy's method
11. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
12. To determine the resistivity of semiconductor by Four probe method
13. To determine the energy gap of a semiconductor
14. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
15. Measurement of resistance with varying temperature.

**Course Outcomes:**

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

- Operate optical instruments like microscope and spectrometer (L2)
- Determine thickness of a hair/paper with the concept of interference (L2)
- Estimate the wavelength of different colors using diffraction grating and resolving power (L2)
- Plot the intensity of the magnetic field of circular coil carrying current with distance (L3)
- Evaluate the acceptance angle of an optical fiber and numerical aperture (L3)
- Determine the resistivity of the given semiconductor using four probe method (L3)
- Identify the type of semiconductor i.e., n-type or p-type using hall effect (L3)
- Calculate the band gap of a given semiconductor (L3)

## References

1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php> -Virtual Labs, Amrita University

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**(20A52101P) COMMUNICATIVE ENGLISH LAB**

(Common to All Branches of Engineering)

**Course Objectives**

- students will be exposed to a variety of self instructional, learner friendly modes of language learning
- students will learn better pronunciation through stress, intonation and rhythm
- students will be trained to use language effectively to face interviews, group discussions, public speaking
- students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

**List of Topics**

1. Phonetics
2. Reading comprehension
3. Describing objects/places/persons
4. Role Play or Conversational Practice
5. JAM
6. Etiquettes of Telephonic Communication
7. Information Transfer
8. Note Making and Note Taking
9. E-mail Writing
10. Group Discussions-1
11. Resume Writing
12. Debates
13. Oral Presentations
14. Poster Presentation
15. Interviews Skills-1

**Suggested Software**

Orel, Walden Infotech, Young India Films

**Reference Books**

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
5. A Textbook of English Phonetics for Indian Students by T.Balasubramanyam

**Web Links**

[www.esl-lab.com](http://www.esl-lab.com)  
[www.englishmedialab.com](http://www.englishmedialab.com)  
[www.englishinteractive.net](http://www.englishinteractive.net)

## Course Outcomes

After completing the course, the student will be able to

- Listening and repeating the sounds of English Language
- Understand the different aspects of the English language
- proficiency with emphasis on LSRW skills
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, stress, rhythm, intonation and syllable
- Division for better listening and speaking comprehension.
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it in order to
- Improve fluency in spoken English.

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**B.Tech (EEE)– I Sem**

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**(20A02102P) FUNDAMENTALS OF ELECTRICAL CIRCUITS LAB**

**Course Objectives:**

- Remember, understand and apply various theorems and verify practically.
- Understand and analyze active, reactive power measurements in three phase balanced & unbalanced circuits.

**List of Experiments:**

1. Verification of Thevenin's and Norton's Theorems
2. Verification of Superposition Theorem for average and rms values
3. Maximum Power Transfer Theorem for DC and AC circuits
4. Verification of Compensation Theorem for DC circuits
5. Verification of Reciprocity, Millmann's Theorems for DC circuits
6. Determination of Self, Mutual Inductances and Coefficient of Coupling
7. Measurement of Active Power for Star Connected Balanced Loads
8. Measurement of Reactive Power for Star Connected Balanced Loads
9. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads
10. Measurement of Active Power for Delta Connected Balanced Loads
11. Measurement of Reactive Power for Delta Connected Balanced Loads

**Course Outcomes:**

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

- Remember, understand and apply various theorems and verify practically.
- Understand and analyze active, reactive power measurements in three phase balanced & unbalanced circuits.

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**(20A54201) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**  
 (Common to Civil, EEE, Mechanical, ECE and Food Technology)

**Course Objectives:**

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- 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.

**UNIT -1**

**Linear differential equations of higher order (Constant Coefficients)**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Identify the essential characteristics of linear differential equations with constant coefficients (L3)
- Solve the linear differential equations with constant coefficients by appropriate method (L3)
- Classify and interpret the solutions of linear differential equations (L3)
- Formulate and solve the higher order differential equation by analyzing physical situations (L3)

**UNIT 2:**

**Partial Differential Equations**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange's method.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply a range of techniques to find solutions of standard pdes (L3)
- Outline the basic properties of standard PDEs (L2)

**UNIT -3**

**Applications of Partial Differential Equations**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Classify the PDE (L3)
- Learn the applications of PDEs (L2)

**UNIT-4****Vector differentiation**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Apply del to Scalar and vector point functions (L3)
- Illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

**UNIT -5****Vector integration**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

**Learning Outcomes:**

At the end of this unit, the student will be able to

- Find the work done in moving a particle along the path over a force field (L4)
- Evaluate the rates of fluid flow along and across curves (L4)
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

**Text Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

**Reference Books:**

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
2. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
3. George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
5. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
6. Micheael Greenberg, Advanced Engineering Mathematics, 9<sup>th</sup> edition, Pearson edn
7. Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press
8. Peter O'neil, Advanced Engineering Mathematics, Cengage Learning.
9. R.L. GargNishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education
10. B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education.
11. H. k Das, Er. RajnishVerma, Higher Engineering Mathematics, S. Chand.
12. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

**Course Outcomes:**

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

- Solve the differential equations related to various engineering fields (L6)
- Identify solution methods for partial differential equations that model physical processes (L3)
- 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 (L6)

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**(20A51101T) CHEMISTRY**

(CSE, AI & DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT, ECE, EEE and IT)

**Course Objectives:**

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods, molecular machines and switches

**Unit 1: Structure and Bonding Models:**

Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of  $\Psi$  and  $\Psi^2$ , applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of  $O_2$  and  $CO$ , etc.  $\pi$ -molecular orbitals of butadiene and benzene, calculation of bond order.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Apply Schrodinger wave equation to hydrogen atom (L3)
- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Explain the calculation of bond order of  $O_2$  and  $CO$  molecules (L2)
- Discuss the basic concept of molecular orbital theory (L3)

**Unit 2: Modern Engineering materials:**

Coordination compounds: Crystal field theory – salient features – splitting in octahedral and tetrahedral geometry. Properties of coordination compounds-Oxidation state, coordination, magnetic and colour.

Semiconductor materials, super conductors- basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.

Supercapacitors: Introduction, Basic concept-Classification – Applications.

Nanochemistry: Introduction, classification of nanomaterials, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

**Learning Outcomes:**

At the end of this unit, the students will be able to

- Explain splitting in octahedral and tetrahedral geometry of complexes (L2).
- Discuss the magnetic behaviour and colour of coordination compounds (L3).
- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nano tubes and Graphines nanoparticles (L2).

**Unit 3: Electrochemistry and Applications:**

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode); Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad), and lithium ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen, methanol fuel cells – working of the cells.

### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Apply Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between pH metry, potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)
- Solve problems based on cell potential (L3)

### **Unit 4: Polymer Chemistry:**

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, copolymerization (stereospecific polymerization) with specific examples and mechanisms of polymer formation.

Plastics - Thermoplastics and Thermosettings, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, polypyrroles – mechanism of conduction and applications.

### **Learning Outcomes:**

At the end of this unit, the students will be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylon-6,6, and carbon fibres (L2)
- Describe the mechanism of conduction in conducting polymers (L2)
- Discuss Buna-S and Buna-N elastomers and their applications (L2)

### **Unit 5: Instrumental Methods and Applications**

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. Principle and applications of pH metry, UV-Visible, IR Spectroscopies. Solid-Liquid Chromatography–TLC, retention time.

### **Learning outcomes:**

After completion of Unit IV, students will be able to:

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles of different analytical instruments (L2)
- Explain the different applications of analytical instruments (L2)

**Text Books:**

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

**Reference Books:**

1. G.V.Subba Reddy, K.N.Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. D. Lee, Concise Inorganic Chemistry, 5/e, Oxford University Press, 2008.
3. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
4. J.M.Lehn, Supra Molecular Chemistry, VCH Publications

**Course Outcomes:**

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

- Compare the materials of construction for battery and electrochemical sensors (I2)
- Explain the preparation, properties, and applications of thermoplastics &thermosetting, elastomers & conducting polymers. (I2)
- Explain the principles of spectrometry, slc in separation of solid and liquid mixtures (I2)
- Apply the principle of Band diagrams in application of conductors and semiconductors (L3)

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**(20A05201T) C-PROGRAMMING & DATA STRUCTURES**  
(Common to All Branches of Engineering)

**Course Objectives:**

- To illustrate the basic concepts of C programming language.
- To discuss the concepts of Functions, Arrays, Pointers and Structures.
- To familiarize with Stack, Queue and Linked lists data structures.
- To explain the concepts of non-linear data structures like graphs and trees.
- To learn different types of searching and sorting techniques.

**UNIT-1**

**Introduction to C Language** - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays.

**Learning outcomes:**

At the end of this unit, the students will be able to

- Use C basic concepts to write simple C programs. (L3)
- Use iterative statements for writing the C programs (L3)
- Use arrays to process multiple homogeneous data. (L3)
- Test and execute the programs and correct syntax and logical errors. (L4)
- Translate algorithms into programs. (L4)
- Implement conditional branching, iteration and recursion. (L2)

**UNIT – 2**

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions, and Command line arguments.

**Learning outcomes:**

At the end of this unit, the students will be able to

- Writing structured programs using C Functions. (L5)
- Writing C programs using various storage classes to control variable access. (L5)
- Apply String handling functions and pointers. (L3)
- Use arrays, pointers and structures to formulate algorithms and write programs.(L3)

### UNIT-3

**Data Structures**, Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

#### **Learning outcomes:**

At the end of this unit, the students will be able to

- Describe the operations of Stack. (L2)
- Explain the different notations of arithmetic expression. (L5)
- Develop various operations on Queues. (L6)

### UNIT – 4

**Linked Lists** – Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

#### **Learning outcomes:**

At the end of this unit, the students will be able to

- Analyze various operations on singly linked list. (L4)
- Interpret operations of doubly linked lists. (L2)
- Apply various operations on Circular linked lists. (L6)

### UNIT-5

**Trees** - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

#### **Learning outcomes:**

At the end of this unit, the students will be able to

- Develop the representation of Tress. (L3)
- Identify the various Binary tree traversals. (L3)
- Illustrate different Graph traversals like BFS and DFS. (L2)
- Design the different sorting techniques (L6)
- Apply programming to solve searching and sorting problems. (L3)

**Text Books:**

1. The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.
2. Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.
3. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.
4. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
5. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

**Reference Books:**

1. Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E. Balaguruswamy, "C and Data Structures", 4<sup>th</sup> Edition, Tata Mc Graw Hill.
3. A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T. Somashekara, "Problem Solving Using C", PHI, 2<sup>nd</sup> Edition 2009.

**Course Outcomes:**

1. Analyse the basic concepts of C Programming language. (L4)
2. Design applications in C, using functions, arrays, pointers and structures. (L6)
3. Apply the concepts of Stacks and Queues in solving the problems. (L3)
4. Explore various operations on Linked lists. (L5)
5. Demonstrate various tree traversals and graph traversal techniques. (L2)
6. Design searching and sorting methods (L3)

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**(20A04101T) Electronic Devices & Circuits**  
**(Common to EEE and ECE)**

**Course Objectives:**

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

**Unit – 1**

**Review of Semiconductors:** Intrinsic semiconductors, Doped Semiconductors, Current Flow in Semiconductors, PN Junction with Open Circuit, PN Junction with Applied Voltage, Capacitive Effects in PN Junction.

**Diodes:** Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions, Modeling the Diode Forward Characteristics- exponential model, graphical analysis and Iterative analysis using the exponential model, constant voltage drop model, the small signal model.

Learning outcomes:

- Remember and understand the basic characteristics of semiconductor diode (L1)
- Understand iterative and graphical analysis of simple diode circuits (L1)

**Unit – 2**

Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Temperature Effects, Rectifier Circuits– half-wave, full-wave and bridge rectifier circuits, rectifier with a filter capacitor, C-L-C filter, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode, light emitting diode(LED), Problem Solving.

**Bipolar Junction Transistors(BJTs):** Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect.

Learning outcomes:

- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Understand the V-I characteristics of BJT and its different configurations (L1)
- Analyze various applications of diode and special purpose diodes (L3)
- Design rectifier and voltage regulator circuits (L4)

**Unit- 3**

BJT circuits at DC, Applying the BJT in Amplifier Design- Voltage Amplifier, Voltage Transfer Characteristic (VTC), Small-Signal Voltage Gain, determining the VTC by Graphical Analysis, Q-

point, Small-signal operation and models- the transconductance, input resistance at the base, input resistance at the emitter, Voltage gain, separating the Signal and the DC Quantities, The Hybrid- $\pi$  Model, the T Model, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Biasing in BJT Amplifier Circuits- Fixed bias, Self bias, voltage divider bias circuits, biasing using a Constant-Current Source, CE amplifier – Small signal analysis and design, Transistor breakdown and Temperature Effects, Problem solving.

Learning outcomes:

- Solve problems on various biasing circuits using BJT (L2)
- Analyze BJT based biasing circuits (L3)
- Design an amplifier using BJT based on the given specifications (L4)

#### Unit – 4

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET, CMOS, V-I characteristics –  $i_D - v_{DS}$  characteristics,  $i_D - v_{GS}$  characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.

Learning outcomes:

- Understand principle of operation of various types of MOSFET devices (L1)
- Understand the V-I characteristics of MOSFET devices and their configurations (L1)

#### Unit – 5

MOSFET Small Signal Operation Models – the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations – three basic configurations, characterizing amplifiers, common source (CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Biasing in MOSFET Amplifier Circuits – biasing by fixing  $V_{GS}$  with and without source resistance, biasing using drain to gate feedback resistor, biasing using constant current source, Common Source Amplifier using MOSFETs – Small signal analysis and design, Body Effect, Problem Solving.

Learning outcomes:

- Solve problems on small signal equivalent of MOSFET devices (L2)
- Analyze various biasing circuits based on different types of MOSFETs (L3)
- Design an amplifier using BJT based on the given specifications (L4)

#### Text Books:

1. Adel S. Sedra and Kenneth C. Smith, “Microelectronic Circuits – Theory and Applications”, 6<sup>th</sup> Edition, Oxford Press, 2013.
2. Donald A Neamen, “Electronic Circuits – analysis and design”, 3<sup>rd</sup> Edition, McGraw Hill (India), 2019.

**References:**

1. J. Milliman and C Halkias, "Integrated electronics", 2<sup>nd</sup> Edition, Tata McGraw Hill, 1991.
2. Behzad Razavi, "Microelectronics", Second edition, Wiley, 2013.
3. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits," 9th Edition, Pearson, 2006.
1. Jimmie J Cathey, "Electronic Devices and Circuits," Schaum's outlines series, 3<sup>rd</sup> edition, McGraw-Hill (India), 2010.

**Course Outcomes:**

*After the completion of the course students will able to*

- CO1:** Understand principle of operation, characteristics and applications of Semiconductor diodes, Bipolar Junction Transistor and MOSFETs.
- CO2:** Applying the basic principles solving the problems related to Semiconductor diodes, BJTs, and MOSFETs.
- CO3:** Analyze diode circuits for different applications such as rectifiers, clippers and clampers also analyze biasing circuits of BJTs, and MOSFETs.
- CO4:** Design of diode circuits and amplifiers using BJTs, and MOSFETs.
- CO5:** Compare the performance of various semiconductor devices.

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**(20A03202) ENGINEERING WORKSHOP**

(Common to All Branches of Engineering)

**Course Objective:**

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

**List of Topics**

**Wood Working:**

Familiarity with different types of woods and tools used in wood working and make following joints

- a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint

**Sheet Metal Working:**

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

- a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

**Fitting:**

Familiarity with different types of tools used in fitting and do the following fitting exercises

- a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two wheeler tyre

**Electrical Wiring:**

Familiarities with different types of basic electrical circuits and make the following connections

- a) Parallel and series b) Two way switch c) Godown lighting  
d) Tube light e) Three phase motor f) Soldering of wires

**Course Outcomes:**

After completion of this lab the student will be able to

- Apply wood working skills in real world applications. (13)
- Build different objects with metal sheets in real world applications. (13)
- Apply fitting operations in various applications. (13)
- Apply different types of basic electric circuit connections. (13)
- Use soldering and brazing techniques. (12)

**Note: In each section a minimum of three exercises are to be carried out.**

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**(20A05202) IT WORKSHOP**  
(Common to All Branches of Engineering)

**Course Objectives:**

- To make the students know about the internal parts of a computer, assembling and disassembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations and LAtEX
- To learn about Networking of computers and use Internet facility for Browsing and Searching

**Preparing your Computer**

**Task 1:**

**Learn about Computer:** Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

**Task 2:**

**Assembling a Computer:** Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

**Task 3:**

**Install Operating system:** Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

**Task 4:**

**Operating system features:** Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

**Networking and Internet**

**Task 5:**

**Networking:** Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimping activity, logical configuration etc. should be done by the student. The entire process has to be documented.

**Task 6:**

**Browsing Internet:** Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

**Task 7:**

**Antivirus:** Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

**Productivity tools**

**Task 8:**

**Word Processor:** Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

**Task 9:**

**Presentations:** creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

**Task 10:**

**Spreadsheet:** Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

**Task 11:**

**LateX:** Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

**References:**

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
6. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

**Course Outcomes:**

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAtEX.
- Prepare Slide presentations using the presentation tool.
- Interconnect two or more computers for information sharing.
- Access the Internet and Browse it to obtain the required information.

**Note:** Use open source tools for implementation of the above exercises.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem**

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**(20A05201P) C-PROGRAMMING & DATA STRUCTURES LAB**

(Common to All Branches of Engineering)

**Course Objectives:**

- To get familiar with the basic concepts of C programming.
- To design programs using arrays, strings, pointers and structures.
- To illustrate the use of Stacks and Queues
- To apply different operations on linked lists.
- To demonstrate Binary search tree traversal techniques.
- To design searching and sorting techniques.

**Week 1**

Write C programs that use both recursive and non-recursive functions

- i) To find the factorial of a given integer.
- ii) To find the GCD (greatest common divisor) of two given integers.
- iii) To solve Towers of Hanoi problem.

**Week 2**

- a) Write a C program to find both the largest and smallest number in a list of integers.
- b) Write a C program that uses functions to perform the following:
  - i) Addition of Two Matrices
  - ii) Multiplication of Two Matrices

**Week 3**

- a) Write a C program that uses functions to perform the following operations:
  - i) To insert a sub-string in to a given main string from a given position.
  - ii) To delete n characters from a given position in a given string.

**Week 4**

- a) Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T.
- b) Write a C program to count the lines, words and characters in a given text.

**Week 5**

- a) Write a C Program to perform various arithmetic operations on pointer variables.
- b) Write a C Program to demonstrate the following parameter passing mechanisms:
  - i) call-by-value
  - ii) call-by-reference

**Week 6**

Write a C program that uses functions to perform the following operations:

- i) Reading a complex number
- ii) Writing a complex number
- iii) Addition of two complex numbers
- iv) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

**Week 7**

Write C programs that implement stack (its operations) using

- i) Arrays
- ii) Pointers

**Week 8**

Write C programs that implement Queue (its operations) using

- i) Arrays
- ii) Pointers

**Week 9**

Write a C program that uses Stack operations to perform the following:

- i) Converting infix expression into postfix expression
- ii) Evaluating the postfix expression

**Week 10**

Write a C program that uses functions to perform the following operations on singly linked list.

- i) Creation
- ii) Insertion
- iii) Deletion
- iv) Traversal

**Week 11**

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

- i) Creation
- ii) Insertion
- iii) Deletion
- iv) Traversal

**Week 12**

Write a C program that uses functions to perform the following operations on circular linkedlist.

- i) Creation
- ii) Insertion
- iii) Deletion
- iv) Traversal

### Week 13

Write a C program that uses functions to perform the following:

- i) Creating a Binary Tree of integers
- ii) Traversing the above binary tree in preorder, inorder and postorder.

### Week 14

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

- i) Linear search
- ii) Binary search

### Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

- i) Bubble sort
- ii) Selection sort
- iii) Insertion sort

### Text Books:

1. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.
2. B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.
3. Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

### Reference Books:

1. PradipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.
2. E.Balaguruswamy, "C and Data Structures", 4<sup>th</sup> Edition, Tata Mc Graw Hill.
3. A.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.
4. M.T.Somashekara, "Problem Solving Using C", PHI, 2<sup>nd</sup> Edition 2009.

### Course Outcomes

- Demonstrate basic concepts of C programming language. (L2)
- Develop C programs using functions, arrays, structures and pointers. (L6)
- Illustrate the concepts Stacks and Queues. (L2)
- Design operations on Linked lists. (L6)
- Apply various Binary tree traversal techniques. (L3)
- Develop searching and sorting methods. (L6)

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**(20A51101P) CHEMISTRY LAB**

**(CSE, AI & DS, CSE (AI), CSE(IoT), CSE (Data Science), CSE(AI & ML), IT, ECE, EEE and IT)**

**Course Objectives:**

- Verify the fundamental concepts with experiments

**List of Experiments:**

1. Measurement of 10Dq by spectrophotometric method
2. Models of potential energy surfaces
3. Conductometric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite and measurement of its mechanical properties (strength.).
8. Verify Lambert-Beer's law
9. Thin layer chromatography
10. Identification of simple organic compounds by IR.
11. Preparation of nanomaterial's by precipitation
12. Estimation of Ferrous Iron by Dichrometry.

**Course Outcomes:**

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

- Determine the cell constant and conductance of solutions (L3)
- Prepare advanced polymer Bakelite materials (L2)
- Measure the strength of an acid present in secondary batteries (L3)
- Analyse the IR of some organic compounds (L3)

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**(20A04101P) ELECTRONIC DEVICES & CIRCUITS LAB**

**Course Objectives:**

- To verify the theoretical concepts practically from all the experiments.
- To analyse the characteristics of Diodes, BJT, MOSFET, UJT.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim.

**LIST OF EXPERIMENTS: (Execute any 12 experiments).**

**Note: All the experiments shall be implemented using both Hardware and Software.**

1. Verification of Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs obtained.
2. Design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. Draw suitable graphs.
3. Verify various clipping and clamper circuits using PN junction diode and draw the suitable graphs.
4. Design a Zener diode-based *voltage regulator* against variations of supply and load. Verify the same from the experiment.
5. Study and draw the *output* and *transfer* characteristics of MOSFET (Enhance mode) in Common Source Configuration experimentally. Find *Threshold voltage ( $V_T$ )*,  *$g_m$* , &  *$K$*  from the graphs.
6. Study and draw the *output* and *transfer* characteristics of MOSFET (Depletion mode) or JFET in Common Source Configuration experimentally. Find  *$I_{DSS}$* ,  *$g_m$* , &  *$V_P$*  from the graphs.
7. Verification of the input and output characteristics of BJT in **Common Emitter** configuration experimentally and find required  *$h$  – parameters* from the graphs.
8. Study and draw the input and output characteristics of BJT in **Common Base** configuration experimentally, and determine required  *$h$  – parameters* from the graphs.
9. Study and draw the Volt Ampere characteristics of UJT and determine  *$\eta$* ,  *$I_P$* ,  *$I_v$* ,  *$V_P$* , &  *$V_v$*  from the experiment.
10. Design and analysis of voltage- divider bias/self-bias circuit using BJT.
11. Design and analysis of voltage- divider bias/self-bias circuit using JFET.
12. Design and analysis of self-bias circuit using MOSFET.
13. Design a suitable circuit for switch using CMOSFET/JFET/BJT.
14. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.
15. Design a small signal amplifier using BJT(common emitter) for the given specifications. Draw the frequency response and find the bandwidth.

**Tools / Equipment Required:** Software Toollike Multisim/Pspice or Equivalent, DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

**Course Outcomes:**

- Understand the basic characteristics and applications of basic electronic devices. (L1) Observe the characteristics of electronic devices by plotting graphs. (L2)
- Analyze the Characteristics of UJT, BJT, MOSFET (L3).  
Design MOSFET / BJT based amplifiers for the given specifications. (L4)  
Simulate all circuits in PSPICE /Multisim. (L5).

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem****L T P C****3 0 0 3****20A54302 Complex variables and Transforms**

(Common to ECE &amp; EEE)

**Pre-requisite**

Functions, Differentiations and Integration

**Course Objectives:**

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.

**Course Outcomes (CO):** Student will be able to

- Understand the analyticity of complex functions and conformal mappings.
- Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
- Understand the usage of Laplace transforms, Fourier transforms and z transforms.
- Evaluate the Fourier series expansion of periodic functions.
- Understand the use of Fourier transforms and apply z transforms to solve difference equations.

**UNIT - I****Complex Variable – Differentiation:**

8 Hrs

Introduction to functions of complex variable-concept of Limit & continuity-Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method-Conformal mappings-standard and special transformations ( $\sin z$ ,  $e^z$ ,  $\cos z$ ,  $z^2$ ) Mobius transformations (bilinear) and their properties.

**UNIT - II****Complex Variable – Integration:**

9 Hrs

Line integral-Contour integration, Cauchy's integral theorem, Cauchy Integral formula, Liouville's theorem (without proof) and Maximum-Modulus theorem (without proof); power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi circle with  $f(z)$  not having poles on real axis).

**UNIT - III****Laplace Transforms**

9 Hrs

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – solving Initial value problems to ordinary differential equations with constant coefficients using Laplace transforms.

**UNIT - IV****Fourier series**

8 Hrs

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence of Fourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions-typical wave forms - Parseval's formula- Complex form of Fourier series.

**UNIT - V****Fourier transforms & Z Transforms:**

9 Hrs

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem .  
Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

**Textbooks:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

**Reference Books:**

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

**Online Learning Resources:**

1. [nptel.ac.in/courses/111107056](http://nptel.ac.in/courses/111107056)
2. [onlinelibrary.wiley.com](http://onlinelibrary.wiley.com)
3. <https://onlinecourses.nptel.ac.in/noc18ma12>.

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**20A02301T ELECTRICAL CIRCUIT ANALYSIS****Pre-requisite****Fundamentals of Electrical Circuits****Course Objectives:**

- To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
- To know the applications of Fourier transforms to electrical circuits excited by non sinusoidal sources.
- Study of Different types of filters, equalizers.

**Course Outcomes (CO):**

- Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations.
- Applications of Fourier transforms to electrical circuits excited by non-sinusoidal sources are known.
- To design filters and equalizers.

**UNIT - I                      Locus Diagrams & Resonance                      8 Hrs**  
 Series R-L, R-C, R-L-C and Parallel Combination with Variation of Various Parameters - Resonance-Series, Parallel Circuits, Frequency Response, Concept of Bandwidth and Q Factor.

**UNIT - II                      Two Port Networks                      9 Hrs**  
 Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

**UNIT - III                      Transient Analysis                      12 Hrs**  
**D.C Transient Analysis:** Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation.  
**A.C Transient Analysis:** Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.

**UNIT - IV                      Fourier Transforms                      10 Hrs**  
 Fourier Theorem - Trigonometric Form and Exponential Form of Fourier series – Conditions of Symmetry - Line Spectra and Phase Angle Spectra - Analysis of Electrical Circuits to Non Sinusoidal Periodic Waveforms. Fourier Integrals and Fourier Transforms – Properties of Fourier Transforms and Application to Electrical Circuits.

**UNIT - V                      Filters                      9 Hrs**  
 Filters – Low Pass – High Pass, Band Pass and Band Stop– RC, RL filters– derived filters and composite filters design – Attenuators – Principle of Equalizers – Series and Shunt Equalizers – L Type - T type and Bridged – T and Lattice Equalizers.

**Textbooks:**

1. William Hayt, Jack E. Kemmerly and Jamie Phillips, “Engineering Circuit Analysis”, Mc Graw Hill, 9th Edition, 2019.
2. A. Chakrabarti, “Circuit Theory: Analysis & Synthesis”, Dhanpat Rai & Sons, 2008.

**Reference Books:**

1. M.E. Van Valkenberg, "Network Analysis", 3rd Edition, Prentice Hall (India), 1980.
2. V. Del Toro, "Electrical Engineering Fundamentals", Prentice Hall International, 2009.
3. Charles K. Alexander and Matthew. N. O. Sadiku, "Fundamentals of Electric Circuits" Mc Graw Hill, 5th Edition, 2013.
4. MahamoodNahvi and Joseph Edminister, "Electric Circuits" Schaum's Series, 6th Edition, 2013.
5. John Bird, Routledge, "Electrical Circuit Theory and Technology", Taylor & Francis, 5th Edition, 2014.

**Online Learning Resources:**

- [https://onlinecourses.nptel.ac.in/noc21\\_ee99/preview](https://onlinecourses.nptel.ac.in/noc21_ee99/preview)
- [https://onlinecourses.nptel.ac.in/noc21\\_ee14/preview](https://onlinecourses.nptel.ac.in/noc21_ee14/preview)

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**20A02302T DC MACHINES & TRANSFORMERS****Pre-requisite** Fundamentals of Electrical circuits and Magnetic circuits**Course Objectives:**

Student will be able to

- Study magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.
- understand the constructional details of DC machines and Transformers
- Analyze the performance characteristics of DC machines and transformer
- Evaluate efficiency, regulation and load sharing of DC machines and transformers Design Equivalent circuit of transformer

**Course Outcomes (CO):**

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

- Understand the concepts of magnetic circuits, principle and operations of DC machines, starters and single and three phase transformers
- Analyze armature reaction, parallel operation, speed control and characteristics of DC machines. Also analyze the performance characteristics with the help of OC and SC tests of transformer
- Evaluate generated emf, back emf, speed, efficiency and regulations of DC machines and efficiency and regulation of transformer also load sharing of parallel connected transformers
- Design winding diagrams of DC machines and equivalent circuit of transformer.

**UNIT - I Magnetic Material Properties and Applications: 10 Hrs**

Introduction, Magnetic materials and their properties, magnetically induced emf and force, AC operation of magnetic circuits, hysteresis and eddy current losses, permanent magnets, and applications of permanent magnet materials.

**Principles of electromechanical energy conversion:**

Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems, forces/torques in systems with permanent magnets, energy conversion via electric field, dynamical equations of electro mechanical systems

**UNIT - II DC Generators 9Hrs**

Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation, armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation, emf induced in a coil undergoing commutation, methods of improving commutation, OCC and load characteristics of different types of generators. Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections

**UNIT - III DC Motors 10 Hrs**

Force on conductor carrying current, back emf, Torque and power developed by armature, speed control of DC motors (Armature control and Flux control methods), Necessity of starters, constructional details of 3-point and 4-point starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency

**Testing of DC machines:**

Brake test, Swinburne's test, Hopkinson's test, Fields test, Retardation test.

**UNIT - IV Single Phase Transformers 10 Hrs**

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagrams (no load and on load), Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, losses and efficiency Testing - open circuit and short circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer.

UNIT - V                      **Three Phase Transformers**

9 Hrs

Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection, Tap-changing transformers - No-load and on-load tap changing of transformers, Three-winding transformers- Cooling of transformers.

**Textbooks:**

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

**Reference Books:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.
3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.

**Online Learning Resources:**

- [https://onlinecourses.nptel.ac.in/noc21\\_ee71/preview](https://onlinecourses.nptel.ac.in/noc21_ee71/preview)
- [https://onlinecourses.nptel.ac.in/noc21\\_ee24/preview](https://onlinecourses.nptel.ac.in/noc21_ee24/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem****L T P C****3 0 0 3****20A04303T DIGITAL LOGIC DESIGN  
(Common to ECE and EEE)****Course Objectives:**

- To familiarize with the concepts of different number systems and Boolean algebra.
- To introduce the design techniques of combinational, sequential logic circuits.
- To model combinational and sequential circuits using HDLs.

**Course Outcomes (CO):**

CO1: Understand the properties of Boolean algebra, other logic operations, and minimization of Boolean functions using Karnaugh map.

CO2: Make use of the concepts to solve the problems related to the logic circuits.

CO3: Analyze the combinational and sequential logic circuits.

CO4: Develop digital circuits using HDL, and Compare various Programmable logic devices

CO5: Design various logic circuits using Boolean algebra, combinational and sequential logic circuits.

**UNIT - I                    Number Systems, Boolean algebra and Logic Gates**

Number systems - binary numbers, octal, hexadecimal, other binary codes; complements, signed binary numbers, digital logic operations and gates, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, complements of Boolean functions, two-level NAND and NOR Implementation of Boolean functions.

**UNIT - II                    Minimization of Boolean functions and Combinational Logic Circuits**

The Karnaugh map method (up to five variables), product of sums simplifications, don't care conditions, Tabular method, Introduction, Combinational circuits, design procedure, adders, subtractors, 4-bit binary adder/ subtractor circuit, BCD adder, carry look- a-head adder, binary multiplier, magnitude comparator, decoders and encoders, multiplexers, demultiplexers,

**UNIT - III                    Sequential Logic Circuits**

Basic architectural distinction between combinational and sequential circuits, Design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering consideration, conversion of flip- flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register

**UNIT - IV                    Finite State Machines and Programmable Logic Devices**

Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice-versa, reduction of state tables using partition technique, Design of sequence detector.

**UNIT - V                    Hardware Description Language**

Types of PLD's: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs, Design of sequential circuits using ROMs, PLAs, CPLDs and FPGAs, Introduction to Verilog - structural Specification of logic circuits, behavioural specification of logic circuits, hierarchical Verilog Code, Verilog for combinational circuits - conditional operator, if-else statement, case statement, for loop; using storage elements with CAD tools-using Verilog constructs for storage elements, flip-flop with clear capability, using Verilog constructs for registers and counters.

**Textbooks:**

1. M. Morris Mano, "Digital Design", 3rd Edition, PHI. (Unit I to IV)
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill (Unit V)

**Reference Books:**

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", 4th Edition, Jaico Publishers.
2. ZviKohavi and Niraj K.Jha, "Switching and Finite Automata Theory, 3rd Edition, Cambridge University Press, 2010.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2<sup>nd</sup>Edition, Prentice Hall PTR.
4. D.P. Leach, A.P. Malvino, "Digital Principles and Applications", TMH, 7th Edition.

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**20A52301 MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS**  
**(Common to All branches of Engineering)**

**Course Objectives:**

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements

**Course Outcomes (CO):**

- Define the concepts related to Managerial Economics, financial accounting and management.
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
- Apply the Concept of Production cost and revenues for effective Business decision
- Analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Develop the accounting statements and evaluate the financial performance of business entity.

**UNIT - I           Managerial Economics**

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

**UNIT - II           Production and Cost Analysis**

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost&Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) -Determination of Break-Even Point (Simple Problems)- Managerial significance and limitations of Break-Even Analysis.

**UNIT - III           Business Organizations and Markets**

Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies

**UNIT - IV           Capital Budgeting**

Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT - V            **Financial Accounting and Analysis**

Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). **Financial Analysis** - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

**Textbooks:**

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

**Reference Books:**

1. Ahuja HI Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

**Online Learning Resources:**

<https://www.slideshare.net/123ps/managerial-economics-ppt>  
<https://www.slideshare.net/rossanz/production-and-cost-45827016>  
<https://www.slideshare.net/darkyla/business-organizations-19917607>  
<https://www.slideshare.net/balarajbl/market-and-classification-of-market>  
<https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>  
<https://www.slideshare.net/ashu1983/financial-accounting>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem**

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**20A52302 ORGANISATIONAL BEHAVIOUR**  
(Common to All branches of Engineering)

**Course Objectives:**

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To impart knowledge about group dynamics
- To make them understand the importance of change and development

**Course Outcomes (CO):**

- Define the Organizational Behaviour, its nature and scope.
- Understand the nature and concept of Organizational behaviour
- Apply theories of motivation to analyse the performance problems
- Analyse the different theories of leadership
- Evaluate group dynamics
- Develop as powerful leader

**UNIT - I Introduction to Organizational Behavior**

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behaviour – Attitude - Perception - Learning – Personality.

**UNIT - II Motivation and Leading**

Theories of Motivation- Maslow's Hierarchy of Needs - Herzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Clelland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory .

**UNIT - III Organizational Culture**

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader- Women and Corporate leadership.

**UNIT - IV Group Dynamics**

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

**UNIT - V Organizational Change and Development**

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

**Textbooks:**

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011
2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017

**Reference Books:**

- McShane, Organizational Behaviour, TMH 2009
- Nelson, Organisational Behaviour, Thomson, 2009.
- Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009.
- Aswathappa, Organisational Behaviour, Himalaya, 2009

**Online Learning Resources:**

<http://www.slideshare.net/Knight1040/organizational-culture-9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714>  
<https://www.slideshare.net/harshrastogi1/group-dynamics-159412405>  
<https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem**

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**20A52303 Business Environment  
(Common to All branches of Engineering)**

**Course Objectives:**

- To make the student to understand about the business environment
- To enable them in knowing the importance of fiscal and monetary policy
- To facilitate them in understanding the export policy of the country
- To impart knowledge about the functioning and role of WTO
- To encourage the student in knowing the structure of stock markets

**Course Outcomes (CO):**

- Define Business Environment and its Importance.
- Understand various types of business environment.
- Apply the knowledge of Money markets in future investment
- Analyse India's Trade Policy
- Evaluate fiscal and monetary policy
- Develop a personal synthesis and approach for identifying business opportunities

**UNIT - I Overview of Business Environment**

Introduction – meaning Nature, Scope, significance, functions and advantages. Types- Internal & External, Micro and Macro. Competitive structure of industries - Environmental analysis- advantages & limitations of environmental analysis & Characteristics of business.

**UNIT - II Fiscal & Monetary Policy**

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.

**UNIT - III India's Trade Policy**

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - Balance of Payments – Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

**UNIT - IV World Trade Organization**

Introduction – Nature, meaning, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT - Agreements in the Uruguay Round – TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

**UNIT - V Money Markets and Capital Markets**

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.

**Textbooks:**

1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.
2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition. HPH 2016

**Reference Books:**

- 1.K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N (2009), International Business, Wiley India.
- 4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

**Online Learning Resources:**

- <https://www.slideshare.net/ShompaDhali/business-environment-53111245>
- <https://www.slideshare.net/rbalsells/fiscal-policy-ppt>
- <https://www.slideshare.net/aguness/monetary-policy-presentationppt>
- <https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982>
- <https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt>
- <https://www.slideshare.net/viking2690/wto-ppt-60260883>
- <https://www.slideshare.net/prateeknepal3/ppt-mo>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– II Sem**

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**20A02301P ELECTRICAL CIRCUIT ANALYSIS LAB**

**Pre-requisite**                      **Electrical circuits**

**Course Objectives:**

- Understand and experimentally verify various resonance phenomenon.
- Understand and analyze various current locus diagrams.
- Apply and experimentally analyze two port network parameters

**Course Outcomes (CO):**

- Understand and experimentally verify various resonance phenomenon.
- Understand and analyze various current locus diagrams.
- Apply and experimentally analyze two port network parameters

**List of Experiments:**

1. Locus Diagram of RL Series Circuits: a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'
2. Locus Diagram of RC Series Circuits: a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'
3. Series Resonance
4. Parallel Resonance
5. Determination of Z Parameters
6. Determination of Y Parameters
7. Transmission Parameters
8. Hybrid Parameters
9. Determination of Coefficient of coupling
10. Response Analysis of R, RL and RLC circuits with sinusoidal and non-sinusoidal excitations.

**References:**

David A. Bell, Fundamentals of Electric Circuits: Lab Manual OUP Canada, 7th Edition, 2009.

**Online Learning Resources/Virtual Labs:**

- <http://vlabs.iitkgp.ernet.in/asnm/index.html>
- <https://vlab.amrita.edu/?sub=1&brch=75>
- [http://vlabs.iitb.ac.in/vlabs-dev/labs/network\\_lab/labs/explist.php](http://vlabs.iitb.ac.in/vlabs-dev/labs/network_lab/labs/explist.php)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem**

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**20A02302P DC MACHINES & TRANSFORMERS LAB****Pre-requisite DC Machines and Transformer****Course Objectives:**

To conduct various experiments on

- DC motors and DC Generators
- The speed control techniques of DC motors.
- To conduct various experiments for testing on 1-phase transformers

**Course Outcomes (CO):**

- Able to conduct and analyze load test on DC shunt generator
- Able to understand and analyze magnetization characteristics of DC shunt generator
- Able to understand and analyze speed control techniques and efficiency of DC machines
- Able to understand to predetermine efficiency and regulation of single-phase Transformers

**List of Experiments:****Minimum ten experiments from the following list are required to be conducted**

1. Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Swinburne's test on DC shunt motor, Predetermination of efficiency.
5. Speed control of DC shunt motor (Armature control and Field control method).
6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
7. OC and SC test on single phase transformer
8. Parallel operation of single phase transformers.
9. Sumpner's test on single phase transformers.
10. Load test on DC long shunt compound generator. Determination of characteristics.
11. Load test on DC short shunt compound generator. Determination of characteristics.
12. Separation of losses in DC shunt motor.
13. Separation of losses of single phase transformer

**References:**

D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017

**Online Learning Resources/Virtual Labs:**

- [http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering](http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering)
- [http://vlabs.iitb.ac.in/vlabs-dev/vlab\\_bootcamp/bootcamp/Sadhya/experimentlist.html](http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem**

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**20A04303P DIGITAL LOGIC DESIGN LAB**  
(Common to ECE and EEE)

**Course Objectives:**

- To understand various pin configurations of the Digital ICs used in the laboratory
- To conduct the experiments and verify the truth tables of various logic circuits.
- To analyze the logic circuits
- To design sequential and combinational logic circuits and verify their properties.
- To design of any sequential/combinational circuit using Hardware Description Language.

**Course Outcomes (CO):**

CO1: Understand the pin configuration of various digital ICs used in the lab

CO2: Conduct the experiment and verify the properties of various logic circuits.

CO3: Analyze the sequential and combinational circuits.

CO4: Design of any sequential/combinational circuit using Hardware/ HDL.

**List of Experiments:**

1. Verification of truth tables of the following Logic gates  
Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR
2. Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
3. Verification of functional table of 3 to 8-line Decoder /De-multiplexer
4. 4variable logic function verification using 8 to1 multiplexer.
5. Design full adder circuit and verify its functional table.
6. Verification of functional tables of (i) JK Edge triggered Flip–Flop (ii) JK Master Slav Flip–Flop (iii) D Flip-Flop
7. Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output
8. Design a four bit Johnson’s counter using D Flip-Flops/JK Flip Flops and verify output
9. Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
10. Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
11. Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
12. (a) Draw the circuit diagram of a single bit comparator and test the output  
(b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

**ADD on Experiments:**

1. Design BCD Adder Circuit and Test the Same using Relevant IC
2. Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit.
3. Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs.
4. Design of any combinational circuit using Hardware Description Language
5. Design of any sequential circuit using Hardware Description Language

**References:**

M. Morris Mano, “Digital Design”, 3rd Edition, PHI

Online learning resources/virtual labs:

<https://www.vlab.co.in/>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– II Sem**

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**20A05305 Application Development with Python**

**Course Objectives:**

- To learn the basic concepts of software engineering and life cycle models
- To explore the importance of Databases in application Development
- Acquire programming skills in core Python
- To understand the importance of Object-oriented Programming

**Course Outcomes (CO):**

Students should be able to

- Identify the issues in software requirements specification and enable to write SRS documents for software development problems
- Explore the use of Object oriented concepts to solve Real-life problems
- Design database for any real-world problem
- Solve mathematical problems using Python programming language

**Module 1. Basic concepts in software engineering and software project management**

Basic concepts: abstraction versus decomposition, the evolution of software engineering techniques, Software development life cycle

Software project management: project planning and project scheduling

Task:

1. [Identifying the Requirements from Problem Statements](#)

**Module 2. Basic Concepts of Databases**

Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table), Data Manipulation Language(DML) Statements

Task:

1. Implement [Data Definition Language\(DDL\) Statements: \(Create table, Alter table, Drop table\)](#)
2. Implement [Data Manipulation Language\(DML\) Statements](#)

**Module 3. Python Programming:**

**Introduction to Python:** Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements

**Python Data Structures:** Lists, Dictionaries, Tuples.

**Strings:** Creating strings and basic operations on strings, string testing methods.

**Functions:** Defining a function- Calling a function- Types of functions-Function Arguments-Anonymous functions- Global and local variables

**OOPS Concepts;** Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

**Modules and Packages:** Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

**Working with Data in Python:** Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:

**1. OPERATORS**

- a. Read a list of numbers and write a program to check whether a particular element is

present or not using membership operators.

- b. Read your name and age and write a program to display the year in which you will turn 100 years old.
- c. Read radius and height of a cone and write a program to find the volume of a cone.
- d. Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

## 2. CONTROL STRUCTURES

- a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if...elif...else statement.
- b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.
- c. Write a Program to find the sum of a Series  $1/1! + 2/2! + 3/3! + 4/4! + \dots + n/n!$ . (Input :n = 5, Output : 2.70833)
- d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

## 3: LIST

- a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
- b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
- c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
- d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

## 4: TUPLE

- a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test\_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
- b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test\_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”, ), (“Gfg”, “CS”)], Output : [(„GFG” , „IS” , „BEST” )]).
- c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

## 5: SET

- a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x\*x).
- b. Write a program to perform union, intersection and difference using Set A and Set B.
- c. Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3)
- d. Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

## 6: DICTIONARY

- a. Write a program to do the following operations:
  - i. Create a empty dictionary with dict() method
  - ii. Add elements one at a time
  - iii. Update existing key" s value
  - iv. Access an element using a key and also get() method
  - v. Deleting a key value using del() method
- b. Write a program to create a dictionary and apply the following methods:
  - i. pop() method
  - ii. popitem() method
  - iii. clear() method
- c. Given a dictionary, write a program to find the sum of all items in the dictionary.

d. Write a program to merge two dictionaries using update() method.

### 7: STRINGS

- Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
- Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
- Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
- Write a program to read a string and count how many times each letter appears. (Histogram).

### 8: USER DEFINED FUNCTIONS

- A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
- Write a function merge\_dict(dict1, dict2) to merge two Python dictionaries.
- Write a fact() function to compute the factorial of a given positive number.
- Given a list of n elements, write a linear\_search() function to search a given element x in a list.

### 9: BUILT-IN FUNCTIONS

- Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
- Write a program to demonstrate the working of built-in trigonometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
- Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
- Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

### 10. CLASS AND OBJECTS

- Write a program to create a BankAccount class. Your class should support the following methods for
  - Deposit
  - Withdraw
  - GetBalance
  - PinChange
- Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).
- Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee\_info() method and also using dictionary (\_\_dict\_\_).
- Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

### 11. FILE HANDLING

- Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
  - Count the sentences in the file.
  - Count the words in the file.
  - Count the characters in the file.
- Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
- Write a Python program to store N student" s records containing name, roll number and branch. Print the given branch student" s details only.

**References:**

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. RamezElmasri, Shamkant, B. Navathe, "Database Systems", Pearson Education, 6th Edition, 2013.
3. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
4. Larry Lutz, "Python for Beginners: Step-By-Step Guide to Learning Python Programming", CreateSpace Independent Publishing Platform, First edition, 2018

**Online Learning Resources/Virtual Labs:**

1. <http://vlabs.iitkgp.ernet.in/se/>
2. <http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php>
3. <https://python-iitk.vlabs.ac.in>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II Sem****L T P C  
3 0 0 3****20A52201 UNIVERSAL HUMAN VALUES  
(Common to all branches of Engineering)****Course Objectives:**

The objective of the course is fourfold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

**Course Outcomes (CO):**

By the end of the course,

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

**UNIT - I** Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 8 Hrs

Purpose and motivation for the course, recapitulation from Universal Human Values-I  
Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration

Continuous Happiness and Prosperity- A look at basic Human Aspirations

Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

**UNIT - II** Understanding Harmony in the Human Being - Harmony in Myself! 12 Hrs

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’

Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility

Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)

Understanding the characteristics and activities of ‘I’ and harmony in ‘I’

Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

**UNIT - III** Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship 8 Hrs

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and competence

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity,

fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT – IV Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 10 Hrs

Understanding the harmony in the Nature

Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature

Understanding Existence as Co-existence of mutually interacting units in all- pervasive space

Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

UNIT – V Implications of the above Holistic Understanding of Harmony on Professional Ethics 8 Hrs

Natural acceptance of human values

Definitiveness of Ethical Human Conduct

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems

Strategy for transition from the present state to Universal Human Order:

- a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
- b. At the level of society: as mutually enriching institutions and organizations

Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

**Textbooks:**

R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

R R Gaur, R Asthana, G P Bagaria, “Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics”, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

**Reference Books:**

Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.

A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004.

The Story of Stuff (Book).

4. Mohandas Karamchand Gandhi “The Story of My Experiments with Truth”

5. E. F Schumacher. “Small is Beautiful”

Slow is Beautiful –Cecile Andrews

J C Kumarappa “Economy of Permanence”

Pandit Sunderlal “Bharat Mein Angreji Raj”

Dharampal, “Rediscovering India”

Mohandas K. Gandhi, “Hind Swaraj or Indian Home Rule”

India Wins Freedom - Maulana Abdul Kalam Azad

Vivekananda - Romain Rolland(English)

Gandhi - Romain Rolland (English)

**MODE OF CONDUCT**

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor’s role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to

connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practicals are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem**

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**20A54402 Numerical Methods & Probability Theory**

(Common to EEE, MECH)

**Pre-requisite** Basic Equations and Basic Probability **Semester****Course Objectives:**

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations, the theory of Probability and random variables.

**Course Outcomes (CO): Student will be able to**

- Apply numerical methods to solve algebraic and transcendental equations
- Derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically
- Apply Probability theory to find the chances of happening of events.
- Understand various probability distributions and calculate their statistical constants.

**UNIT - I Solution of Algebraic & Transcendental Equations: 8 Hrs**

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method

System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

**UNIT - II Interpolation 8 Hrs**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

**UNIT - III Numerical Integration & Solution of Initial value problems to Ordinary differential equations 9 Hrs**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

**UNIT - IV Probability theory: 9 Hrs**

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

**UNIT - V Random variables & Distributions 9 Hrs**

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution

**Textbooks:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, PNIE.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

**Reference Books:**

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc17\\_ma14/preview](https://onlinecourses.nptel.ac.in/noc17_ma14/preview)
2. [nptel.ac.in/courses/117101056/17](https://nptel.ac.in/courses/117101056/17)
3. <http://nptel.ac.in/courses/111105090>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem****L T P C  
3 0 0 3****20A04404T ANALOG ELECTRONIC CIRCUITS****Pre-requisite**

Network Analysis, Electronic Devices and Circuits

**Course Objectives:**

- List various types of feedback amplifiers, oscillators and large signal Amplifiers.
- Explain the operation of various electronic circuits and linear ICs.
- Apply various types of electronic circuits to solve engineering problems
- Analyse various electronic circuits and regulated power supplies for proper understanding
- Justify choice of transistor configuration in a cascade amplifier.
- Design electronic circuits for a given specification.

**Course Outcomes (CO):**

CO1. List various types of feedback amplifiers, oscillators and large signal amplifiers

CO2. Explain the operation of various electronic circuits and linear ICs

CO3. Apply various types of electronic circuits to solve engineering problems

CO4. Analyze various electronic circuits and regulated power supplies for proper understanding

CO5. Justify choice of transistor configuration in a cascade amplifier

CO6. Design electronic circuits for a given specification

**UNIT - I Multistage Amplifiers**

Classification of amplifiers, different coupling schemes used in amplifiers, general analysis of cascade amplifiers, Choice of transistor configuration in a cascade amplifier, frequency response and analysis of two stage RC coupled and direct coupled amplifiers, principles of Darlington amplifier, Cascode amplifier.

**UNIT - II Feedback Amplifiers and Oscillators**

Concepts of Feedback, Classification of Feedback Amplifiers, Transfer Gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Effect of Feedback on Amplifier characteristics, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage-shunt.

Oscillators: Sinusoidal Oscillators, Conditions for oscillations, Phase-shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

**UNIT - III Large Signal Amplifiers (Power Amplifiers)**

Introduction, Classification, Class A large signal amplifiers, Second - Harmonic Distortion, Higher - Order Harmonic Generations, Transformer Coupled Class A Audio Power Amplifier, Efficiency of Class A, Class B, Class AB Amplifiers, Distortion in Power Amplifiers, Class C Power Amplifier.

**UNIT - IV Operational Amplifier**

Introduction, Block diagram, Characteristics and Equivalent circuits of an ideal op-amp, Various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, Inverting and non-inverting amplifier configurations. The Practical op-amp: Introduction, Input offset voltage, Offset current, Thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and Gain–bandwidth product, frequency limitations and compensations, transient response.

**UNIT - V Applications of OP-AMPS and Special ICs**

Adder, Integrator, Differentiator, Difference amplifier and Instrumentation amplifier, Converters: Current to voltage and voltage to current converters, Active Filters: First order filters, second order low pass, high pass, band pass and band reject filters, Oscillators: RC phase shift oscillator, Wien bridge oscillator, Square wave generator.

Special Purpose Integrated Circuits: Functional block diagram, working, design and applications of Timer 555 (Monostable & Astable), Functional block diagram, working and applications of VCO566, PLL565, Fixed and variable Voltage regulators.

**Textbooks:**

- Millman, Halkias and Jit , “Electronic Devices and Circuits” , 4<sup>th</sup> Edition , McGraw Hill Education (India) Private Ltd.,2015.
- Salivahanan and N. Suresh Kumar, “ Electronic Devices and Circuits”,4<sup>th</sup>Edition,McGrawHill Education(India)Private Ltd.,2017.
- Ramakanth A. Gayakwad, “Op-Amps& LinearICs”,4<sup>th</sup>Edition, Pearson, 2017.

**Reference Books:**

- Millman and Taub, Pulse, Digital and Switching Waveforms, 3<sup>rd</sup>Edition, TataMcGraw-Hill Education, 2011.
- J. Milliman, C.C. Halkias and Chetan Parikh, “Integrated Electronics”, 2<sup>nd</sup>Edition, McGraw Hill, 2010.
- David A. Bell, “ Electronic Devices and Circuits”, 5<sup>th</sup>edition,OxfordPress,2008.
- D. Roy Choudhury, “LinearIntegratedCircuits”,2<sup>nd</sup>Edition, New Age International (p)Ltd,2003.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem**

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**20A02401T POWER ELECTRONICS****Pre-requisite****Electrical circuits and semiconductor devices****Course Objectives:**

The student will be able to:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters.

**Course Outcomes (CO):**

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

- Understand the operation, characteristics and usage of basic Power Semiconductor Devices.
- Understand different types of Rectifier circuits with different operating conditions.
- Understand DC-DC converters operation and analysis of their characteristics.
- Understand the construction and operation of voltage source inverters, Voltage Controllers and Cyclo Converters.
- Apply all the above concepts to solve various numerical problem solving

**UNIT - I                      Power Switching Devices                      9 Hrs**

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO. Introduction to Gallium Nitride and Silicon Carbide Devices.

**UNIT - II                      Rectifiers                      10 Hrs**

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance; Analysis of rectifiers with filter capacitance, Dual Converter -Numerical problems.

**UNIT - III                      DC-DC CONVERTERS                      9 Hrs**

Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

**UNIT - IV                      INVERTERS                      10 Hrs**

Single phase Voltage Source inverters – operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters – Mc Murray and Mc Murray Bedford inverters, Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle of operation only, Three phase bridge inverters (VSI) – 180 degree mode – 120 degree mode of operation - Numerical problems.

**UNIT - V                      AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS:                      10 Hrs**

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems.

Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

**Textbooks:**

1. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", 2nd edition, Prentice Hall of India, 1998
2. P.S.Bimbhra,"Power Electronics", 4th Edition, Khanna Publishers, 2010.
3. M. D. Singh & K. B. Kanchandhani, "Power Electronics", Tata Mc Graw Hill Publishing Company, 1998.

**Reference Books:**

1. Ned Mohan, "Power Electronics", Wiley, 2011.
2. Robert W. Erickson and Dragan Maksimovic, "Fundamentals of Power Electronics" 2nd Edition, Kluwer Academic Publishers, 2004.
3. Vedam Subramanyam, "Power Electronics", New Age International (P) Limited, 1996.
4. V.R.Murthy, "Power Electronics", 1st Edition, Oxford University Press, 2005. 5. P.C.Sen, "Power Electronics", Tata Mc Graw-Hill Education, 1987.
5. "Power Electronic Control of Alternating Current Motors" by J.M.D.Murphy

**Online Learning Resources:**

<https://www.classcentral.com/course/youtube-electrical-power-electronics-47667/classroom>

[https://onlinecourses.nptel.ac.in/noc21\\_ee01/preview](https://onlinecourses.nptel.ac.in/noc21_ee01/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem****L T P C****3 0 0 3****20A02402T AC MACHINES****Pre-requisite****Electrical circuits, Magnetic circuits, DC machines and transformers****Course Objectives:**

The students will be able to:

- Understand the fundamentals of AC machines, know equivalent circuit performance characteristics.
- Understand the methods of starting of Induction motors.
- Understand the methods of starting of Synchronous motors.
- Understand the parallel operation of Alternators.

**Course Outcomes (CO):**

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

- Understand the basics of ac machine windings, construction, principle of working, equivalent circuit of induction and synchronous machines.
- Analyze the phasor diagrams of induction and synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators.
- Apply the concepts to determine V and inverted V curves and power circles of synchronous motor.
- Analyze the various methods of starting in both induction and synchronous machines.

**UNIT - I Fundamentals of AC machine windings 9Hrs**

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factors.

**UNIT - II Induction Machines 10 Hrs**

Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram, performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging. Analysis of 3 phase induction motors with single phasing operation.

**UNIT - III Synchronous generators 10 Hrs**

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation, EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

**UNIT - IV Synchronous motors 10 Hrs**

Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation and power circles.

**UNIT - V Single-phase induction motors 9 Hrs**

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase motors, reluctance single phase motors, stepper motors, BLDC motors.

**Textbooks:**

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

**Reference Books:**

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

**Online Learning Resources:**

- [https://onlinecourses.nptel.ac.in/noc21\\_ee13/preview](https://onlinecourses.nptel.ac.in/noc21_ee13/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem****L T P C****3 0 0 3****20A02403T ELECTROMAGNETIC FIELD THEORY****Pre-requisite****Magnetic circuits****Course Objectives:**

- To understand the basic principles of electrostatics
- To understand the basic principles of magneto statics for time invariant and time varying fields
- To understand the principles of dielectrics, conductors and magnetic potentials

**Course Outcomes (CO):**

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

- Understand the concept of electrostatics
- Understand the concepts of Conductors and Dielectrics
- Understand the fundamental laws related to Magneto Statics
- Understand the concepts of Magnetic Potential and Time varying Fields

**UNIT - I ELECTROSTATICS**

9 Hrs

Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential due to point charges, line charges and Volume Charges - Potential Gradient - Gauss Law Application of Gauss Law-Maxwell's First Law – Numerical Problems. Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

**UNIT - II CONDUCTORS AND DIELECTRICS**

9 Hrs

Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

**UNIT - III MAGNETO STATICS**

11 Hrs

Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular & Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Sheet of Current and a Long Current Carrying Filament – Point Form of Ampere's Circuital Law – Maxwell's Third Equation – Numerical Problems. Magnetic Force — Lorentz Force Equation – Force on Current Element in a Magnetic Field - Force on a Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment – A Differential Current Loop as a Magnetic Dipole – Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

**UNIT - IV MAGNETIC POTENTIAL**

9 Hrs

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations. Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and Intensity in a Magnetic Field – Numerical Problems.

**UNIT - V TIMEVARYING FIELDS**

10 Hrs

Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current. Wave

Equations – Uniform Plane Wave Motion in Free Space, Conductors and Dielectrics – Velocity, Wave Length, Intrinsic Impedence and Skin Depth – Poynting Theorem – Poynting Vector and its Significance.’

**Textbooks:**

1. Sadiku, Kulkarni, “Principles of Electromagnetics”, 6th Edition, Oxford University Press, 2015
2. William.H.Hayt, “Engineering Electromagnetics”, Mc Graw Hill, 2010.

**Reference Books:**

- 1.J.D.Kraus, “Electromagnetics”, 5th Edition, Mc Graw Hill Inc, 1999.
2. David K. Cheng, “Field & Electromagnetic Waves”, 2nd Edition, 1989.
3. Joseph A. Edminister, “Electromagnetics”, 2nd Edition, Schaum’s Outline, Mc Graw Hill, 2017.
4. K.A. Gangadhar and P.M. Ramanathan, “Electromagnetic Field Theory”, 8th Reprint, Khanna Publications, 2015.

**Online Learning Resources:**

- <https://www.classcentral.com/course/youtube-electrical-electro-magnetic-fields-47689/classroom>
- [https://onlinecourses.nptel.ac.in/noc21\\_ee83/preview](https://onlinecourses.nptel.ac.in/noc21_ee83/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
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**20A04404P ANALOG ELECTRONIC CIRCUITS LAB**

**Course Objectives:**

- To learn basic techniques for the design of analog circuits and fundamental concepts used in the design of systems.
- To design and analyze multistage amplifiers, feedback amplifiers and OPAMP based circuits.
- To implement simple logical operations using combinational logic circuits
- To design combinational logic circuits, sequential logic circuits.

**Course Outcomes (CO):**

- Analyze various amplifier circuits.
- Design multistage amplifiers.
- Design OPAMP based analog circuits.
- Understand working of logic gates.
- Design and implement Combinational and Sequential logic circuits.

**List of Experiments:**

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Band width from its frequent cure sponse curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency respons ecurve.
3. Design and simulate voltageseries feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/Wien bridge oscillator and square wave generator for the given specifications. Determine the frequency of oscillation.
5. Analyze a Class B complementary symmetry power amplifier and observe the waveforms with and without cross-over distortion. Determine maximum output power and efficiency.
6. Design a class AB amplifier to remove the cross over distortion using MOSFETs.
7. Design inverting and non-inverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.
8. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.
9. Design a second order low pass and high pass active filters using OP-AMP using the given specifications. Verify them practically.
10. Design a square waveform generator using OP-AMP for the given specifications.
11. Design an astable multi-vibrator circuit for the given specifications using 555 timer. Observe ON & OFF states of transistor in an astable multi-vibrator. Plot output waveforms.
12. Design an M<sup>o</sup>n stable Multi-Vibrator circuit for the given specifications using 555 Timer. Plot output waveforms.
13. Verify one application of PLL (IC 565) by choosing appropriate circuit.
14. Conduct experiment to generate multiple functions using IC 566.

**Note:** Perform at least twelve (12) experiments from the above list.

**Virtual Lab:** <http://vlabs.iitb.ac.in/vlabs-dev/labs/analog-electronics/experimentlist.html>

**Online learning resources/Virtual Labs:**

<https://www.vlab.co.in/>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem****L T P C****0 0 3 1.5****20A02401P POWER ELECTRONICS LAB****Pre-requisite Power Electronics****Course Objectives:**

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.
- Create and analyze various power electronic converters using PSPICE software.

**Course Outcomes (CO):**

By the end of the course the student will be able to:

- Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
- Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
- Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.
- Create and analyze various power electronic converters using PSPICE software.

**List of Experiments:****Minimum eight experiments from the following list are required to be conducted**

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads
9. Single Phase Half controlled converter with R and RL load
10. Single Phase Fully controlled converter with R and RL load
10. Three Phase half controlled bridge converter with R, RL-load
11. Three Phase fully controlled bridge converter with R, RL-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads

**References:**

1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007.
2. M.H.Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications.
3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA. 5. MATLAB and its Tool Books user's manual and – Math works, USA.

**Online Learning Resources/Virtual Labs:**

- [http://vlabs.iitb.ac.in/vlabs-ev/labs/mit\\_bootcamp/power\\_electronics/labs/index.php](http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem****L T P C**  
**0 0 3 1.5****20A02402P AC MACHINES LAB**  
**AC Machines****Pre-requisite****Course Objectives:**

- Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods.
- Predetermine the regulation of Alternator by Zero Power Factor method  $X_d$  and  $X_q$  determination of salient pole synchronous machine.
- Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

**Course Outcomes (CO):**

By the end of the course, the student will be able to:

- Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods.
- Predetermine the regulation of Alternator by Zero Power Factor method  $X_d$  and  $X_q$  determination of salient pole synchronous machine.
- Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

**List of Experiments:****All the following ten experiments are required to be conducted**

1. No-load & Blocked-rotor tests on Squirrel cage Induction motor.
2. Load test on three phase slip ring Induction motor.
3. Speed control of three phase induction motor
4. Rotor resistance starter for slip ring induction motor
5. Load test on single phase induction motor.
6. Determination of Equivalent circuit of a single phase induction motor.
7. Predetermination of Regulation of a three phase alternator by synchronous impedance & m.m.f methods.
8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.
9. Determination of  $X_d$  and  $X_q$  of a salient pole synchronous machine by slip test.
10. V and inverted V curves of a 3-phase synchronous motor.

**References:**

1. D. P.Kothari and B. S. Umre, "Laboratory Manual for Electrical Machines" I.K International Publishing House Pvt. Ltd, 2017.
2. D.R. Kohli and S.K. Jain, "A Laboratory Course in Electrical Machines" NEM Chand & Bros.

**Online Learning Resources/Virtual Labs:**

- <http://vem-iitg.vlabs.ac.in/>
- [http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering](http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering)
- [http://vlabs.iitb.ac.in/vlabs-dev/vlab\\_bootcamp/bootcamp/Sadhya/experimentlist.html](http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
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**20A02404 CIRCUITS SIMULATION AND ANALYSIS USING PSPICE**

**Pre-requisite**

**Electrical Circuits, Power Electronics**

**Course Objectives:**

- Simulation of various circuits using PSPICE software.
- Simulation of single-phase half & fully-controlled converters, and inverters
- Simulation of single-phase AC Voltage controllers with different loads.

**Course Outcomes (CO)**

By the end of the course, the student will be able to:

- Simulation of various circuits using PSPICE software.
- Simulation of single-phase half & fully-controlled converters, and inverters
- Simulation of single-phase AC Voltage controllers with different loads.

**List of Experiments:**

**I Simulation of Electrical Circuits**

- a) DC & AC Circuits
- b) Mesh Analysis
- c) Nodal Analysis
- d) Transient Response

**II Simulation of Power Electronic Circuits**

- a) Single-phase half wave, Semi and full converters with RLE loads.
- b) Three-phase half wave, Semi and full converters with RLE loads.
- c) Buck, Boost and Buck-Boost Converters
- d) Single-phase AC voltage controller
- e) Single and Three phase Quasi Square wave and PWM Inverters.

**References:**

1. Simulation of Power Electronics Circuit, M B Patil, V Ramanarayan and V T Ranganat, Alpha Science International Ltd., 2009.
2. Simulation of Electric and Electronic circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA.
5. MATLAB and its Tool Books user's manual and – Mathworks, USA

**Online Learning Resources/Virtual Labs:**

- [http://vlabs.iitb.ac.in/vlabs-ev/labs/mit\\_bootcamp/power\\_electronics/labs/index.php](http://vlabs.iitb.ac.in/vlabs-ev/labs/mit_bootcamp/power_electronics/labs/index.php)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– II-I Sem****L T P C**  
**2 1 0 0****20A99401 Design Thinking for Innovation  
(Common to All branches of Engineering)****Course Objectives:**

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

**Course Outcomes (CO):**

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

**UNIT - I Introduction to Design Thinking 10 Hrs**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

**UNIT - II Design Thinking Process 10 Hrs**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

**Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

**UNIT - III Innovation 8 Hrs**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

**Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

**UNIT - IV Product Design 8 Hrs**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

**Activity:** Importance of modelling, how to set specifications, Explaining their own product design.

**UNIT - V Design Thinking in Business Processes 10 Hrs**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

**Activity:** How to market our own product, About maintenance, Reliability and plan for startup.

**Textbooks:**

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

**Reference Books:**

1. Design Thinking in the Classroom by David Lee, Ulysses press

2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

**Online Learning Resources:**

<https://nptel.ac.in/courses/110/106/110106124/>

<https://nptel.ac.in/courses/109/104/109104109/>

[https://swayam.gov.in/nd1\\_noc19\\_mg60/preview](https://swayam.gov.in/nd1_noc19_mg60/preview)

## COMMUNITY SERVICE PROJECT

.....Experiential learning through community engagement

### Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

### Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

### Implementation of Community Service Project

- Every student should put in a 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty incharge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.

- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

### **Procedure**

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
  - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

## **EXPECTED OUTCOMES**

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**

#### **Learning Outcomes**

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

#### **Personal Outcomes**

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

#### **Social Outcomes**

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

### **Career Development**

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

### **Relationship with the Institution**

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS**

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES**

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

### **BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY**

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

### **SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT**

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

#### **For Engineering Students**

- 1. Water facilities and drinking water availability**
- 2. Health and hygiene**
- 3. Stress levels and coping mechanisms**
- 4. Health intervention programmes**
- 5. Horticulture**
- 6. Herbal plants**
- 7. Botanical survey**
- 8. Zoological survey**
- 9. Marine products**
- 10. Aqua culture**
- 11. Inland fisheries**
- 12. Animals and species**

13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Flourey culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilisation of free electricity to farmers and related issues
40. Gender ration in schooling lvel- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmes are;

#### **Programmes for School Children**

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

#### **Programmes for Women Empowerment**

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

#### **General Camps**

1. General Medical camps
2. Eye Camps

3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

**Programmes for Youth Empowerment**

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

**Common Programmes**

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
  - i. Agriculture
  - ii. Health
  - iii. Marketing and Cooperation
  - iv. Animal Husbandry
  - v. Horticulture
  - vi. Fisheries
  - vii. Sericulture
  - viii. Revenue and Survey
  - ix. Natural Disaster Management
  - x. Irrigation
  - xi. Law & Order
  - xii. Excise and Prohibition
  - xiii. Mines and Geology
  - xiv. Energy

**Role of Students:**

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.
- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

### **Timeline for the Community Service Project Activity**

**Duration: 8 weeks**

#### **1. Preliminary Survey (One Week)**

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

#### **2. Community Awareness Campaigns (One Week)**

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

#### **3. Community Immersion Programme (Three Weeks)**

**Along with the Community Awareness Programmes**, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

#### **4. Community Exit Report (One Week)**

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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

**(20A02501) POWER SYSTEM ARCHITECTURE**

**Course Objectives:**

- Operation of Conventional Power generating systems and their components.
- The role of non-conventional power generating systems and their operation and economic aspects.
- Calculation of different transmission line parameters and their use.
- Modeling of transmission line and evaluation of constants.

**Course Outcomes:**

- Remember and understand the concepts of conventional and nonconventional power generating systems.
- Apply the economic aspects to the power generating systems.
- Analyse the transmission lines and obtain the transmission line parameters and constants.
- Design and develop the schemes to improve the generation and capability of transmission line to meet the day-to-day power requirements.

**UNIT I POWER GENERATING SYSTEMS**

**Thermal Power:** Block Diagram of Thermal Power Station (TPS), Brief Description of TPS Components

**Hydro Power:** Selection of Site, Classification, Layout, Description of Main Components.

**Nuclear Power:** Nuclear Fission and Chain Reaction-Principle of Operation of Nuclear Reactor.- Reactor Components: Moderators, Control Rods, Reflectors and Coolants- Radiation Hazards: Shielding and Safety Precautions- Types of Nuclear Reactors.

**Solar Power Generation:** Role and Potential of Solar Energy Options, Principles of Solar Radiation, Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.

**Wind Power Generation:** Role and potential of Wind Energy Options, Horizontal and Vertical Axis Windmills- Performance Characteristics-Pitch & Yaw Controls – Economic Aspects.

**UNIT II TRANSMISSION LINE PARAMETERS**

Types of conductors - calculation of resistance for solid conductors, Bundle conductors, Skin effect, Proximity effect, concept of GMR & GMD- Transposition of Power lines- Calculation of inductance for single phase and three phase, single and double circuit lines, symmetrical and asymmetrical conductor configurations with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines, Numerical Problems.

**UNIT III MODELING OF TRANSMISSION LINES**

Classification of Transmission Lines - Short, medium and long lines and their models - representations - Nominal-T, Nominal- $\pi$  and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent –  $\pi$ , Numerical Problems – Surge Impedance and surge Impedance loading - Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients- Termination of lines with different types of conditions-wavelengths and Velocity of propagation – Ferranti effect, Charging current, Need of Shunt Compensation.

**UNIT IV INSULATORS, CORONA AND MECHANICAL DESIGN OF LINES AND CABLES**

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of string efficiency, Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications.Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems.

**UNIT V GENERAL ASPECTS OF DISTRIBUTION SYSTEMS**

Classification of Distribution Systems - Comparison of DC & AC and Under-Ground & Over - Head Distribution Systems. Voltage Drop and power loss in D.C Distributors for the following cases: Radial D.C Distributors fed at one end and at ends (equal/unequal Voltages), Uniform loading and Ring Main Distributor, LVDC Distribution Network. Design Considerations of Distribution Feeders: Radial and loop types of primary feeders, feeder loading; basic design of secondary distribution. Voltage Drop and power loss in A.C. Distributors.

**SUBSTATIONS:**

**Location of Substations:** Rating of distribution substations, service area within primary feeders. Benefits derived through optimal location of substations.

**Classification of substations:** Air insulated substations - Indoor & Outdoor substations: Substation layout showing the location of all the substation equipment – Gas Insulated Substation (GIS).

**Textbooks:**

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, DhanpatRai& Co. Pvt. Ltd., 1999.
2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005.
3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.

**Reference Books:**

1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006.
2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003.
3. Principles of Power Systems by V.K. Mehta and Rohit Mehta, S.CHAND& COMPANY LTD., New Delhi 2004.
4. Wind Electrical Systems by S. N. Bhadra, D. Kastha& S. Banerjee – Oxford University Press, 2013.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee17/preview](https://onlinecourses.nptel.ac.in/noc22_ee17/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– III-I Sem****L T P C****3 0 0 3****(20A02502T) CONTROL SYSTEMS****Course Objectives:**

- Merits and demerits of open loop and closed loop systems; the effect of feedback
- The use of block diagram algebra and Mason's gain formula to find the overall transfer function
- Transient and steady state response, time domain specifications and the concept of Root loci
- Frequency domain specifications, Bode diagrams and Nyquist plots
- State space modelling of Control system

**Course Outcomes:**

- Understand the concepts of control systems classification, feedback effect, mathematical modelling, time response and frequency response characteristics, state space analysis
- Apply the concepts of Block diagram reduction, Signal flow graph method and state space formulation for obtaining mathematical and Root locus, Bode, Nyquist, Polar plots for stability calculations, controllability and observability and demonstrate the use of these techniques.
- Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.
- Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them in solving various engineering applications.

**UNIT I CONTROL SYSTEMS CONCEPTS**

Open loop and closed loop control systems and their differences- Examples of control systems- Classification of control systems, Feedback characteristics, Effects of positive and negative feedback, Mathematical models – Differential equations of translational and rotational mechanical systems and electrical systems, Analogous Systems, Block diagram reduction methods – Signal flow graphs - Reduction using Mason's gain formula. Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchronos.

**UNIT II TIME RESPONSE ANALYSIS**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, P, PI, PID Controllers.

**UNIT III STABILITY ANALYSIS IN TIME DOMAIN**

The concept of stability – Routh's stability criterion – Stability and conditional stability – limitations of Routh's stability. The Root locus concept - construction of root loci-effects of adding poles and zeros to  $G(s)H(s)$  on the root loci.

**UNIT IV FREQUENCY RESPONSE ANALYSIS**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis.

Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

**UNIT V STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Block diagrams. Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

**Textbooks:**

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5<sup>th</sup> edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5<sup>th</sup> edition, 2007.

**Reference Books:**

1. Control Systems Principles & Design by M.Gopal, 4<sup>th</sup> Edition, Mc Graw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud& Ivan J Williams, 2<sup>nd</sup> Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6<sup>th</sup> Edition, Pearson, 2010.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee31/preview](https://onlinecourses.nptel.ac.in/noc22_ee31/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– III-I Sem****L T P C**  
**3 0 0 3****(20A02503T) MEASUREMENTS & SENSORS****Course Objectives:**

- The student has to acquire knowledge about:
- The basic principles of different types of electrical instruments for the measurement of voltage, current, power factor, power and energy.
- The measurements of RLC parameters using bridge principles.
- The principles of magnetic measurements
- The principle of working of CRO and its applications

**Course Outcomes:**

- Able to Understand the working of various instruments and equipments used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc in industry as well as in power generation, transmission and distribution sectors
- Able to analyze and solve the varieties of problems and issues coming up in the vast field of electrical measurements.
- Analyse the different operation of extension range ammeters and voltmeters, DC and AC bridge for measurement of parameters and different characteristics of periodic and aperiodic signals using CRO.
- Design and development of various voltage and current measuring meters and the varieties of issues coming up in the field of electrical measurements.

**UNIT I MEASURING INSTRUMENTS & DIGITAL METERS**

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range – Numerical examples.

Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type-Digital Frequency Meter-Digital Multimeter-Digital Tachometer.

**UNIT II MEASUREMENT OF POWER, POWER FACTOR AND ENERGY**

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter – Numerical examples

**UNIT III INSTRUMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS**

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations. DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization – Applications.Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method – A.C. Testing – Iron Loss of Bar Samples – Numerical Examples

**UNIT IV D.C & A.C BRIDGES**

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method. Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge. Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge – Numerical Examples

**UNIT V CRO AND SENSORS**

Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns.

Capacitive and Inductive displacement sensors, Electromagnetism in sensing, Flow, Level sensors, Position and Motion sensors, Pressure sensors and Temperature sensors

**Textbooks:**

1. Electrical & Electronic Measurement & Instruments by A.K.SawhneyDhanpat Rai & Co. Publications, 2007.
2. Electrical Measurements and measuring Instruments – by E.W. Golding and F.C. Widdis, 5<sup>th</sup> Edition, Reem Publications, 2011.

**Reference Books:**

1. Electronic Instrumentation by H. S. Kalsi, Tata Mcgrawhill, 3<sup>rd</sup> Edition, 2011.
2. Electrical Measurements: Fundamentals, Concepts, Applications – by Reissland, M.U, New Age International (P) Limited, 2010.
3. Electrical & Electronic Measurement & Instrumentation by R. K. Rajput, 2<sup>nd</sup> Edition, S. Chand & Co., 2<sup>nd</sup> Edition, 2013.
4. Sensor Technology: Handbook by Jon S. Wilson, ELSEVIER publications, 2005

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee112/preview](https://onlinecourses.nptel.ac.in/noc22_ee112/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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

**(20A02504a) SWITCHGEAR AND PROTECTION**  
**(Professional Elective Course-I)**

**Course Objectives:**

- To discuss the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- The study of different Circuit Breakers and Relays
- The protection of Generators and Transformers
- The protection of various feeder bus bars from abnormal conditions and over voltages & importance on Neutral grounding for overall protection.

**Course Outcomes:**

- Understand the operation of different circuit breakers.
- Analyze the concepts of different relays which are used in real time power system operation.
- Apply various protective schemes for Transformers, Rotating machines, Bus bars, Feeders.
- Develop the practical applications of power system operation and planning.

**UNIT I CIRCUIT BREAKERS**

Circuit Breakers: Elementary principles of arc interruption, Recovery, Restriking Voltage and Recovery voltages - Restriking Phenomenon, Average, Max. RRRV, Current Chopping and Resistance Switching - CB ratings and Specifications: Types and Numerical Problems. - Auto reclosures. Description and Operation of- Minimum Oil Circuit breakers, Air Blast Circuit Breakers, Vacuum and SF6 circuit breakers.

**UNIT II ELECTROMAGNETIC, STATIC AND NUMERICAL RELAYS**

Basic Requirements of Relays – Primary and Backup protection - Construction details of – Attracted armature, balanced beam, inductor type and differential relays – Universal Torque equation – Characteristics of over current, Direction and distance relays. Static Relays – Advantages and Disadvantages – Definite time, Inverse and IDMT static relays – Comparators – Amplitude and Phase comparators. Microprocessor based relays – Advantages and Disadvantages – Block diagram for over current (Definite, Inverse and IDMT) and Distance Relays and their Flow Charts.

**UNIT III PROTECTION OF GENERATORS AND TRANSFORMERS**

Protection of generators: Protection of generators against Stator faults, Rotor faults, and Abnormal Conditions. Restricted Earth fault and Inter-turn fault Protection. Numerical Problems on % Winding Unprotected. Protection of transformers: Percentage Differential Protection, Numerical Problem on Design of CT s Ratio, Buchholtz relay Protection.

**UNIT IV PROTECTION OF FEEDERS, TRANSMISSION LINES AND BUSBARS**

Protection of Feeders (Radial & Ring main) using over current Relays. Protection of Transmission lines – 3 Zone protection using Distance Relays. Carrier current protection. Protection of Bus bars - Differential protection.

**UNIT V PROTECTION AGAINST OVER VOLTAGES**

Generation of Over Voltages in Power Systems.-Protection against Lightning Over Voltages - Valve type and Zinc-Oxide Lightning Arresters - Insulation Coordination –BIL. Neutral Grounding, Grounded and Ungrounded Neutral Systems. - Effects of Ungrounded Neutral on system performance. Methods of Neutral Grounding: Solid, Resistance, Reactance – Arcing Grounds and Grounding Practices.

**Textbooks:**

1. Switchgear and Protection – by Sunil S Rao, Khanna Publishers.
2. Power System Protection and Switchgear by Badari Ram, D.N Viswakarma, TMH Publications.
3. Power System Protection- P. M. Anderson, Wiley Publishers.

**Reference Books:**

1. Protective Relaying Principles and Applications – J Lewis Blackburn, CRC Press.
2. Numerical Protective Relays, Final Report 2004 – 1009704 EPRI, USA.
3. Protective Relaying Theory and Applications - Walter A Elmore, Marcel Dekker.
4. Transmission network Protection by Y.G. Paithankar, Taylor and Francis, 2009.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee101/preview](https://onlinecourses.nptel.ac.in/noc22_ee101/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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

**(20A02504b) POWER ELECTRONICS DRIVES**  
**(Professional Elective Course-I)**

**Course Objectives:**

- To understand the various drive mechanisms and methods for energy conservation.
- To apply power electronic converters to control the speed of DC motors and induction motors.
- To evaluate the motor and power converter for a specific application.
- To develop closed loop control strategies of drives

**Course Outcomes:**

- Understand the various drive mechanisms and methods for energy conservation.
- Apply power electronic converters to control the speed of DC motors and induction motors.
- Evaluate the motor and power converter for a specific application.
- Develop closed loop control strategies of drives

**UNIT I INTRODUCTION TO ELECTRIC DRIVES**

Introduction, Advantages of Electric drives, Parts of Electrical Drives, Electric Motors, Power Modulators, Sources, Choice of Electric Drives and selection of drives for various applications.

**UNIT IIDYNAMICS OF ELECTRICAL DRIVES**

Fundamental torque equation, components of load torque, speed-torque characteristics of loads, Nature and classification of load torques, speed-torque convention & multi- quadrant operation. Equivalent values of drive parameters, loads with rotational motion, loads with translational motion, measurement of moment of inertia, components of load torques. Steady state stability, dynamic stability, load equalization. Basic principles of closed-loop control.

**UNIT IIIDC MOTOR DRIVES**

Speed control of DC motors using single-phase and three-phase fully controlled and half controlled rectifiers in continuous and discontinuous mode of operation. Single quadrant, two quadrant and four quadrant chopper controlled drives in continuous and discontinuous mode of operation.

**UNIT IVINDUCTION MOTOR DRIVES**

Speed control of cage induction motor with v/f control; slip power recovery scheme, static Scherbius and Kramer methods. Variable frequency and variable voltage control using VSI and CSI. AC and DC dynamic braking methods.

**UNIT VSYNCHRONOUS MOTOR DRIVES**

Wound field cylindrical rotor motor, Equivalent circuits, performance equations of operation Power factor control and V curves, starting and braking of Synchronous motor drives, speed control of synchronous motors, adjustable frequency operation of synchronous motors, voltage source inverter drive with open loop control, self controlled and separate controlled synchronous motor, self controlled synchronous motor drive using load commutated thyristor inverter, Cycloconverter fed drive

**Textbooks:**

1. G.K. Dubey: Fundamentals of Electric Drives –Narosa Publishers, Second edition, 2007.
2. S.B. Dewan, G.R. Slemom, A. Straughen: Power semiconductor drives, John Wiley & Sons.
3. Vedam Subramanyam: Electric Drives Concepts & Applications –Tata McGraw Hill Edn. Pvt.Ltd, Second Edition, 2011.

**Reference Books:**

1. Werner Leonhard: Control of Electric Drives, Springer international edition 2001.
2. Nisit K. De and Swapan K. Dutta: Electric Machines and Electric Drives, PHI learning Pvt. Ltd, 2011.
3. V. Subrahmanyam: Thyristor Control of Electric Drives, Tata McGraw Hill Edn. Pvt.Ltd, 2010.

**Online Learning Resources:**<https://nptel.ac.in/courses/108/104/108104140/>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

**L T P C**  
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**(20A02504c) POWER QUALITY**  
**(Professional Elective Course-I)**

**Course Objectives:**

- To learn about voltage disturbances and power transients that is occurring in power systems.
- To know about voltage sag and transient over voltages for quality of power supply
- To understand about harmonics and their mitigation
- To study about different power quality measuring and monitoring concepts.
- To know about long duration voltage variations

**Course Outcomes:**

- Understand the basic concepts of different power quality issues and to mitigate them, principles of regulation of long duration voltage variations
- Analyze voltage disturbances and power transients that are occurring in power systems.
- Understand the concept of harmonics in the system and their effect on different power system equipment.
- Apply the knowledge about different power quality measuring and monitoring concepts.

**UNIT I POWER QUALITY ISSUES**

Power quality, voltage quality, The power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-duration voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

**UNIT II VOLTAGE SAGS AND TRANSIENT OVER VOLTAGES**

Sources of sags and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-use level, Motor-starting sags and utility system fault-clearing issues, sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

**UNIT III FUNDAMENTALS OF HARMONICS**

Harmonic sources from commercial and industrial loads, locating harmonic sources, Power system response characteristics, Harmonics Vs transients, Effect of harmonics, harmonic distortion, voltage and current distortion, harmonic indices, inter harmonics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive and active filters, IEEE and IEC Standards.

**UNIT IV LONG-DURATION VOLTAGE VARIATIONS**

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation, End user capacitor applications, flicker.

**UNIT V POWER QUALITY BENCH MARKING AND MONITORING**

Benchmarking process, RMS Voltage variation Indices, Harmonic indices Power Quality Contracts, Monitoring considerations, power quality measurement equipment, Power quality Monitoring standards.

**Textbooks:**

1. Electrical Power Systems Quality by Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty, 2<sup>nd</sup> Edition, TMH Education Pvt. Ltd, 2012
2. Power quality by C. Sankaran, CRC Press, 2017

**Reference Books:**

1. Electrical systems quality Assessment by J. Arrillaga, N.R. Watson, S. Chen, John Wiley & Sons, 2000.
2. Understanding Power quality problems by Math H. J. Bollen, Wiley-IEEE Press, 2000

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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**(20A02502P) CONTROL SYSTEMS LAB**

**Course Objectives:**

- Determination of transfer functions of various systems and control of it by different methodologies.
- To provide knowledge in the analysis and design of controllers and compensators.
- The characteristics of servo mechanisms which are helpful in automatic control systems.
- To know the stability analysis using MATLAB.

**Course Outcomes:**

- Get the knowledge of feedback control and transfer function of DC servo motor.
- Model the systems and able to design the controllers and compensators.
- Get the knowledge about the effect of poles and zeros location on transient and steady state behavior of second order systems and can implement them to practical systems and MATLAB
- Determine the performance and time domain specifications of first and second order systems.

**List of Experiments:**

1. Time response of Second order system
2. Characteristics of Synchronos
3. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions and application of speed control of motor.
4. Effect of feedback on DC servo motor
5. Transfer function of DC Machine
6. Effect of P, PD, PI, PID Controller on a second order system
7. Lag and lead compensation – Magnitude and phase plot
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Simulation of Op-Amp based Integrator and Differentiator circuits.
12. Linear system analysis (Time domain analysis, Error analysis) using Soft Tools.
13. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using Soft Tools
14. State space model for classical transfer function using Soft Tools – Verification.
15. P, PI and PID Controller design for Temperature Control using Soft Tools.

**References:**

1. Simulation of Electrical and electronics Circuits using PSPICE – by M.H.Rashid, M/s PHI Publications.
2. PSPICE A/D user's manual – Microsim, USA.
3. PSPICE reference guide – Microsim, USA.
4. MATLAB and its Tool Books user's manual and – Mathworks, USA.

**Online Learning Resources/Virtual Labs:**

1. <http://iitb.vlab.co.in/?sub=8&brch=117>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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**(20A02503P) MEASUREMENTS AND SENSORS LAB**

**Course Objectives:**

This laboratory deals with the practical exercises for:

- Calibration of various electrical measuring instruments
- Accurate determination of inductance and capacitance using AC Bridges
- Measurement of coefficient of coupling between two coupled coils
- Measurement of resistance for different range of resistors using bridges

**Course Outcomes:**

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

- Calibrate various electrical measuring instruments
- Accurately determine the values of inductance and capacitance using AC bridges
- Compute the coefficient of coupling between two coupled coils
- Accurately determine the values of very low resistances

**List of Experiments:**

1. Calibration and Testing of single phase energy Meter
2. Calibration of dynamometer power factor meter
3. Crompton D.C. Potentiometer – Calibration of PMMC ammeter and voltmeter
4. Kelvin's double Bridge – Measurement of low resistance – Determination of Tolerance
5. Determination of Coefficient of coupling between two mutually coupled coils
6. Determination of Capacitance using Schering Bridge
7. Determination of Inductance using Anderson bridge
8. Measurement of 3-phase reactive power with single-phase wattmeter
9. Measurement of parameters of a choke coil using 3-voltmeter and 3-ammeter methods
10. Determination of Inductance using Maxwell's bridge
11. Determination of Capacitance using DeSauty bridge
12. Calibration of LPF wattmeter – by Phantom loading
13. Wheatstone bridge – measurement of medium resistances
14. LVDT and capacitance pickup – characteristics and Calibration
15. Resistance strain gauge – strain measurement and Calibration
16. Transformer turns ratio measurement using AC Bridge
17. AC Potentiometer – Calibration of AC Voltmeter, Parameters of Choke coil

**References:**

NA

**Online Learning Resources/Virtual Labs:**

1. <http://vlabs.iitkgp.ernet.in/asnm/#>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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**(20A52401) SOFT SKILLS**  
**(Skill Oriented Course-III)**

**Course Objectives:**

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

**Course Outcomes (CO):**

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

**UNIT – I**

**Soft Skills & Communication Skills**

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

**Activities:**

**Intrapersonal Skills-** Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

**Interpersonal Skills-** Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

**Verbal Communication-** Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

**Non-verbal communication** – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

**UNIT – II**

**Critical Thinking**

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

**Activities:**

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

**UNIT – III**

**Problem Solving & Decision Making**

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

**Activities:**

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.

Case Study & Group Discussion

**UNIT – IV Emotional Intelligence & Stress Management**

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

**Activities:**

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

**UNIT – V**

**Leadership Skills**

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

**Activities:**

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

**NOTE-:**

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

**Textbooks:**

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

**Reference Books:**

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

**Online Learning Resources:**

1. [https://youtu.be/DUlsNJtg2L8?list=PLLy\\_2iUCG87CQhELCYtvXh0E\\_y-bOO1\\_q](https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCYtvXh0E_y-bOO1_q)
2. [https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel\\_j2PUy0pwjVUgj7KIJ](https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KIJ)
3. <https://youtu.be/-Y-R9hDI71U>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-I Sem**

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

**(20A99201) ENVIRONMENTAL SCIENCE**

(Common to All Branches of Engineering)

**Course Objectives:**

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

**UNIT – I**

**Multidisciplinary Nature Of Environmental Studies:** – Definition, Scope and Importance – Need for Public Awareness.

**Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

**Learning outcomes:**

At the end of this unit, the students will be able to

- To know the importance of public awareness
- To know about the various resources

**UNIT – II**

**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)

**Biodiversity And Its Conservation :** Introduction 0 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-spots 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.

**Learning outcomes:**

At the end of this unit, the students will be able to

- To know about various echo systems and their characteristics
- To know about the biodiversity and its conservation

**UNIT – III**

**Environmental Pollution:** Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. 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.

**Learning outcomes:**

At the end of this unit, the students will be able to

- To know about the various sources of pollution.
- To know about the various sources of solid waste and preventive measures.
- To know about the different types of disasters and their managerial measures.

**UNIT – IV**

**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.

**Learning outcomes:**

At the end of this unit, the students will be able to

- To know about the social issues related to environment and their protection acts.
- To know about the various sources of conservation of natural resources.
- To know about the wild life protection and forest conservation acts.

**UNIT – V**

**Human Population And The Environment:** Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human

Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**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, and birds – river, hill slopes, etc..

**Learning outcomes:**

At the end of this unit, the students will be able to

- To know about the population explosion and family welfare programmes.
- To identify the natural assets and related case studies.

**TEXT BOOKS:**

1. Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

**REFERENCES:**

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

**Course Outcomes:**

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

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

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

**(20A02601T) POWER SYSTEM ANALYSIS**

**Course Objectives:**

- The use of per unit values and graph theory concepts, solving a problem using computer.
- Formation of  $Y_{bus}$  and  $Z_{bus}$  of a Power System network, power flow studies by various methods.
- Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
- Analysis of power system for steady state and transient stability and also methods to improve stability

**Course Outcomes:**

- Remember and understand the concepts of per unit values, Y Bus and Z bus formation, load flow studies, symmetrical and unsymmetrical fault calculations.
- Apply the concepts of good algorithm for the given power system network and obtain the converged load flow solution and experiment some of these methods using modern tools and examine the results.
- Analyse the symmetrical faults and unsymmetrical faults and done the fault calculations, analyse the stability of the system and improve the stability. Demonstrate the use of these techniques through good communication skills.
- Develop accurate algorithms for different networks and determine load flow studies and zero, positive and negative sequence impedances to find fault calculations.

**UNIT I. u. SYSTEM AND  $Y_{bus}$  FORMATION**

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix,  $Y_{Bus}$  formation by Direct and Singular Transformation Methods, Numerical Problems.

**UNIT II FORMATION OF  $Z_{bus}$**

Formation of  $Z_{Bus}$ : Partial network, Algorithm for the Modification of  $Z_{Bus}$  Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of  $Z_{Bus}$  for the changes in network ( Problems )

**UNIT III POWER FLOW ANALYSIS**

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

**UNIT IV SHORT CIRCUIT ANALYSIS**

Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components, Positive, Negative and Zero sequence Networks. Symmetrical Fault Analysis: LLLG faults with and without fault impedance, Unsymmetrical Fault Analysis: LG, LL and LLG faults with and without fault impedance, Numerical Problems.

**UNIT V STABILITY ANALYSIS**

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation - Methods to improve Stability - Application of Auto Reclosing and Fast Operating Circuit Breakers.

**Textbooks:**

1. Computer Methods in Power System Analysis by G.W.Stagg and A.H.El-Abiad, Mc Graw-Hill, 2006.
2. Modern Power system Analysis by I.J.Nagrath&D.P.Kothari, Tata McGraw-Hill Publishing Company, 4<sup>th</sup> Edition, 2011.

**Reference Books:**

1. Power System Analysis by Grainger and Stevenson, McGraw Hill, 1994.
2. Power System Analysis by Hadi Saadat, McGraw Hill, 1998.
3. Power System Analysis and Design by B.R.Gupta, S. Chand & Company, 2005.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee120/preview](https://onlinecourses.nptel.ac.in/noc22_ee120/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– III-II Sem****L T P C  
3 0 0 3****(20A02602T) DIGITAL COMPUTING PLATFORMS****Course Objectives:**

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understand the Interfacing of 8086 with various advanced communication devices
- Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
- To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
- To understand Xilinx programming and understanding of Spartan FPGA board

**Course Outcomes:**

- Understand the basic architecture & pin diagram of 8086 microprocessor, 8051 Microcontroller, DSP Processor and FPGA Processors
- Apply the concepts to design Assembly language programming to perform a given task, Interrupt service routines for all interrupt types
- Design Real time applications by writing Assembly Language Programs for the Digital Signal Processors, Xilinx programming for Spartan FPGA boards and use Interrupts for real-time control applications
- Analyse various real time systems by using various controllers

**UNIT I INTRODUCTION TO MICROPROCESSORS**

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams - CISC and ARM Processors.

**UNIT II ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE**

Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes.

**UNIT III 8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS**

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control.

**UNIT IV INTRODUCTION TO TMS320LF2407 DSP CONTROLLER**

Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

**UNIT V FIELD PROGRAMMABLE GATE ARRAYS (FPGA)**

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.

**Textbooks:**

1. Ramesh S. Gaonkar, DI Architecture Programming and Applications with 8085, Penram Intl. Publishing, 6<sup>th</sup> Edition, 2013
2. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3<sup>rd</sup> Edition, 2013.

**Reference Books:**

1. Microprocessor and Interfacing by Douglas V Hall, 2<sup>nd</sup> Edition, Tata McGraw hill, 1992
2. Microprocessor, Nilesh B Bahadure, PHI, 2010.
3. The 8051 Micro Controller Architecture, Programming and Applications by Kenneth J Ayala, Pearson International publishing (India).
4. Hamid A. Tolyat, DSP Based Electro Mechanical Motion Control, CRC press, 2004.
5. Application Notes from the webpage of Texas Instruments.
6. XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998
7. XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999
8. Wayne Wolf, FPGA based system design, Prentice hall, 2004.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/106108100>
2. <https://nptel.ac.in/courses/108105102>
3. <https://nptel.ac.in/courses/117108040>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

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

**(20A04502T) DIGITAL SIGNAL PROCESSING**

**Course Objectives:**

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing.

**Course Outcomes:**

- Formulate difference equations for the given discrete time systems
- Apply FFT algorithms for determining the DFT of a given signal
- Compare FIR and IIR filter structures
- Design digital filter (FIR & IIR) from the given specifications
- Outline the concept of multirate DSP and applications of DSP.

**UNIT I**

Introduction to discrete time signals and systems

Introduction to digital signal processing, review of discrete-time signals and systems, analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

**UNIT II**

Discrete Fourier Transform - Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform - Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

**UNIT III**

IIR Filters - Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

**UNIT IV**

FIR Filters - Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

**UNIT V**

Quantization Errors in Digital Signal Processing: Representation of numbers, Quantization of filter coefficients, Round-off Effects in digital filters.

Multirate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Polyphase decomposition.

**Textbooks:**

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI.

**References:**

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.

**Online Learning Resources:**

[https://onlinecourses.nptel.ac.in/noc22\\_ee99/preview,2](https://onlinecourses.nptel.ac.in/noc22_ee99/preview,2). <https://nptel.ac.in/courses/108105055>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

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

**(20A02604a) HVDC AND FACTS**  
**(Professional Elective Course-II)**

**Course Objectives:** To get the student exposed to:

- High voltage DC transmission systems
- Flexible AC transmission systems
- Various configurations of the above, Principle of operation, Characteristics of various FACTS devices

**Course Outcomes:**

- Understand the necessity of HVDC systems as emerging transmission networks
- Understand the necessity of reactive power compensation devices
- Design equivalent circuits of various HVDC system configurations
- Design and analysis of various FACTS devices

**UNIT I INTRODUCTION**

Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS.

**UNIT II HIGH VOLTAGE DC TRANSMISSION – I**

Types of HVDC links - Monopolar, Homopolar, Bipolar and Back-to-Back, Advantages and disadvantages of HVDC Transmission, Analysis of Greatz circuit, Analysis of bridge circuit without overlap, Analysis of bridge with overlap less than  $60^\circ$ , Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link.

**UNIT III HIGH VOLTAGE DC TRANSMISSION – II**

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

**UNIT IV FLEXIBLE AC TRANSMISSION SYSTEMS-I**

Types of FACTS Controllers, brief description about various types of FACTS controllers, Operation of 6-pulse converter, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation, principle of operation of various types of Controllable shunt Var Generation, Principle of switching converter type shunt compensator, principles of operation of various types of Controllable Series Var Generation, Principle of Switching Converter type series compensator.

**UNIT V FLEXIBLE AC TRANSMISSION SYSTEMS-II**

Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Interline Power Flow Controller (IPFC) – Principle of operation and Characteristics, UPFC and IPFC control structures (only block diagram description), objectives and approaches of voltage and phase angle regulators

**Textbooks:**

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.

**Reference Books:**

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.
2. AnriqueAcha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.
3. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

**Online Learning Resources** : <https://nptel.ac.in/courses/108104013>,  
<https://nptel.ac.in/courses/108107114>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– III-II Sem** **L T P C**  
**3 0 0 3**  
**(20A02604b) NONLINEAR SYSTEM ANALYSIS**  
**(Professional Elective Course-II)**

**Course Objectives:**

To get the student exposed to:

- Basics of Nonlinear systems
- Mathematical preliminaries
- Stability concepts and various case studies

**Course Outcomes:**

The student will be able to:

- Understand the basic concepts of Nonlinear systems
- Understand the mathematical analysis of nonlinear systems
- Analyze various nonlinear case studies
- Evaluation of stability conditions for given nonlinear systems

**UNIT I MATHEMATICAL PRELIMINARIES-I**

Why nonlinear systems? - Non-linear Models of Physical Systems, Mathematical Preliminaries: Finite dimensional normed spaces, Euclidean space and its topology, Infinite dimensional Banach spaces - Contraction mapping theorem.

**UNIT II MATHEMATICAL PRELIMINARIES-II**

Existence and Uniqueness results for solutions to non linear ODEs, ODEs as vector fields - One dimensional systems - Phase portrait of second order linear systems -Equilibrium points, linearization and their classification

**UNIT III CASE STUDIES**

Examples: Simple pendulum, Bead on a hoop, Lotka-Volterra models for predation and competition, biological transcriptional system, van der Pol oscillator and conservative systems, non linear circuits - Limit cycles

**UNIT IV STABILITY CRITERION-I**

Bifurcations of two-dimensional flows: Saddle-node, pitchfork, transcritical and Hopf - their normal forms, Notions of stability - Lyapunov and LaSalle's theorems, Finding Lyapunov functions: Linear systems, variable gradient method - Center Manifold Theorem

**UNIT V STABILITY CRITERION-II**

Physical Non-linearities - Interconnections and feedback - Aizermann's conjecture – Passivity, PR systems - Dissipation equality - Passive filters, KYP Lemma - Popov and circle criterion

**Textbooks:**

1. Nonlinear Systems - Hassan Khalil
2. Nonlinear dynamics and chaos: with applications to physics, biology, chemistry, and engineering - Steven Strogatz

**Reference Books:**

1. Nonlinear systems: analysis, stability, and control - S.S.Sastry
2. Nonlinear Systems Analysis – Vidyasagar

**Online Learning Resources:**

[https://onlinecourses.nptel.ac.in/noc22\\_ee01/preview](https://onlinecourses.nptel.ac.in/noc22_ee01/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

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**3 0 0 3**

**(20A02604c) DESIGN OF PHOTOVOLTAIC SYSTEMS**  
**(Professional Elective Course-II)**

**Course Objectives:**

To get the student exposed to:

- Basics of PV Cell
- Energy Estimation and costing
- Maximum Power Point Tracking
- PV Interfacing

**Course Outcomes:**

- Understand the basic concepts of PV Cells
- Understand the concepts of Energy estimation and Sizing
- Design MPPT
- Analyze PV system along with its interfacing

**UNIT I PV CELL**

A historical perspective, PV cell characteristics and equivalent circuit, Model of PV cell, Short Circuit, Open Circuit and peak power parameters, Datasheet study, Cell efficiency, Effect of temperature, Temperature effect calculation example, Fill factor, PV cell simulation, Series and Parallel Interconnection

**UNIT II ENERGY ESTIMATION AND SIZING PV**

Energy from Sun, insolation and irradiance, insolation variation with time delay, Solar geometry, Insolation on a horizontal flat plate, Sunrise and sunset hour angles, Energy plots in octave, atmospheric effects, air mass, Clearness index

Sizing PV for applications without batteries, Examples, Batteries: Introduction, Capacity, C-rate, efficiency, energy and power densities, Battery selection, other energy storage methods, PV system design

**UNIT III MAXIMUM POWER POINT TRACKING**

MPPT concept, Input impedance of DC-DC converters - Boost converter, Buck converter, Buck-Boost converter, PV module in SPICE, Simulation - PV and DC-DC interface, Impedance control methods-voltage scaling, current scaling, Sampling method, Power slope method 1, Power slope method 2, Hill climbing method, Practical points - Housekeeping power supply, Gate driver, MPPT for non-resistive loads, Simulation

**UNIT IV PV-BATTERY INTERFACE**

Direct PV-battery connection, Charge controller, Battery charger - Understanding current control, slope compensation, simulation of current control, Batteries in series - charge equalisation, Batteries in parallel

Peltier device – principle, Peltier element – datasheet, Peltier cooling, Thermal aspects- Conduction, Convection, A peltier refrigeration example, Radiation and mass transport, Demo of Peltier cooling, PV and Water pumping

**UNIT V PV AND GRID INTERFACE**

Grid connection principle, PV to grid topologies, 3ph d-q controlled grid connection- introduction, dq-axis theory, AC to DC transformation, DC to AC transformation, Complete 3ph grid connection, 1ph d-q controlled grid connection, 3ph PV-Grid interface example, SVPWM - discrete implementation, analog implementation, Application of integrated magnetics, LIFE CYCLE COSTING Growth models, examples, Annual payment and present worth factor, Examples

**Textbooks:**

1. Design of Photovoltaic Systems by L. Umanand

Online Learning Resources: <https://nptel.ac.in/courses/117108141>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

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**(20A02601P) POWER SYSTEMS ANALYSIS LAB**

**Course Objectives:**

The objectives of this course include

- To do the experiments (in machines lab) on various power system concepts like determination of sequence impedance, fault analysis, finding of subtransient reactance's.
- To draw the equivalent circuit of three winding transformer by conducting a suitable experiment.
- To develop the MATLAB program for formation of Y and Z buses. To develop the MATLAB programs for Gauss-Seidel and fast decoupled load flow studies.
- To develop the SIMULINK model for single area load frequency problem.

**Course Outcomes:**

After completion of the course the student will able to

- Get the practical knowledge on calculation of sequence impedance, fault currents, voltages and sub transient reactance's.
- Get the practical knowledge on how to draw the equivalent circuit of three winding transformer.
- Get the knowledge on development of MATLAB program for formation of Y and Z buses.
- Get the knowledge on development of MATLAB programs for Gauss-Seidel and Fast Decouple Load Flow studies.
- Get the knowledge on development of SIMULINK model for single area load frequency problem.

**List of Experiments:**

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine
2. Determination of Sequence Impedances of salient pole Synchronous Machine
3. LG Fault Analysis on an un loaded alternator
4. LL Fault Analysis on conventional phases
5. LLG Fault Analysis
6. LLLG Fault Analysis
7. Determination of Sub transient reactance of salient pole synchronous machine
8. Equivalent circuit of three winding transformer.
9.  $Y_{Bus}$  formation using Soft Tools
10.  $Z_{Bus}$  formation using Soft Tools
11. Gauss-Seidel load flow analysis using Soft Tools
12. Newton-Raphson load flow analysis using Soft Tools
13. Fast decoupled load flow analysis using Soft Tools
14. Solve the Swing equation and Plot the swing curve
15. Develop a model for a uncontrolled single area load frequency control problem and simulate the same using Soft Tools.
16. Develop a model for PI controlled single area load frequency control problem and simulate the same using Soft Tools.
17. Develop a model for a uncontrolled two area load frequency control problem and simulate the same using Soft Tools.
18. Develop a model for PI controlled two area load frequency control problem and simulate the same using Soft Tools.

**Online Learning Resources/Virtual Labs:**

1. <https://www.ee.iitb.ac.in/~vlabsync/template/vlab/index.html#>

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**B.Tech (EEE)– III-II Sem**

**L T P C**  
**0 0 3 1.5**

**(20A02602T) DIGITAL COMPUTING PLATFORMS LAB**

**Course Objectives:**

- Write Assembly language programming on 8086 Microprocessors
- To Interface various devices with 8086
- To develop MASAM Programming
- For Interfacing of 8051 Microcontroller with its peripheral devices.

**Course Outcomes:**

- Understand the basic concepts to write assembly language programming on 8086 Microprocessors.
- Design various device configurations and Interfacing of various devices with 8086.
- Understand the basic concepts to write programming on 8051 Microcontroller.
- Design various Interfacing circuitry with 8051 Microcontroller with its peripheral devices

**List of Experiments:**

1. Programs for 16 bit arithmetic operations for 8086 (using various addressing modes) .
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086
5. Interfacing ADC and DAC to 8086.
6. Parallel communication between two microprocessors using 8255.
7. Serial communication between two microprocessor kits using 8251.
8. Interfacing to 8086 and programming to control stepper motor.
9. Programming using arithmetic, logical and bit manipulation instructions of 8051
10. Program and verify Timer/Counter in 8051.
11. Program and verify interrupt handling in 8051.
12. UART operation in 8051.
13. Communication between 8051 kit and PC.
14. Interfacing LCD to 8051.
15. Interfacing matrix or keyboard to 8051.

**References:**

1. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3<sup>rd</sup> Edition, 2013.
2. Microprocessor and Interfacing by Douglas V Hall, 2<sup>nd</sup> Edition, Tata McGraw hill, 1992
3. Microprocessors and Microcontrollers Lab Manual: 8086 & 8051 by Srinivasa Murthy, Kindle Edition.

Online Learning Resources/Virtual Labs:

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

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**0 0 3 1.5**

**(20A04502P) DIGITAL SIGNAL PROCESSING LAB**

**Course Outcomes:**

- Implement various DSP Algorithms using software packages.
- Implement DSP algorithms with Digital Signal Processor.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth, Chebyshev filters.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.
- Analyze digital filters using Software Tools.

The Programs shall be implemented in Software (Using MATLAB / Lab View / C Programming/ Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

**List of Experiments:**

1. Generate the following standard discrete time signals.
  - i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.
  - i. Using rectangular window
  - ii. Using hamming window
  - iii. Using Kaiser window
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.
14. Compute the correlation coefficient for the two given audio signals of same length using a digital signal processor.

**Note: Any TWELVE of the experiments are to be conducted.**

**References:**

1. Digital Signal Processing: Alon V. Oppenheim, PHI
2. Digital Signal processing(II-Edition): S.K. Mitra, TMH

**Online Learning Resources/Virtual Labs:**

1. <http://vlabs.iitkgp.ac.in/dsp/#>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– III-II Sem**

**L T P C**  
**1 0 2 2**

**(20A02606) APPLICATIONS OF SOFT COMPUTING TOOLS IN ELECTRICAL  
ENGINEERING (Skill Oriented Course – IV)**

**Course Objectives:**

The objectives of this course include:

- Understand the basic concepts of Electrical Engineering.
- Apply the concepts to design MATLAB models.
- Analyse various Electrical engineering applications through MATLAB.
- Develop real time models using MATLAB.

**Course Outcomes:**

At the end of the course the student will be able to:

- Understand the basic concepts of Electrical Engineering.
- Apply the concepts to design MATLAB models.
- Analyse various Electrical engineering applications through MATLAB.
- Develop real time models using MATLAB.

**List of Experiments:**

Theory:

MATLAB-Introduction, different tool boxes, creation of program files, creation of simulink files, GUI, commonly used blocks, Simpower system toolbox, control system toolbox, Sim Drive lines, Creation of functions, Project implementation through MATLAB

**List of Experiments:**

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second order system
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using  $Z_{bus}$  matrix
11. Design of virtual PMU
12. Wide area control of Two area Kundur system

**Online Learning Resources/Virtual Labs:**

1. <http://vem-iitg.vlabs.ac.in/>
2. <https://vp-dei.vlabs.ac.in/Dreamweaver/>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (EEE)– III-II Sem** **L T P C**  
**2 0 0 0**

**(20A99601) INTELLECTUAL PROPERTY RIGHTS AND PATENTS**  
**(Mandatory Non-Credit Course)**

**Course Objectives:**

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations

**Course Outcomes:**

- Understand IPR law & Cyber law
- Discuss registration process, maintenance and litigations associated with trademarks
- Illustrate the copy right law
- Enumerate the trade secret law.

**UNIT I**

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

**UNIT II**

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law-Semiconductor Chip Protection Act.

**UNIT III**

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

**UNIT IV**

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

**UNIT V**

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

**Textbooks:**

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
2. Kompal Bansal & Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections

**References:**

1. Prabhuddha Ganguli: ‘ Intellectual Property Rights’ Tata Mc-Graw – Hill, New Delhi
2. Richard Stim: “Intellectual Property”, Cengage Learning, New Delhi.
3. R. Radha Krishnan, S. Balasubramanian: “Intellectual Property Rights”, Excel Books. New Delhi.
4. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– IV-I Sem****L T P C  
3 0 0 3****(20A02701a) POWER SYSTEM OPERATION AND CONTROL  
(Professional Elective Course – III)****Course Objectives:**

- To know about economic load dispatch problems with and without losses in Power Systems
- To distinguish between hydro-electric and thermal plants and coordination between them
- To understand about optimal power flow problems and solving using specified method
- To understand about Automatic Generation Control problems and solutions in Power Systems
- To understand necessity of reactive power control, compensation under no-load and load operation of transmission systems
- To understand about deregulation aspects in Power Systems

**Course Outcomes:**

- Understand to deal with problems in Power System as Power System Engineer
- Understand to deal with AGC problems in Power System
- Analyze the problems in hydro electric and hydro thermal problems
- Evaluate the complexity of reactive power control problems and to deal with them
- Understand the necessity of deregulation aspects and demand side management problems in the modern power system era.

**UNIT IECONOMIC OPERATION OF POWER SYSTEMS**

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

**UNIT IIHYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW**

**Hydro-thermal Coordination:** Characteristics of various types of hydro-electric plants and their models, Introduction to hydro-thermal Coordination, Scheduling energy with hydro-thermal coordination, Short-term hydro-thermal scheduling. **Optimal Power Flow:** Optimal power flow problem formulation for loss and cost minimisation, Solution of optimal power flow problem using Newton's method and Linear Programming technique – Numerical problems

**UNIT IIIAUTOMATIC GENERATION CONTROL**

Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system, Static response of two-area system – Numerical examples

**UNIT IVREACTIVE POWER CONTROL**

Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problems

**UNIT VPOWER SYSTEMS DEREGULATION**

Principle of economics, utility functions, power exchanges, electricity market models, market power indices, ancillary services, transmission and distribution charges, principles of transmission charges, transmission pricing methods, demand-side management, regulatory framework – Numerical problems

**Textbooks:**

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2<sup>nd</sup> edition, 1996.
2. Power System Engineering, D P Kothari and I J Nagrath, McGraw Hill Education India Pvt.

Limited, Chennai, 3e, 2019..

**Reference Books:**

1. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2<sup>nd</sup> edition, 1983.
2. Reactive Power Control in Electric Systems, T J E Miller, John Wiley & Sons, New York, 1982.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108104052>
2. <https://nptel.ac.in/courses/108101004>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– IV-I Sem****L T P C  
3 0 0 3****(20A02701b) SWITCHED MODE POWER CONVERTERS  
(Professional Elective Course – III)****Course Objectives:** By the end of the course, the student will be able to

- Understand basic concepts of DC-DC converters
- Understand the concepts of resonant converters and their classification, various types of multilevel inverters, power conditioners, UPS and filters.
- Apply various modulation and harmonic elimination techniques over the converters.
- Analyze the state space modelling of various types of converters.
- Design inductor and transformer for various power electronic applications.

**Course Outcomes:**

- Understand the problems and to design of various DC-DC converters, advanced converters of SMPCs
- Evaluate the performance of resonant converters
- Analyze the performance characteristics of 1- $\phi$  and 3- $\phi$  inverters with single/multi levels, power conditioners, UPS and filters
- Design various applications of the above in Power Systems, EVE, Renewable Energy Systems, etc.

**UNIT I DC-DC CONVERTERS**

Principles of step-down and step-up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and Cuk converters – Numerical Examples

**UNIT II SWITCHING MODE POWER CONVERTERS**

Analysis and state space modelling of flyback, Forward, Luo, Half bridge and full bridge converters- control circuits and PWM techniques – Numerical Examples

**UNIT III RESONANT CONVERTERS**

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control – Numerical Examples

**UNIT IV DC-AC CONVERTERS**

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

**UNIT V POWER CONDITIONERS, UPS & FILTERS**

Introduction- Power line disturbances- Power conditioners –UPS: offline UPS, Online UPS, Applications – Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

**Textbooks:**

1. Power Electronics: Essentials and Applications by L. Umanand, Wiley, 2009
2. M.H. Rashid – Power Electronics handbook, Elsevier Publication, 2001.
3. Course material on Switched Mode Power Conversion by V Ramanarayanan, Dept. of Electrical Engg. IISc. Bangalore.

**Reference Books:**

1. Philip T. Krein, “Elements of Power Electronics”, Oxford University Press, 2012
2. Ned Mohan, Tore.M.Undeland, William.P.Robbins, Power Electronics converters, Applications and design, 3<sup>rd</sup> Edition, John Wiley and Sons, 2006
3. M.H. Rashid, Power Electronics circuits, devices and applications, 3<sup>rd</sup> Edition Prentice Hall of India New Delhi, 2007.

**Online Learning Resources:** 1. <https://nptel.ac.in/courses/108108036>2. <https://nptel.ac.in/courses/108105180>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– IV-I Sem**

**L T P C**

**3 0 0 3**

**(20A02701c) ELECTRICAL & ELECTRONICS INSTRUMENTATION  
(Professional Elective Course – III)**

**Course Objectives:** The student has to acquire knowledge about:

- Measuring system, Common errors, Objectives of Measuring systems
- Test signals and modulation phenomenon, Data acquisition system, various telemetry systems and various modulation systems
- Measuring various meters and analyzers
- Basic transducers and their usage in various measurements

**Course Outcomes:**

- Understand Measuring systems, error measurements, test signals, different types of data transmission and modulation techniques
- Analyze various telemetry systems, basic operation of Data acquisition systems, measuring meters and signal analyzers
- Understand Transducers and their measurement of electrical and non-electrical quantities
- Apply the concepts to design various applications of the above

**UNIT I INSTRUMENT ERRORS**

Measuring Systems, Objectives of Measuring Instruments, definition of terms-Span & Range, Sensitivity, Threshold & Resolution, Accuracy, Precision & Reliability, Performance Characteristics - Static Characteristics, Dynamic Characteristics; Errors in Measurement – Gross Errors, Systematic Errors, Statistical evaluation of measuring data – Numerical Problems

**UNIT II DATA TRANSMISSION AND TELEMETRY**

Signals and Their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation. Methods of Data Transmission – General Telemetry System. Frequency Modulation System (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Acquisition Systems – Components of Analog DAS – Types of Multiplexing Systems: Time Division and Frequency Division Multiplexing – Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram)

**UNIT III SIGNAL ANALYZERS**

Wave Analyzers- Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers- Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters.

**UNIT IV TRANSDUCERS**

Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle Operation of Resistor, Inductor and Capacitive Transducers; LVDT and its Applications, Strain Gauge and Its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Piezo Electric Transducers, Photo electric Transducers, Hall effect, Photo Diodes.

**UNIT V MEASUREMENT OF NON-ELECTRICAL QUANTITIES**

Measurement of strain, Gauge Sensitivity, Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Vacuum, Flow, Liquid level

**Textbooks:**

1. Transducers and Instrumentation by D.V.S Murthy, Prentice Hall of India,2004.
2. A course in Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai & Co.,2012.

**Reference Books:**

1. Electronic Instrumentation-by H.S.Kalsi Tata MCGraw-Hill Edition, 3/e.,2010.
2. Modern Electronic Instrumentation and Measurement techniques – by A.DHelfrick and W.D.Cooper, Pearson/Prentice Hall of India.,1990.
3. Industrial Instrumentation – Principles and Design by T. R. Padmanabhan, Springer, 3<sup>rd</sup> re print, 2009.

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_ee112/preview](https://onlinecourses.nptel.ac.in/noc22_ee112/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– IV-I Sem**

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

**(20A02702a) ELECTRICAL DISTRIBUTION SYSTEM & AUTOMATION**  
**(Professional Elective Course – IV)**

**Course Objectives:**

- To know about fundamental aspects of distribution system, principle of distribution substations
- To know about classification of various loads
- To understand difference between conventional load flow studies of power system and distribution system load flow
- To know about evaluation of voltage droop and power loss calculations, distribution automation and management system, SCADA

**Course Outcomes:**

- Understand basics of distribution systems and substations, modelling of various loads
- Evaluation of load flow solutions in distribution system
- Evaluation of power loss and feeder cost
- Analyze the concepts of SCADA, Automation distribution system and management

**UNIT I DISTRIBUTION SYSTEM FUNDAMENTALS**

Brief description about electrical power transmission and distribution systems, Different types of distribution sub-transmission systems, Substation bus schemes, Factors effecting the substation location, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors effecting the primary feeder loading.

**UNIT II DISTRIBUTION SYSTEM SUBSTATIONS AND LOADS**

**Substations:** Rating of a distribution substation for square and hexagonal shaped distribution substation service area, K constant, Radial feeder with uniformly and non-uniformly distributed loading. **Loads:** Various types of loads, Definitions of various terms related to system loading, detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors.

**UNIT III DISTRIBUTION SYSTEM LOAD FLOW**

Exact line segment model, Modified line model, approximate line segment model, Step-Voltage Regulators, Line drop compensator, Forward/Backward sweep distribution load flow algorithm – Numerical problems

**UNIT IV VOLTAGE DROP AND POWER LOSS CALCULATION**

Analysis of non-three phase primary lines, concepts of four-wire multi-grounded common-neutral distribution system, Percent power loss calculation, Distribution feeder cost calculation methods, Capacitor installation types, types of three-phase capacitor-bank connections, Economic justification for capacitors – Numerical problems

**UNIT V DISTRIBUTION AUTOMATION**

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management, decision support applications, substation automation, control feeder automation, database structures and interfaces.

**Textbooks:**

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.

**Reference Books:**

1. Control and automation of electrical power distribution systems, James Northcote-Green and Robert Wilson, CRC Press (Taylor & Francis), New York, 2007.

**Online Learning Resources:** [https://onlinecourses.nptel.ac.in/noc22\\_ee126/preview](https://onlinecourses.nptel.ac.in/noc22_ee126/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– IV-I Sem****L T P C  
3 0 0 3****(20A02702b) FPGA BASED CONTROLLER DESIGN  
(Professional Elective Course – IV)****Course Objectives:**

- To know about FPGA architecture features and fabrics and basics of VLSI technology
- To learn about logic implementation and design aspects of FPGA
- To understand about performance analysis of sequential machines
- To learn about architectures and multi-FPGA large scale systems

**Course Outcomes:**

- Understand about features of FPGA and its fabrics
- Design of FPGA based systems and develop single and multi FPGA systems
- Apply the basic concepts to design various combinational logic gates using FPGAs
- Develop sequential logic machines and analyze the performance

**UNIT I FPGA ARCHITECTURE AND FABRICS**

Programmable Logic Devices-Types-PLA, PAL, FPGA-architectures, SRAM-based FPGAs, Permanently Programmed FPGAs, Chip I/O. Circuit Design of FPGA Fabrics. Architecture of FPGA Fabrics.

**UNIT II FPGA-BASED SYSTEMS AND VLSI TECHNOLOGY**

Introduction, Basic Concepts, Digital Design and FPGAs. FPGA-based system design. Manufacturing Processes, Deriving Transistor Characteristics, CMOS Logic Gates, Wires, Registers and RAM, Packages and Pads.

**UNIT III COMBINATIONAL LOGIC**

The Logic Design Process. Hardware Description Languages, combinational network delay. Power and energy optimization, arithmetic logic, logic implementation for FPGAs. Physical Design for FPGAs. The Logic Design Process.

**UNIT IV SEQUENTIAL MACHINES**

The sequential machine design process. Sequential design styles. Rules for Clocking. Performance Analysis. Power Optimization.

**UNIT V LARGE SCALE SYSTEMS**

Architectures and Large-Scale Systems, Behavioral Design, Design Methodologies. Design Example. Buses, Platform FPGAs, Multi-FPGA Systems, Novel Architectures.

**Textbooks:**

1. FPGA Based System Design, Wayne Wolf, Prentice Hall, 2004.
2. Modern VLSI Design, Wayne Wolf, Pearson Education 2002.

**Reference Books:**

1. Advanced Digital Design with verilog HDL, Michael D Ciletti, Pearson Education 2005
2. Verilog HDL, Samir Palnitkar, Pearson Education 2005.
3. A Verilog HDL Primer, J Bhaskar, 2nd edition, B S Publications, 2007.
4. VHDL for Programmable Logic, Kevin Skahill Pearson Education, 2004

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/117108040>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– IV-I Sem****L T P C  
3 0 0 3****(20A02702c) INTELLIGENT CONTROL TECHNIQUES  
(Professional Elective Course – IV)****Course Objectives:**

- To get exposed to a few Intelligent Control Techniques
- To learn about Artificial Neural Network based Estimators
- To learn about Fuzzy Logic Control System as one of the ICT
- To learn about a few evolutionary algorithms, implement the various ICTs for linear and non-linear systems as case studies

**Course Outcomes:**

- Understand various Intelligent Control Techniques
- Design the controllers and estimators using ANN and Fuzzy Logic
- Apply Evolutionary algorithms suitable to optimize and design a given system specifications
- Designing of various ICTs for system modeling, control schemes and to design estimators using MATLAB tool boxes

**UNIT I FUNDAMENTALS OF AI**

AI trend in Engineering applications, Need for AI, Approaches to intelligent control; Architectures for intelligent control; Symbolic reasoning system; rule-based systems; Knowledge representation; Expert systems.

**UNIT II ANN BASED CONTROLLERS AND ESTIMATORS**

Concept of Artificial Neural Networks and its basic mathematical model; McCulloch-Pitts neuron model; Learning and Training the neural network-Supervised and unsupervised learning concepts, simple perceptron; Adaline and Madaline; Feed-forward Multilayer Perceptron – Back Propagation algorithm; BAM networks, Self-organizing network and Recurrent network; Neural Network based controllers and estimators design.

**UNIT III FUZZY LOGIC CONTROL SYSTEM**

Motivation and basic definitions; Crisp sets, Fuzzy sets, difference between crisp and fuzzy sets, Fuzzy properties, operations and relations; Fuzzy logic system and its components; Membership functions and methods for assignment of membership function values, Fuzzy knowledge and rule bases; Fuzzy modelling and control schemes for linear and nonlinear systems; Fuzzy estimators.

**UNIT IV EVOLUTIONARY ALGORITHMS**

Genetic Algorithm: Introduction - basic concepts, application, Adaptive Neuro-fuzzy Inference System (ANFIS), Neuro-Genetic, Fuzzy-Genetic systems. Ant colony optimization, Particle swarm optimization (PSO) – basic concepts and design procedures.

**UNIT V CASE STUDIES**

Identification and control of linear and nonlinear dynamic systems using Neural Networks, Power System Load Flow using Back Propagation algorithm; Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Single area Load Frequency Control using Fuzzy Logic; optimization for controller design in case of constrained and unconstrained optimization issues, Economic Load Dispatch using Genetic Algorithm/PSO.

**Textbooks:**

1. Jacek. M. Zurada; "Introduction to Artificial Neural Systems", Jaico Publishing House, 1<sup>st</sup> Edition, 1994
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3<sup>rd</sup> Edition, WILEY Publications, 2011
3. S.N. Sivanandam and S.N. Deepa, Introduction to Genetic Algorithms, Springer Publications, 2008

**Reference Books:**

1. J.S.R. Jang, C.T.Sun and E. Mizutami, “Neuro-Fuzzy & Soft Computing”, Pearson India Education Services Pvt. Ltd.
2. LaurereFauselt, “Fundamentals of Neural Networks”, Pearson India Education Services Pvt. Ltd.
3. Padhy.N.P.; “Artificial Intelligence and Intelligent Systems”; Oxford University Press, 2005

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108104049>
2. <https://nptel.ac.in/courses/112103301>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– IV-I Sem****L T P C  
3 0 0 3****(20A02703a) PROGRAMMABLE LOGIC CONTROLLERS  
(Professional Elective Course – V)****Course Objectives:**

- The student will be able to:
- Understand the basic functions and types of PLCs, Easy Veep software, its applications
- Understand Classification of PLCs and applications
- Design PLC Programming for various applications
- Analyze PLC Troubleshooting aspects

**Course Outcomes:**

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

- Understand different types of PLCs, Its classification and the usage of Easy Veep software
- Analyze the hardware details of Allen Bradley PLC
- Design PLC Programming for various applications
- Apply PLC programming concepts in different fields of Science and Technology

**UNIT I INTRODUCTION TO PLCs**

Introduction:

Basic functions of PLCs, Mechanical relays versus PLC, Different types of PLC's – Allen-Bradley – Micrologix: ML1000, ML1100, SLC500, Compact Logix, Mitsubishi FX series, HMI's, Processor and I/O cards

**UNIT II PLC COMPUTATIONAL TOOL**

Introduction to Easy Veep software, Link between mechanical, electrical and programming documentation, Logic diagrams, Flip-Flop Logic, M8000, M8001 internal bits interpretation, Binary code, data table, manipulation and search engine in Mitsubishi environment Communication between PC and PLC, Communication between PC and HMI, PLC and HMI Serial Local network, Introduction to SLC500

**UNIT III PLC DEVELOPMENT**

PLC software and applications, Boolean algebra – understanding binary code, ADD and SUB functions, UP and Down Counters, Introduction to k1Y0, MOV function, CPR and ZCP functions, SHWT and SHRD instructions, Introduction to Absolutely Drum Instruction.

Allen Bradley PLC: Introduction to Rockwell Software, Hardware focus, Hardware considerations (Field wiring, Master Control Relay, VFD), Basic programming and applications, Cascade control – subroutine, Different programs.

**UNIT IV PLC PROGRAMMING**

Programming instructions: Instructions and binary interpretation, Bit Instruction, Timers and counters, Comparison instructions, Programming Instructions - Math instructions, Move and Logical Instructions, Discussions of programming, communications for PLC-Robotic arm, Exercise of setup and monitoring.

**UNIT V APPLICATIONS**

Analog and Digital parameters by using SLC5/03-VFD-Panel Mate series 1700, Practical Troubleshooting, troubleshooting technique, Control system stability and tuning basics. Applications: Process to rewind, test, and integrate with extrusion process for wiring and fibre optic industries, Food industry – yeast, flour distribution and control. Process Medical equipment Industry – Gas analyzer, Leak tester (using CO<sub>2</sub>), plastic wrapping machines etc.

**Textbooks:**

1. Automating manufacturing systems with PLCs by Hugh Jack, 2010.
2. PLC Hand Book (Automationdirect Siemens)

**Reference Books:**

1. Programmable Logic Controllers by R. Bliesener, F Ebel, Festo. Didactic publishers, 2002.
2. Programmable Logic Controllers by W. Bolton, 4<sup>th</sup> Edition, Newnes, 2006.
3. Introduction to PLCs by Jay F. Hooper, 2<sup>nd</sup> Edition, Carolina Academic Press, 2006.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108105088>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)– IV-I Sem****L T P C  
3 0 0 3****(20A04403T) LINEAR& DIGITAL IC APPLICATIONS  
(Professional Elective Course – V)****Course Objectives:**

- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of PLL.
- To introduce the concepts of waveform generation and introduce some special function ICs.
- Exposure to digital IC's

**Course Outcomes (CO):**

- List out the characteristics of Linear and Digital ICs.
- Discuss the various applications of linear & Digital ICs.
- Solve the application-based problems related to linear and digital ICs.
- Analyze various applications based circuits of linear and digital ICs.
- Design the circuits using either linear ICs or Digital ICs from the given specifications.

**UNIT – I ICs and OP- AMPS**

**INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER:** Introduction, Classification of IC's, IC chip size and circuit complexity, basic information of Op-Amp IC741 Op-Amp and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC.

**UNIT – II Applications of OP- AMP**

**LINEAR APPLICATIONS OF OP-AMP:** Inverting and non-inverting amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator and differentiator.  
**NON-LINEAR APPLICATIONS OF OP-AMP:** Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators, Oscillators

**UNIT - III Active Filters and other ICs**

**ACTIVE FILTERS:** Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

**TIMER AND PHASE LOCKED LOOPS:** Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL.

**UNIT – IV Voltage Regulators and Converters**

**VOLTAGE REGULATOR:** Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

**D to A AND A to D CONVERTERS:** Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

**UNIT - V Digital ICs**

**CMOS LOGIC:** CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.

**COMBINATIONAL CIRCUITS USING TTL 74XX ICS:** Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC74138, IC 74154), BCD-to-7-segment decoder (IC 7447), Encoder (IC 74147), Multiplexer (IC 74151), Demultiplexer (IC74154).

**SEQUENTIAL CIRCUITS USING TTL 74XX ICS:** Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).

**Textbooks:**

1. D. Roy Choudhury, Shail B. Jain, "Linear Integrated Circuit", 4th edition (2012), New Age International Pvt.Ltd., New Delhi, India
2. Ramakant A. Gayakwad, "OP-AMP and Linear Integrated Circuits", 4th edition (2012), Prentice Hall / Pearson Education, New Delhi.
3. Floyd, Jain, "Digital Fundamentals", 8th edition (2009), Pearson Education, New Delhi.

**References:**

1. Sergio Franco (1997), Design with operational amplifiers and analog integrated circuits, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108108111>
2. <https://nptel.ac.in/courses/108106069>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

B.Tech (EEE)– IV-I Sem

L T P C

3 0 0 3

**(20A02703c) ELECTRIC VEHICLE TECHNOLOGIES****(Professional Elective Course – V)****Course Objectives:**

- Understand the concepts of electric vehicles, hybrid electric vehicles and their impact on environment
- Analyze the drive-train topologies and advanced propulsion techniques
- Analyze hybrid energy storage methodologies
- Design suitable power converter topologies for motor control and hybrid energy storage

**Course Outcomes:**

- Understand the concepts of electric vehicles, hybrid electric vehicles and their impact on environment
- Analyze the drive-train topologies and advanced propulsion techniques
- Analyze hybrid energy storage methodologies
- Design suitable power converter topologies for motor control and hybrid energy storage

**UNIT I INTRODUCTION**

Conventional vehicle, basics of vehicle performance, History of electric vehicles, social and environmental importance of electric vehicles, impact of modern drive-trains on energy supplies.

**UNIT II HYBRID ELECTRIC VEHICLES**

Micro hybrid vehicles, mild hybrid vehicles, full hybrid vehicles, Parallel hybrid vehicles, series Hybrid Vehicles, Series-Parallel Hybrid vehicles ,plug-in hybrid vehicles, power flow diagrams for various operating modes. Plug-in Hybrid Vehicles: Operating principle, architectures: series-parallel-series-parallel, challenges related to grid connection. Range-extended Electric Vehicles: Classification and configurations, Fuel Cell Electric Vehicles, Solar electric Vehicles, Electric Bicycles and their propulsion systems, Vehicle-to-grid, vehicle to-home concepts, Concept of Hybrid Electric Vehicles.

**UNIT III ELECTRIC DRIVE-TRAINS & PROPULSION UNIT**

Electric drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis

Electric propulsion unit: Electric components used in electric vehicles, Configuration and control of DC Motor drives, Induction Motor drives, Permanent Magnet Motor drives, Switch Reluctance Motor drives, Drive system efficiency.

**UNIT IV ENERGY STORAGE**

Storage requirements for Electric Vehicles, Battery based energy storage, Fuel Cell based energy storage, Super Capacitor based energy storage and their analysis. Power pack management systems, Cell balancing techniques, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices, compressed air storage systems, super conducting magnetic storage systems and Energy management systems.

**UNIT V CONVERTERS FOR HYBRID ENERGY STORAGE SYSTEMS**

Converter configurations for hybrid energy systems based on Battery and Ultra Capacitors-cascaded converter, multiple parallel-connected converter, dual-active-bridge converter, multiple-input converter,- multiple modes single converter, interleaved converter, switched capacitor converter, converters for coupled inductor based hybridization. Fundamentals of Chargers: Charger classifications and standards, selection of AC charging systems, DC charging systems, Converter topologies for charging, wireless chargers.

**Textbooks:**

1. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, Taylor & Francis Group 2015.
2. Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Hussein, CRC Press, 2003, 2nd Edition.

**Reference Books:**

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, CRC Press, 2005.
2. Electric Vehicle Technology Explained, James Larminie, John Lowry, Wiley, 2003.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108/106/108106170/>
2. <https://nptel.ac.in/courses/108/102/108102121/>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– IV-I Sem**

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

**20A52701a) ENTREPRENEURSHIP & INCUBATION  
(HUMANITIES ELECTIVE II)**

**Course Objectives:**

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

**Course Outcomes:**

- Understand the concept of Entrepreneurship and challenges in the world of competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
- Evaluate the role of central government and state government in promoting Entrepreneurship.
- Create and design business plan structure through incubations.

**UNIT I**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**UNIT II**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

**UNIT III**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

**UNIT IV**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

**UNIT V**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

**Textbooks:**

1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : [login.cengage.com](http://login.cengage.com))
2. Nandan H, “Fundamentals of Entrepreneurship”, PHI, 2013

**References:**

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2<sup>nd</sup> Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwanal “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

**E-Resources**

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. <http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship>
3. [http://nptel.ac.in/courses/122106032/Pdf/7\\_4.pdf](http://nptel.ac.in/courses/122106032/Pdf/7_4.pdf)
4. <http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (CE)– III-II Sem**

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

**(20A52701b) MANAGEMENT SCIENCE**  
**(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

**Course Outcomes:**

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

**UNIT I INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

**UNIT II OPERATIONS MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

**UNIT III HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

**UNIT IV STRATEGIC & PROJECT MANAGEMENT**

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

**UNIT V CONTEMPORARY ISSUES IN MANAGEMENT**

The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

**Textbooks:**

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

**References:**

1. Koontz & Wehrich, "Essentials of Management", 6<sup>th</sup> edition, TMH, 2005.
2. Thomas N. Duening & John M. Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.
4. Samuel C. Certo, "Modern Management", 9<sup>th</sup> edition, PHI, 2005

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (CE)– III-II Sem**

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**(20A52701c) ENTERPRISE RESOURCE PLANNING**  
**(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

- To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning
- To enable the students in knowing the Advantages of ERP
- To train the students to develop the basic understanding of how ERP enriches the Business organizations in achieving a multidimensional growth.
- Impart knowledge about the historical background of BPR
- To aim at preparing the students, technologically competitive and make them ready to self-upgrade with the higher technical skills.

**Course Outcomes:**

- Understand the basic use of ERP Package and its role in integrating business functions.
- Explain the challenges of ERP system in the organization
- Apply the knowledge in implementing ERP system for business
- Evaluate the role of IT in taking decisions with MIS
- Create reengineered business processes with process redesign

**UNIT I**

Introduction to ERP: Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM),

**UNIT II**

Benefits of ERP: Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design-making Capability

**UNIT III**

ERP Implementation Lifecycle: Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

**UNIT IV**

BPR: Historical background: Nature, significance and rationale of business process reengineering (BPR), Fundamentals of BPR. Major issues in process redesign: Business vision and process objectives, Processes to be redesigned, Measuring existing processes,

**UNIT V**

IT in ERP: Role of information technology (IT) and identifying IT levers. Designing and building a prototype of the new process: BPR phases, Relationship between BPR phases. MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System.

**Textbooks:**

1. Pankaj Sharma. “Enterprise Resource Planning”. Aph Publishing Corporation, New Delhi, 2004.
2. Alexis Leon, “Enterprise Resource Planning”, IV Edition, Mc.Graw Hill, 2019

**References:**

1. Marianne Bradford “Modern ERP”, 3rd edition.
2. “ERP making it happen Thomas f. Wallace and Michael
3. Directing the ERP Implementation Michael w pelphrey

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)– IV-I Sem**

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**(20A02706) ENERGY CONSERVATION AND AUDIT**  
**(Skill Oriented Course – V)**

**Course Objectives:**

The following industry relevant skills of the competency ‘Undertake energy conservation and energy audit’ are expected to be developed in the students by undertaking

- Identification of energy losses and opportunities of energy conservation.
- Implementation of energy conservation technique.
- Apply energy conservation techniques in electrical installations.
- Use Co-generation and relevant tariff for reducing losses in facilities.
- Carryout energy audit for electrical system.

**Course Outcomes:**

At the end of the course the student will be able to:

- Understand energy conservation policies in India.
- Design energy conservation techniques in electrical machines.
- Apply energy conservation techniques in electrical installations, Co-generation and relevant tariff for reducing losses in facilities.
- Design and analyze energy audit for electrical system.

**List of Experiments:**

Theory:

Different types of Electrical apparatus, ratings, units, Loads, efficiency calculations, power consumption calculations, improvement of p.f., lightening, fans, electricity tariff, need for energy saving, energy audit questionnaire

**List of Experiments:**

1. Analyze star labeled electrical apparatus and compare the data sheet (Pamphlet) of various star ratings.
2. Determine the ‘% loading’ and the related efficiency of given Induction motor at different loading
3. Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode at no load/ light loads.
4. Use APFC / PFC unit for improvement of p. f. of electrical load.
5. Compare power consumption of (Fluorescent and LED) lighting
6. Determine Net Energy Saving by Lamp replacements.
7. Determine Energy conservation in Fan by using Electronic Regulator
8. Analysis of electric bill based on tariff of Industrial consumer to reduce energy usage and electric bill
9. To analyze the energy bill of a commercial consumer and to suggest (if needed) suitable tariff to achieve energy conservation and reduction in energy bill
10. To interpret the energy bill of a residential consumer, suggest suitable tariff to achieve energy conservation and reduction in energy bill.
11. Estimate energy saving by improving power factor and load factor for given cases.
12. Prepare a sample energy audit questionnaire for the given industrial facility.
13. Prepare an energy audit report
14. Determination of rating of Inverter capacity for household applications

**References:**

1. Guide Books no. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors
2. Energy Management and Conservation By Sharma, K. V., Venkateshaiah P

**Online Learning Resources/Virtual Labs:**

1. <https://nptel.ac.in/courses/108106022>

# OPEN ELECTIVES

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**

**(20A01505) BUILDING TECHNOLOGY**  
**(Open Elective-I)**

**Course Objectives:**

- To know different types of buildings, principles and planning of the buildings.
- To identify the termite control measure in buildings, and importance of grouping circulation, lighting and ventilation aspects in buildings.
- To know the different modes of vertical transportation in buildings.
- To know the utilization of prefabricated structural elements in buildings.
- To know the importance of acoustics in planning and designing of buildings.

**Course Outcomes (CO):**

- Understand the principles in planning and design the buildings
- To get different types of buildings, principles and planning of the buildings
- To know the different methods of termite proofing in buildings.
- Know the different methods of vertical transportation in buildings.
- Know the implementation of prefabricated units in buildings and effect of earthquake on buildings.
- Know the importance of acoustics in planning and designing of buildings.

**UNIT I**

Overview of the course, basic definitions, buildings-types-components-economy and design-principles of planning of buildings and their importance. Definitions and importance of grouping and circulation-lighting and ventilation-consideration of the above aspects during planning of building.

**UNIT II**

Termite proofing: Inspection-control measures and precautions-lighting protection of buildings-general principles of design of openings-various types of fire protection measures to be considered while planning a building.

**UNIT III**

Vertical transportation in a building: Types of vertical transportation-stairs-different forms of stairs-planning of stairs-other modes of vertical transportation –lifts-ramps-escalators.

**UNIT IV**

Prefabrication systems in residential buildings-walls-openings-cupboards-shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, principles, seismic forces and their effect on buildings.

**UNIT V**

Acoustics –effect of noise –properties of noise and its measurements, principles of acoustics of building. Sound insulation-importance and measures.

**Textbooks:**

1. Building construction by Varghese, PHI Learning Private Limited 2<sup>nd</sup> Edition 2015
2. Building construction by Punmia.B.C, Jain.A.K and Jain.A.K Laxmi Publications 11<sup>th</sup> edition 2016

**Reference Books:**

1. National Building Code of India, Bureau of Indian Standards
  2. Building construction-Technical teachers training institute, Madras, Tata McGraw Hill.
  3. Building construction by S.P.Arora and S.P.BrndraDhanpat Rai and Sons Publications, New Delh 2014 edition
- <https://nptel.ac.in/courses/105102206>  
<https://nptel.ac.in/courses/105103206>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech III-I Sem**

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

**(20A03505) 3D PRINTING TECHNOLOGY**  
**(Open Elective-I)**

**Course Objectives:**

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.
- Train Various Pre – Processing, Processing and Post Processing errors in RP Processes.

**Course Outcomes:**

- Use techniques for processing of CAD models for rapid prototyping.
- Understand and apply fundamentals of rapid prototyping techniques.
- Use appropriate tooling for rapid prototyping process.
- Use rapid prototyping techniques for reverse engineering.
- Identify Various Pre – Processing, Processing and Post Processing errors in RP processes.

**UNIT I Introduction to 3D Printing**

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

**UNIT II Solid and Liquid Based RP Systems**

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

**UNIT III Powder Based & Other RP Systems**

**Powder Based RP Systems:** Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).

**Other RP Systems:** Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

**UNIT IV Rapid Tooling & Reverse Engineering**

**Rapid Tooling:** Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

**Reverse Engineering (RE):** Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

**UNIT V Errors in 3D Printing and Applications:**

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc.

**Software:** Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

**Applications:** Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

**Textbooks:**

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer, 2/e, 2010.

**Reference Books:**

1. Frank W.Liou, "Rapid Prototyping & Engineering Applications", CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley&Sons, 2006.

**Online Learning Resources:**

- NPTEL Course on Rapid Manufacturing.
- <https://nptel.ac.in/courses/112/104/112104265/>
- <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
- <https://slideplayer.com/slide/6927137/>
- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- [https://www.cet.edu.in/noticefiles/258\\_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf](https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf)
- [https://www.vssut.ac.in/lecture\\_notes/lecture1517967201.pdf](https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf)
- <https://www.youtube.com/watch?v=NkC8TNts4B4>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech III-I Sem**

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

**(20A04506) PRINCIPLES OF COMMUNICATION SYSTEMS**

**Course Objectives:**

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

**Course Outcomes:**

- Understand the concept of various modulation schemes and multiplexing
- Apply the concept of various modulation schemes to solve engineering problems
- Analyse various modulation schemes, and evaluate various modulation scheme in real time applications

**UNIT I Amplitude Modulation**

Introduction to Noise and Fourier Transform. An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

**UNIT II Angle Modulation**

Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

**UNIT III Pulse Modulation**

Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

**UNIT IV Digital Modulation**

Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

**UNIT V Communication Systems**

Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

**Textbooks:**

1. Herbert Taub, Donald L Schilling and Goutam Saha, "Principles of Communication Systems", 3<sup>rd</sup>Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

**References:**

1. B. P. Lathi, Zhi Ding and Hari M. Gupta, "Modern Digital and Analog Communication Systems", 4<sup>th</sup> Edition, Oxford University Press, 2017.
2. K. Sam Shanmugam "Digital and Analog Communication Systems", Wiley India Edition, 2008.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech III-I Sem**

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

**(20A05505a) JAVA PROGRAMMING**  
**(Open Elective Course – I)**

**Course Objectives:**

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

**Course Outcomes:**

- Solve real-world problems using OOP techniques.
- Apply code reusability through inheritance, packages and interfaces
- Solve problems using java collection framework and I/O classes.
- Develop applications by using parallel streams for better performance and develop applets for web applications.
- Build GUIs and handle events generated by user interactions and Use the JDBC API to access the database.

**UNIT I Introduction**

Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods

**UNIT II Inheritance, Packages, Interfaces**

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, Finding packages and CLASSPATH, Access Protection, Importing packages.

Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

**UNIT III Exception handling, Stream based I/O**

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

**UNIT IV Multithreading, The Collections Framework**

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes-Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

**UNIT V Applet, GUI Programming with Swings, Accessing Databases with JDBC**

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenutem,

creating a main menu, show message dialog, show confirmdialog, show input dialog, show option dialog, jdialog, create a modeless dialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

**Textbooks:**

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

**Reference Books:**

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java, P. Radha Krishna, University Press.
6. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
7. Java Programming and Object-oriented Application Development, R.A. Johnson, Cengage Learning.

**Online Learning Resources:**

[https://www.w3schools.com/java/java\\_oop.asp](https://www.w3schools.com/java/java_oop.asp)

<http://peterindia.net/JavaFiles.html>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-I Sem** **L T P C**  
**3 0 0 3**  
**(20A05502T) ARTIFICIAL INTELLIGENCE**  
**Open Elective Course - I**

**Course Objectives:**

This course is designed to:

- Introduce Artificial Intelligence
- Teach about the machine learning environment
- Present the searching Technique for Problem Solving
- Introduce Natural Language Processing and Robotics

**Course Outcomes:**

After completion of the course, students will be able to

- Apply searching techniques for solving a problem
- Design Intelligent Agents
- Develop Natural Language Interface for Machines
- Design mini robots
- Summarize past, present and future of Artificial Intelligence

**UNIT I Introduction** Lecture 9Hrs

**Introduction:** What is AI, Foundations of AI, History of AI, The State of Art.

**Intelligent Agents:** Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

**UNIT II Solving Problems by searching** Lecture 9 Hrs

Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

**UNIT III Reinforcement Learning & Natural Language Processing** Lecture 8Hrs

**Reinforcement Learning:** Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL

**Natural Language Processing:** Language Models, Text Classification, Information Retrieval, Information Extraction.

**UNIT IV Natural Language for Communication** Lecture 8 Hrs

**Natural Language for Communication:** Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition

**Perception:** Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

**UNIT V Robotics** Lecture 10Hrs

**Robotics:** Introduction, Robot Hardware, Robotic Perception, planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains

**Philosophical foundations:** Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

**Textbooks:**

1. Stuart J.Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3<sup>rd</sup> Edition, Pearson Education, 2019.

**Reference Books:**

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.

**Online Learning Resources:**

<http://peterindia.net/AILinks.html>

<http://nptel.ac.in/courses/106106139/>

<https://nptel.ac.in/courses/106/105/106105152/>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech III-I Sem**

**L T P C**

**3 0 0 3**

**(20A12502) MOBILE APPLICATION DEVELOPMENT USING ANDROID**

**(Open Elective-I)**

**Course Objectives:**

- Facilitate students to understand android SDK.
- Help students to gain a basic understanding of Android application development.
- Inculcate working knowledge of Android Studio development tool.

**Course Outcomes:**

- Identify various concepts of mobile programming that make it unique from programming for other platforms.
- Evaluate mobile applications on their design pros and cons.
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- Develop mobile applications for the Android operating system that use basic and advanced phone features.
- Demonstrate the deployment of applications to the Android marketplace for distribution.

**UNIT I Introduction and Mobile User Interface Design**

Introduction to Android: The Android Platform, Android SDK, Android Studio Installation, Android Installation, building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

**UNIT II Activities, Intents and Android User Interface**

Android Application Design Essentials: Anatomy of an Android application, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions

**UNIT III Advanced User Interface and Data Persistence**

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

**UNIT IV Android Services, Publishing Android Applications**

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

**UNIT V Android Databases**

Using Common Android APIs: Using Android Data and Storage APIs, managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

**Textbooks:**

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011).
2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development," Wiley India, First Edition, 2012.

**Reference Books:**

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

**Online Learning Resources:**

1. <https://developer.android.com/>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-I Sem**

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**3 0 0 3**

**(20A27505) COMPUTER APPLICATIONS IN FOOD TECHNOLOGY**  
**(Open Elective-1)**

**Course Objectives:**

- To know different software and applications in food technology.
- To understand the Chemical kinetics in food processing, Microbial distraction in thermal processing of food.
- To acquire knowledge on computer aided manufacturing and control of food machinery, inventory control, process control.

**Course Outcomes:**

- Students will gain knowledge on software in food technology, data analysis, Chemical kinetics, microbial distortion in thermal process
- Use of linear regression in analyzing sensory data, application of computer in some common food industries like, milk plant, bakery units & fruits vegetable plants.

**UNIT I**

Introduction to various software and their applications in food technology. Application of MS Excel to solve the problems of Food Technology, SPSS and JMP for data analysis, Pro-Engineering for design, Lab VIEW and SCADA for process control .

**UNIT II**

Chemical kinetics in food processing: Determining rate constant of zero order reaction First order rate constant and half-life of reactions. Determining energy of activation of vitamin degradation during food storage Rates of Enzymes catalyzed reaction. Microbial distraction in thermal processing of food. Determining decimal reduction time from microbial survival data, Thermal resistance factor, Z-values in thermal processing of food. Sampling to ensure that a lot is not contaminated with more than a given percentage Statistical quality control. Probability of occurrence in normal distribution. Using binomial distribution to determine probability of occurrence. Probability of defective items in a sample obtained from large lot

**UNIT III**

Sensory evaluation of food Statistical descriptors of a population estimated from sensory data obtained from a sample Analysis of variance. One factor, completely randomized design For two factor design without replication. Use of linear regression in analyzing sensory data. Mechanical transport of liquid food. Measuring viscosity of liquid food using a capillary tube viscometer . Solving simultaneous equations in designing multiple effect evaporator while using matrix algebra available in excel.

**UNIT IV**

Familiarization with the application of computer in some common food industries like, milk plant, bakery units & fruits vegetable plants, stating from the receiving of raw material up to the storage & dispatch of finished product.

**UNIT V**

Basic Introduction to computer aided manufacturing. Application of computers, instrumentation and control of food machinery, inventory control, process control etc.

**Recommended books:**

1. Computer Applications in Food Technology: Use of Spreadsheets in Graphical, Statistical and Process Analysis by R. Paul Singh, AP.
2. Manuals of MS Office.

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**(20A54501) OPTIMIZATION TECHNIQUES**  
**(Open Elective- I)**

**Course Objectives:**

This course enables the students to classify and formulate real-life problem for modeling as optimization problem, solving and applying for decision making.

**Course Outcomes:** Student will be able to

- formulate a linear programming problem and solve it by various methods.
- give an optimal solution in assignment jobs, give transportation of items from sources to destinations.
- identify strategies in a game for optimal profit.
- implement project planning.

**UNIT I**

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.

**UNIT II**

Transportation problems- assignment problems-Game theory.

**UNIT III**

CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations.

**UNIT IV**

Sequencing Problems-Replacement problems-Capital equipment- Discounting costs- Group replacement.

**UNIT V**

Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models- Single period inventory models with shortage cost.

**Textbooks:**

1. Operations Research , S.D. Sharma.
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
3. Operations Research, Nita H Shah, Ravi M Gor, Hardik Soni, PHI publishers

**Reference Books:**

1. Problems on Operations Research, Er. Prem kumargupta, Dr.D.S. Hira, Chand publishers
2. Operations Research, CB Gupta, PK Dwivedi, Sunil kumaryadav

**Online Learning Resources:**

[https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module\\_1/M1L2slides.pdf](https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L2slides.pdf)  
<https://slideplayer.com/slide/7790901/>  
<https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf>

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## (20A56501) MATERIALS CHARACTERIZATION TECHNIQUES

(Open Elective- I)

**Course Objectives:**

- To provide an exposure to different characterization techniques.
- To enlighten the basic principles and analysis of different spectroscopic techniques.
- To explain the basic principle of Scanning electron microscope along with its limitations and applications.
- To identify the Resolving power and Magnification of Transmission electron microscope and its applications.
- To educate the uses of advanced electric and magnetic instruments for characterization.

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

- To explain the structural analysis by X-ray diffraction.
- To understand the morphology of different materials using SEM and TEM.
- To recognize basic principles of various spectroscopic techniques.
- To study the electric and magnetic properties of the materials.
- To make out which technique can be used to analyse a material

**UNIT I**

Structure analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

**UNIT II**

Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

**UNIT III**

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

**UNIT IV**

Spectroscopy techniques – Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

**UNIT V**

Electrical & Magnetic Characterization techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

**Textbooks:**

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Handbook of Materials Characterization -by Sharma S. K. - Springer

**References:**

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall, 2001
3. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods-[Yang Leng](#)- John Wiley & Sons
4. Characterization of Materials 2<sup>nd</sup> Edition, 3 Volumes-Kaufmann E N -John Wiley (Bp)

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(20A51501) CHEMISTRY OF ENERGY MATERIALS

(Open Elective- I)

**Course Objectives:**

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
- Necessity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

**Course Outcomes:**

- Ability to perform simultaneous material and energy balances.
- Student learn about various electrochemical and energy systems
- Knowledge of solid, liquid and gaseous fuels
- To know the energy demand of world, nation and available resources to fulfill the demand
- To know about the conventional energy resources and their effective utilization
- To acquire the knowledge of modern energy conversion technologies
- To be able to understand and perform the various characterization techniques of fuels
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively

**UNIT I: Electrochemical Systems:** Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batteries.

**UNIT II: Fuel Cells:** Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell,.

**UNIT III: Hydrogen Storage:** Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogen storage by high pressure methods. Liquification method.

**UNIT IV: Solar Energy:** Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells.

**UNIT V: Photo and Photo electrochemical Conversions:** Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

**References:**

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins
4. Fuel Cell Hand Book 7<sup>th</sup> Edition, by US Department of Energy (EG&G technical services and corporation)
5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff

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**(20A01605) ENVIRONMENTAL ECONOMICS  
(Open Elective Course - II)**

**Course Objectives:**

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

**Course Outcomes :**

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

- The information on sustainable development and economics of energy
- The information regarding environmental degradation and economic analysis of degradation
- The identification of economics of pollution and their management
- The cost benefit analysis of environmental resources
- The principles of economics of biodiversity

**UNIT I**

Sustainable Development: Introduction to sustainable development - Economy-Environment inter-linkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy – Nonrenewable energy, scarcity, optimal resources, backstop technology, property research, externalities, and the conversion of uncertainty.

**UNIT II**

Environmental Degradation: Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

**UNIT - III**

Economics of Pollution: Economics of Pollution - Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

**UNIT IV**

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

**UNIT V**

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

**Textbooks:**

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

**Reference Books:**

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaf, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),
3. Environmental and Resource Economics: An Introduction by Michael S. Common and Michael Stuart 2<sup>nd</sup>Edition, Harlow: Longman.(1996),
4. Natural Resource and Environmental Economics by Roger Perman, Michael Common, Yue Ma and James Mc Gilvray 3<sup>rd</sup>Edition, Pearson Education.(2003),

**Online Learning Resources:**

<https://nptel.ac.in/courses/109107171>

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B.Tech IV-I Sem

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## (20A03605c) INTRODCUTION TO ROBOTICS

(Open Elective-II)

**Course Objectives:**

- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system

**Course Outcomes:**

After completing the course, the student will be able to,

- Explain fundamentals of Robots
- Apply kinematics and differential motions and velocities
- Demonstrate control of manipulators
- Understand robot vision
- Develop robot cell design and programming

**UNIT I** Fundamentals of Robots

Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

**UNIT II** Kinematics, Differential motions and velocities of robot

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, the inverse kinematic of robots, degeneracy and dexterity, simple problems with D-H representation.

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

**UNIT III** Control of Manipulators

Open- and close-loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

**UNIT IV** Robot Vision

Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

**UNIT V** Robot Cell Design and Programming

Robot cell layouts-Robot centred cell, In-line robot cell, considerations in work cell design, work cell control, interlocks, error detection, work cell controller. methods of robot programming, WAIT, SIGNAL, and DELAY commands, Robotic languages, VAL system.

**Textbooks:**

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, Industrial Robotics — Mc Graw Hill, 1986.
2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.

**References:**

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley- Interscience, 1986.
3. Robert J. Schillin, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.

**Online Learning Resources:**

<https://nptel.ac.in/courses/108105088>

<https://nptel.ac.in/courses/108105063>

<https://nptel.ac.in/courses/108105062>

<https://nptel.ac.in/courses/112104288>

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech III-I Sem

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## (20A04606) BASIC VLSI DESIGN

**Course Objectives:**

- Understand the fundamental aspects of circuits in silicon
- Relate to VLSI design processes and design rules

**Course Outcomes:**

- Identify the CMOS layout levels, and the design layers used in the process sequence.
- Describe the general steps required for processing of CMOS integrated circuits.
- Design static CMOS combinational and sequential logic at the transistor level.
- Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic, etc.
- Interpret the need for testability and testing methods in VLSI.

**UNIT I**

Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, pwell processes, BiCMOS, Comparison of bipolar and CMOS. Basic Electrical Properties of MOS And BiCMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, trans conductance.

**UNIT II**

Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio: nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up. Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, BiCMOS drivers.

**UNIT III**

MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style Design rules and layout & Scaling of MOS Circuits:  $\lambda$  - based design rules, scaling factors for device parameters

**UNIT IV**

Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS Examples of structured design: Parity generator, Bus arbitration, multiplexers, logic function block, code converter.

**UNIT V**

Subsystem Design and Layout-2: Clocked sequential circuits, dynamic shift registers, bus lines, General considerations, 4-bit arithmetic processes, 4-bit shifter, Regularity Definition & Computation Practical aspects and testability: Some thoughts of performance, optimization and CAD tools for design and simulation.

**Textbooks:**

1. "Basic VLSI Design", Douglas A Pucknell, Kamran Eshraghian, 3 rd Edition, Prentice Hall of India publication, 2005.

**References:**

1. "CMOS Digital Integrated Circuits, Analysis And Design", Sung – Mo (Steve) Kang, Yusuf Leblebici, Tata McGraw Hill, 3 rd Edition, 2003.
2. VLSI Technology", S.M. Sze, 2nd edition, Tata McGraw Hill, 2003

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**(20A04701b) INTRODUCTION TO INTERNET OF THINGS**

**(Open Elective Course-II)**

**Course Objectives:**

Students will understand the concepts of Internet of Things and can able to build IoT applications.

**Course Outcomes:**

- Understand the concepts of Internet of Things
- Identify hardware and software components of Internet of Things
- Analyze basic communication protocols
- Design IoT applications in different domain and be able to analyze their performance

**UNIT 1**

Introduction to IoT: Architectural overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals-Devices and gateways, Data management, Business processes in IoT, Role of cloud in IoT

**UNIT II**

Elements of IoT: Hardware components – computing (Arduino, Raspberry Pi), communication, Sensing, Actuation, I/O interfaces Software Components- Programming APIs (Using python/Arduino) for communication protocols-MQTT, Zigbee, Bluetooth, CoAP, UDP, TCP

**UNIT III**

Sensing and Actuation: Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT

**UNIT IV**

IoT Application Development: Solution frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices

**UNIT V**

IoT Case Studies: IoT Case studies and mini projects based on industrial Automation, Transportation, Agriculture, Healthcare, Home Automation.

**Textbooks:**

1. Vijay Madiseti, ArshdeepBahga, “Internet of Things a Hands-On- Approach”,2014.

**References:**

1. Dr SRN Reddy, RachitThukral and Manasi Mishra ,” Introduction to Internet of Things”: A practical Approach” ETI Labs
2. Raj Kamal , “ Internet of Things: Architecture and Design”, McGraw Hill
3. Adrian McEwen, “Designing the Internet of Things”, Wiley Publishers, 2013

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**(20A05605a) PRINCIPLES OF OPERATING SYSTEMS**  
**(Open Elective Course – II)**

**Course Objectives:**

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Expose the students with different techniques of handling deadlocks
- Provide good insight on various memory management techniques
- Explore the concept of file-system and its implementation issues

**Course Outcomes:**

- Demonstrate and understand of computer systems and operating systems functions
- Distinguish between process and thread and classify scheduling algorithms
- Solve synchronization and deadlock problems
- Compare various memory management schemes
- Explain file systems concepts and i/o management

**UNIT I Introduction to Computer and Operating system**

Computer Types, Functional Units, Basic Operational Concepts, Number Representation and Arithmetic Operations, Character Representation, Performance, Historical Perspective, Memory Locations and Addresses, Memory operations, Instructions and Instruction Sequencing, Addressing modes Architecture Operating System Structure, Operations Process, Memory, Storage Management, Protection and Security Computing Environments Operating System Services User Operating System Interface System Calls Types System Programs OS Structure OS Generation System Boot.

**UNIT II Process, Threads and Scheduling**

Process Concept Scheduling Operations on Processes Cooperating Processes Inter-Process Communication Threads - Multithreading Models -Thread Libraries- Threading Issues – Scheduling Criteria Scheduling Algorithms Algorithm Evaluation.

**UNIT III Process Synchronization and Deadlocks**

The Critical-Section Problem Synchronization Hardware Mutex Locks -Semaphores Classic Problems of Synchronization Critical Regions Monitors Deadlocks System Model Deadlock Characterization Methods for Handling Deadlocks Deadlock Prevention Deadlock Avoidance Deadlock Detection Recovery from Deadlock.

**UNIT IV Memory Management**

Introduction - Swapping Contiguous Memory Allocation Paging Segmentation- Structure of the Page Table - Virtual Memory- Background Demand Paging Copy on Write Page Replacement Allocation of Frames Thrashing.

**UNIT V Input/ Output and Files**

Overview of Mass Storage Structure - Disk Structure - Disk Scheduling and Management-File System Interface File Concept - Access Methods -Directory and Disk Structure- Directory Implementation - Allocation Methods- I/O Systems I/O Hardware- Application I/O Interface - Kernel I/O Subsystem.

**Textbooks:**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.
2. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating Systems Concepts, Ninth Edition, Wiley, 2012.

**Reference Books:**

1. William Stallings, Operating Systems: Internals and Design Principles, Ninth Edition, Prentice-Hall, 2018.
2. Andrew Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall, 2009.

**Online Learning Resources:**

<https://nptel.ac.in/courses/106/106/106106144/>  
<http://peterindia.net/OperatingSystems.html>

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**(20A05605b) FOUNDATIONS OF MACHINE LEARNING**

**Open Elective Course– II**

**Course Objectives:**

- Acquire theoretical knowledge on setting hypothesis for pattern recognition.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms and to provide solution for various real-world applications.

**Course Outcomes (CO):**

After completion of the course, students will be able to

1. Understand the characteristics of machine learning strategies.
2. Apply various supervised learning methods to appropriate problems.
3. Identify and integrate more than one technique to enhance the performance of learning.
4. Create probabilistic and unsupervised learning models for handling unknown pattern.
5. Analyse the co-occurrence of data to find interesting frequent patterns.
6. Pre-process the data before applying to any real-world problem and can evaluate its performance

**UNIT - I Introduction to Machine Learning Lecture 8Hrs**

What is machine learning, learning associations, classification, regression, unsupervised learning, reinforcement learning

Supervised Learning: learning a class from examples, learning multiple classes, model selection and generalization

**UNIT - II Parametric, Non-Parametric methods Lecture 9Hrs**

Parametric Methods: Introduction, maximum likelihood estimation, evaluating an estimator, parametric classification, regression, model selection procedures

Nonparametric Methods: Introduction, nonparametric density estimation: histogram estimator, kernel estimator, k-nearest neighbour estimator

**UNIT - III Multivariate Methods Lecture 9Hrs**

Multivariate Methods: Multivariate data, parameter estimation, estimation of missing values, multivariate normal distribution, multi variate classification

**UNIT - IV Dimensionality Reduction, Clustering Lecture 8Hrs**

Dimensionality Reduction: Introduction, subset selection, principal component analysis, singular value decomposition and matrix factorization

Clustering: Mixture densities, k-means clustering, expectation-maximization algorithm, mixtures of latent variables

**UNIT - V Deep Learning Lecture 8Hrs**

Deep Learning: Introduction, train multiple hidden layers, improving training convergence, regularization, convolution layers, tuning the network structure, learning sequences.

**Textbooks:**

1. EthemAlpaydin, Introduction to Machine Learning, Fourth Edition, MIT Press, Fourth Edition, 2020
2. MehryarMohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press, 2012

**Reference Books:**

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2019.
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, CRC Press, 2015.
3. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.

**Online Learning Resources:**

1. <https://bloomberg.github.io/foml/>
2. [https://d1rkab7tlqy5f1.cloudfront.net/EWI/Over%20de%20faculteit/Afdelingen/Intelligent%20Systems/Patter n%20Recognition%20Laboratory/PR/Reading%20Group/Foundations\\_of\\_Machine\\_Learning.pdf](https://d1rkab7tlqy5f1.cloudfront.net/EWI/Over%20de%20faculteit/Afdelingen/Intelligent%20Systems/Patter n%20Recognition%20Laboratory/PR/Reading%20Group/Foundations_of_Machine_Learning.pdf)

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**(20A05605c) DATA ANALYTICS USING R**  
**(Open Elective-II)**

**Course Objectives:**

- Facilitate students to understand R programming
- Help students to gain a basic understanding of Data Analytics
- Inculcate working knowledge of plotting

**Course Outcomes:**

- Identify and execute basic syntax and programs in R
- Perform the Matrix operations using R built in functions
- Apply nonnumeric values in vectors
- Create the list and data frames
- Exploit the graph using ggplot2.

**UNIT I Introduction to R Programming**

History and Overview of R- Basic Features of R-Design of the R System- Installation of R- Console and Editor Panes- Comments- Installing and Loading R Packages- Help Files and Function Documentation-Saving Work and Exiting R- Conventions- R for Basic Math- Arithmetic-Logarithms and Exponentials - E-Notation - Assigning Objects – Vectors - Creating a Vector- Sequences, Repetition, Sorting and Lengths – Subsetting and Element Extraction -Vector – Oriented Behavior.

**UNIT II Matrices and Arrays**

Defining a Matrix – Defining a Matrix- Filling Direction- Row and Column Bindings- Matrix Dimensions-Subsetting- Row, Column, and Diagonal Extractions- Omitting and Overwriting- Matrix Operations and Algebra- Matrix Transpose- Identity Matrix- Matrix Addition and Subtraction- Matrix Multiplication-Matrix Inversion-Multidimensional Arrays-Subsets, Extractions and Replacements.

**UNIT III Non-Numeric values**

Logical Values- Relational Operators- Characters- Creating a String- Concatenation- Escape Sequences-Substrings and Matching- Factors- Identifying Categories- Defining and Ordering Levels- Combining and Cutting.

**UNIT IV Lists and Data frames**

List of Objects - Component Access – Naming – Nesting - Data Frames - Adding Data Columns and Combining Data Frames – Logical Record Subsets – Some Special Values – Infinity – NaN – NA - NULL – Attributes – Object - Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions

**UNIT V Basic Plotting**

Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels-Color-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an ExistingPlot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms—Reading and Writing Files- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots-AdHoc Object Read/Write Operations

**Textbooks:**

1. Tilman M. Davies, “The Book of R-A First Programming, Statistics” Library of Congress Cataloging-in-Publication Data, 2016.

**Reference Books:**

1. Hadley Wickham, Garrett Grolemund, ”R for Data Science”, Oreilly Publication, 2017.
2. Roger D. Peng, “R Programming for Data Science” Lean Publishing, 2016.
3. Steven Keller, “R ProgrammingforBeginners”, CreateSpaceIndependentPublishingPlatform2016.

**Online Learning Resources:**

1. <https://www.coursera.org/learn/data-analysis-r>
2. <https://www.careers360.com/courses-certifications/data-analysis-with-r-courses-brpg>

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**(20A27605) FOOD REFRIGERATION AND COLD CHAIN MANAGEMENT**  
**OPEN ELECTIVE II**

**Course Objectives:**

- To know the equipment available to store perishable items for a long time
- To understand to increase the storage life of food items

**Course Outcomes**

By the end of the course, the students will

- Understand various principles and theories involved in refrigeration systems
- Understand the different equipment useful to store the food items for a long period.
- Understand how to increase the storage life of food items

**UNIT I**

Principles of refrigeration: Definition, background with second law of thermodynamics, unit of refrigerating capacity, coefficient of performance; Production of low temperatures: Expansion of a liquid with flashing, reversible/ irreversible adiabatic expansion of a gas/ real gas, thermoelectric cooling, adiabatic demagnetization; Air refrigerators working on reverse Carnot cycle: Carnot cycle, reversed Carnot cycle, selection of operating temperatures;

**UNIT II**

Air refrigerators working on Bell Coleman cycle: Reversed Brayton or Joule or Bell Coleman cycle, analysis of gas cycle, polytropic and multistage compression; Vapour refrigeration: Vapor as a refrigerant in reversed Carnot cycle with p-V and T-s diagrams, limitations of reversed Carnot cycle; Vapour compression system: Modifications in reverse Carnot cycle with vapour as a refrigerant (dry vs wet compression, throttling vs isentropic expansion), representation of vapor compression cycle on pressure- enthalpy diagram, super heating, sub cooling;

**UNIT III**

Liquid-vapour regenerative heat exchanger for vapour compression system, effect of suction vapour super heat and liquid sub cooling, actual vapour compression cycle; Vapour-absorption refrigeration system: Process, calculations, maximum coefficient of performance of a heat operated refrigerating machine, Common refrigerants and their properties: classification, nomenclature, desirable properties of refrigerants- physical, chemical, safety, thermodynamic and economical; Azeotropes; Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve;

**UNIT IV**

Ice manufacture, principles and systems of ice production, Treatment of water for making ice, brines, freezing tanks, ice cans, air agitation, quality of ice; Cold storage: Cold store, design of cold storage for different categories of food resources, size and shape, construction and material, insulation, vapour barriers, floors, frost-heave, interior finish and fitting, evaporators, automated cold stores, security of operations; Refrigerated transport: Handling and distribution, cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display;

**UNIT V**

Air-conditioning: Meaning, factors affecting comfort air-conditioning, classification, sensible heat factor, industrial air-conditioning, problems on sensible heat factor; Winter/summer/year round air-conditioning, unitary air-conditioning systems, central air-conditioning, physiological principles in air-conditioning, air distribution and duct design methods; design of complete air-conditioning systems; humidifiers and dehumidifiers; Cooling load calculations: Load sources, product cooling, conducted heat, convected heat, internal heat sources, heat of respiration, peak load; etc.

**Textbooks:**

1. Arora, C. P. "Refrigeration and Air Conditioning". Tata MC Graw Hill Publishing Co.Ltd., New Delhi. 1993.

**References:**

1. Adithan, M. and Laroia, S. C. "Practical Refrigeration and Air Conditioning". Wiley Estern Ltd., New Delhi 1991

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech III-II Sem** **L T P C**  
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**(20A54701) WAVELET TRANSFORMS AND ITS APPLICATIONS**  
**(Open Elective-II)**

**Course Objectives:**

This course provides the students to understand Wavelet transforms and its applications.

**Course Outcomes:**

- Understand wavelets and wavelet expansion systems.
- Illustrate the multi resolution analysis and scaling functions.
- Form fine scale to coarse scale analysis.
- Find the lattices and lifting.
- Perform numerical complexity of discrete wavelet transforms.
- Find the frames and tight frames using fourier series.

**UNIT I** Wavelets

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets - effectiveness of Wavelet Analysis -The Discrete Wavelet Transform the Discrete-Time and Continuous Wavelet Transforms.

**UNIT II** A Multiresolution Formulation of Wavelet Systems

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

**UNIT III** Filter Banks and the Discrete Wavelet Transform

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

**UNIT IV** Time-Frequency and Complexity

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

**UNIT V** Bases and Matrix Examples

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

**Textbooks:**

1. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).
2. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).

**Reference Books:**

1. Raghuvveer Rao, "Wavelet Transforms", Pearson Education, Asia.

## Online Learning Resources:

<https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915>

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## (20A56701) PHYSICS OF ELECTRONIC MATERIALS AND DEVICES

(Open Elective-II)

**Course Objectives:**

- To impart the fundamental knowledge on various materials, their properties and applications.
- To provide insight into various semiconducting materials, and their properties.
- To enlighten the characteristic behavior of various semiconductor devices.
- To provide the basics of dielectric and piezoelectric materials and their properties.
- To explain different categories of magnetic materials, mechanism and their advanced applications.

**Course Outcome:** At the end of the course the student will be able

- To understand the fundamentals of various materials.
- To exploit the physics of semiconducting materials
- To familiarize with the working principles of semiconductor-based devices.
- To understand the behaviour of dielectric and piezoelectric materials.
- To identify the magnetic materials and their advanced applications.

**UNIT I Fundamentals of Materials Science**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Basic idea of point, line and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge).

**UNIT II Semiconductors**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

**UNIT III Physics of Semiconductor devices**

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Construction and working principles of: Light emitting diodes, Heterojunctions, Transistors, FET and MOSFETs.

**UNIT IV Dielectric Materials and their applications:**

Introduction, Dielectric properties, Electronic polarizability and susceptibility, Dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties.

**UNIT V Magnetic Materials and their applications**

Introduction, Magnetism & various contributions to para and dia magnetism, Ferro and Ferri magnetism and ferrites, Concepts of Spin waves and Magnons, Anti-ferromagnetism, Domains and domain walls, Coercive force, Hysteresis, Nano-magnetism, Super-paramagnetism – Properties and applications.

**Textbooks**

1. Principles of Electronic Materials and Devices- S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd., 3rd edition, 2007.
2. Electronic Components and Materials- Grover and Jamwal, Dhanpat Rai and Co.

**Reference Books:**

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning, 6th edition
2. Electronic Materials Science- Eugene A. Irene, , Wiley, 2005
3. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd., , 2nd Edition,2011
4. A First Course In Material Science- by Raghvan, McGraw Hill Pub.
5. The Science and Engineering of materials- Donald R.Askeland, Chapman& Hall Pub.

**NPTEL courses links:**<https://nptel.ac.in/courses/113/106/113106062/>

[https://onlinecourses.nptel.ac.in/noc20\\_mm02/preview](https://onlinecourses.nptel.ac.in/noc20_mm02/preview), <https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07>

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## (20A51701) CHEMISTRY OF POLYMERS AND ITS APPLICATIONS

**Course Objectives:**

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

**Course Outcome**

- At the end of the course, the student will be able to:
- Understand the state of art synthesis of Polymeric materials
- Understand the hydro gels preparation, properties and applications in drug delivery system.
- Characterize polymers materials using IR, NMR, XRD.
- Analyze surface phenomenon fo micelles and characterise using photoelectron spectroscopy, ESCA and Auger spectroscopy

**UNIT I : Polymers-Basics and Characterization**

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: condensation, addition, radical chain, ionic and coordination and copolymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

**UNIT II : Synthetic Polymers**

Addition and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, XRD.

**UNIT III : Natural Polymers & Modified cellulotics**

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulotics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEAK.

Learning Outcomes:

**UNIT IV: Hydrogels of Polymer networks and Drug delivery**

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

**UNIT V : Surface phenomena**

Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

**References :**

1. A Text book of Polymer science, Billmayer

2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra

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**(20A01704) COST EFFECTIVE HOUSING TECHNIQUES**  
**(Open Elective Course - III)**

**Course Objectives:**

- To understand the requirements of structural safety for future construction.
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- To know the traditional practices of rural housing
- To know the different innovative cost-effective construction techniques
- To know the alternative building materials for low-cost housing.

**Course Outcomes:**

- To know the repair and restore action of earthquake damaged non engineered buildings and ability to understand the requirements of structural safety for future construction
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- Apply the traditional practices of rural housing
- Understand the different innovative cost-effective construction techniques
- Suggest the alternative building materials for low-cost housing

**UNIT I**

- a) **Housing Scenario: Introducing** - Status of urban housing - Status of Rural Housing
- b) **Housing Finance:** Introducing - Existing finance system in India - Government role as facilitator - Status at Rural Housing Finance - Impedimently in housing finance and related issues
- c) **Land use and physical planning for housing: Introduction-** Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye lass - Residential Densities
- d) **Housing the urban poor: Introduction** - Living conditions in slums - Approaches and strategies for housing urban poor

**UNIT II**

**Development and adoption of low-cost housing technology**

Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements in partial prefatroids - Adopting of total prefactcation of mass housing in India- General remarks on pre cast roofing/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall – Fly-ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

**UNIT III**

**Alternative building materials for low cost housing**

Introduction - Substitute for scarce materials – Ferro-cement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - alternative building maintenance

**Low cost Infrastructure services:**

Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy

**UNIT IV**

**Rural Housing:** Introduction traditional practice of rural housing continuous - Mud Housing technology Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs

**UNIT V**

**Housing in Disaster prone areas:**

Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirement's of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

**Textbooks:**

1. Building materials for low – income houses – International council for building research studies and documentation.
2. Hand book of low cost housing by A.K.Lal – Newage international publishers.
3. Low cost Housing – G.C. Mathur by South Asia Books

**Reference Books:**

1. Properties of concrete – Neville A.m. Pitman Publishing Limited, London.
2. Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.
3. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Rama chandra Murthy &G.Annamalai. E. & F. N. Spon Publishers

**Online Learning Resources:**

<https://nptel.ac.in/courses/124107001>

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(20A03704) PRODUCT DESIGN AND DEVELOPMENT

(Open Elective-III)

**Course Objectives:**

- To Design products creatively while applying engineering design principles.
- To Apply principles of human factors, ethics and environmental factors in product design.
- To Work in groups or individually in their pursuit of innovative product design.
- To implement value design for optimum product cost.

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

- Apply knowledge of basic science and engineering fundamentals
- Undertake problem identification, formulation and solution
- Understanding of the principles of sustainable design and development
- Understanding of professional and ethical responsibilities and commitment to them

**UNIT I** Product Development Process

General problem-solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behaviour.

**UNIT II** Task Clarification

Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and extending the requirements, Compiling the requirements list, Examples. Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

**UNIT III** Conceptual Design

Steps in Conceptual Design. Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem. Formulation, Identifying the essential problems from the requirements list, establishing functions structures, Overall function, Breaking a function down into sub-functions. Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures. Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of working structures. Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

**UNIT IV** Embodiment Design

Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of Tasks, Principles of Self-Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design to Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards. Evaluation of Embodiment Designs.

**UNIT V** Mechanical Connections, Mechatronics And Adaptronics:

Mechanical Connections - General functions and General Behaviour, Material connections, From Connections, Force connections, Applications. Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solution, Examples. Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.

**Textbooks:**

1. G.Paul; W. Beitzetal, Engineering Design, Springer International Education, 2010.
2. Kevin Otto: K. Wood, Product Design And Development, Pearson Education, 2013.

**References:**

1. Kenith B. Kahu, Product Planning Essentials, Yes dee Publishing, 2011.
2. K.T. Ulrich, Product Design and Development, TMH Publishers, 2011.

**Online Learning Resources:**

- <https://nptel.ac.in/courses/112107217>
- <https://nptel.ac.in/courses/112104230>
- <https://www.youtube.com/watch?v=mvaqZAFdL6U>
- <https://nptel.ac.in/courses/107103082>
- <https://quizxp.com/nptel-product-design-and-manufacturing-assignment-5/>

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**(20A04704) ELECTRONIC SENSORS**  
**(Open Elective Course –III)**

**Course Objectives:**

- Learn the characterization of sensors.
- Known the working of Electromechanical, Thermal, Magnetic and radiation sensors
- Understand the concepts of Electro analytic and smart sensors
- Able to use sensors in different applications

**Course Outcomes:**

- Learn about sensor Principle, Classification and Characterization.
- Explore the working of Electromechanical, Thermal, Magnetic, radiation and Electro analytic sensors
- Understand the basic concepts of Smart Sensors
- Design a system with sensors

**UNIT I**

**Sensors / Transducers:** Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization

**Electromechanical Sensors:** Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors

**UNIT II**

**Thermal Sensors:** Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor ,Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors

**UNIT III**

**Magnetic sensors:** Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

**UNIT IV**

**Radiation Sensors:** Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors

**Electro analytical Sensors:** The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

**UNIT V**

**Smart Sensors:** Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing –Sensors for environmental Monitoring

**Textbooks:**

1. “Sensors and Transducers - D. Patranabis” –PHI Learning Private Limited., 2003.
2. Introduction to sensors- John veteline, aravindraghu, CRC press, 2011

**References:**

1. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
2. Make sensors: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media,2014.
3. Sensors handbook- Sabriesoloman, 2nd Ed. TMH, 2009

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(20A05704a) WEB TECHNOLOGIES  
(Open Elective-III)

**Course Objectives:**

The course is designed to Introduce the key technologies that have been developed as part of the birth and maturation of the World Wide Web.

**Course Outcomes:**

- Understand the Web essentials.
- Develop web pages using XHTML
- Apply style to web pages using CSS
- Write scripts for client side
- Develop and transform XML documents.

**UNIT I Web Essentials: Clients, Servers, and Communication**

The Internet, Basic Internet protocols, WWW, HTTP request message, HTTP response message, Web clients, Web Servers, Case study.

**UNIT II Markup Languages: XHTML 1.0**

An introduction to HTML, Basic XHTML syntax and semantics, fundamental HTML elements, Relative URLs, Lists, Tables, Frames, Forms, Defining XHTML's abstract syntax, Creating HTML documents.

**UNIT III Cascading Style Sheets**

Introduction, features, core syntax, style sheets and HTML, style rule cascading and inheritance, text properties, Box model, normal flow box layout, beyond the normal flow, lists, tables, cursor styles.

**UNIT IV Client-side programming: JavaScript**

Basic syntax, variables and data types, statements, operators, literals, functions, objects, Arrays, built-in objects, JavaScript debuggers.

**UNIT V Representing Web Data: XML**

Documents and vocabularies, Versions and declaration, Namespaces, Ajax, DOM and SAX parsers, transforming XML documents, XPath, XSLT, Displaying XML documents in Web browsers.

**Textbooks:**

1. J.C. Jackson, Web technologies: A computer science perspective, Pearson.

**Reference Books:**

1. Sebesta, Programming world wide web, Pearson.
2. Dietel and Nieto , Internet and World Wide Web – How to program, Pearson Education
3. Chris Bates , Web Programming, building internet applications, 2nd edition, WILEY, Dreamtech

**Online Learning Resources:**

<http://getbootstrap.com/>

<https://www.w3schools.com/whatis/>

<https://nptel.ac.in/courses/106105084>

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(20A05704b) VR & AR FOR ENGINEERS  
(Open Elective Course – III)

**Course Objectives:**

- Introduce to the design of visualization tools
- Demonstrate Virtual reality
- Learn Virtual reality animation and 3D Art optimization
- Understand the foundational principles describing how hardware, computer vision algorithms function
- Explore the history of spatial computing and design interactions

**Course Outcomes:**

- Apply VR/MR/AR in various fields in industry
- Design Data visualization tools
- Design audio and video interaction paradigms
- Apply technical and creative approaches to make successful applications and experiences.
- Explain how the humans interact with computers

**UNIT I**

**Computer generated worlds:** what is augmented reality? what is virtual reality?

**Understanding virtual space:** defining visual space and content, defining position and orientation in three dimensions, navigation

**The Mechanics of Sight:** the visual path way, spatial vision, and Depth Cues.

**Component Technologies of Head mounted Displays:** Display fundamentals, related terminology and concepts, optical Architectures.

**UNIT II**

**Augmented Displays:** Binocular augmenting displays, Monocular augmenting displays.

**Fully immersive Displays:** PC-Console driven displays, smartphone based displays, CAVES and Walls, Hemispheres and Domes.

**The Mechanics of hearing:** Defining sound, the auditory pathway, sound cues and localization, the vestibular system.

**Audio displays:** Conventional audio

**UNIT III**

**The Mechanics of Feeling:** The Science of feeling, Anatomy and Composition of the skin.

**Tactile and force feedback Devices:**Haptic illusions, tactile feedback devices, Force feedback devices.

**Sensors for tracking Position, and orientation and motion:** introduction to sensor technologies, optical trackers, beacon trackers,electromagnetic trackers, inertial sensors, acoustic sensors.

**Devices to enable navigation and interaction:** 2D vs 3D interaction and navigation, the importance of a manual interface, hand and gesture tracking, whole body tracking, gaming and entertainment interfaces, navigating with your mind.

**UNIT IV**

**Gaming and Entertainment:** Virtual reality and the arts, gaming, immersive video/ cinematic virtual reality.

**Architecture and Construction:**Artificial spaces, architectural design: Manage group architectures, Construction management, real estate sales applications, architectural acoustics.

**Science and engineering:** Simulate and innovate, naval architecture and marine engineering, automotive engineering, aerospace engineering, nuclear engineering and manufacturing.

**Health and medicine:** advancing the field of medicine, training applications, treatment applications.

#### UNIT V

**Aerospace and Defence:** Flight simulation and training, mission planning and rehearsal, dismounted soldier situational awareness, advanced cockpit avionics, space operations.

**Education:** Tangible skills education, theory, knowledge acquisition and concept formation.

**Information control and big data visualization:** What is big data?, big data analytics and human vision.

**Telerobotics and Telepresence:** Defining Telerobotics and Telepresence, space applications and robonaut, undersea applications, Terrestrial and airborne applications.

#### Textbooks:

1. Steve Aukstakalnis, “Practical Augmented Reality”, Pearson Education, 2017.

#### Reference Books:

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, “Creating Augmented& Virtual Realities”, O'REILLY

#### Online Learning Resources:

1. <https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality-technologies-applications-issues>
2. <https://www.coursera.org/learn/ar>

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**(20A05704b) SOFTWARE ENGINEERING**  
**(Open Elective Course – III)**

**Course Objectives:**

- To learn the basic concepts of software engineering and life cycle models
- To explore the issues in software requirements specification and enable to write SRS documents for software development problems
- To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems
- To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- To reveal the basic concepts in software project management

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Obtain basic software life cycle activity skills.
- Design software requirements specifications for given problems.
- Implement structure, object oriented analysis and design for given problems.
- Design test cases for given problems.
- Apply quality management concepts at the application level.

**UNIT - I                      Basic concepts in software engineering and software project management                      Lecture 8Hrs**

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

**UNIT - II                      Requirements analysis and specification                      Lecture 8Hrs**

The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.

**UNIT - III                      Software Design                      Lecture 9Hrs**

Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.

**UNIT - IV                      Coding and Testing                      Lecture 9Hrs**

Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.

**UNIT - V                      Software quality, reliability, and other issues                      Lecture 9Hrs**

Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.

Textbooks:

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. Pressman R, "Software Engineering- Practioner Approach", McGraw Hill.

Reference Books:

1. Somerville, "Software Engineering", Pearson 2.
2. Richard Fairley, "Software Engineering Concepts", Tata McGraw Hill.
3. JalotePankaj, "An integrated approach to Software Engineering", Narosa

Online Learning Resources:

<https://nptel.ac.in/courses/106/105/106105182/>

<http://peterindia.net/SoftwareDevelopment.html>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

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**(20A27704) HUMAN NUTRITION**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To get knowledge on Concepts and content of nutrition source and metabolic functions.
- To know about Balanced diets for various groups; Diets and disorders, recommended dietary allowances
- To learn about Epidemiology of under nutrition and over nutrition.
- To understand Nutrition and immunity.

**Course Outcomes:**

- To study the Salient features of Concepts and content of nutrition, Malnutrition, Nutrition education
- Assessment of nutritional status, disorders Food fad and faddism.

**UNIT I**

Concepts and content of nutrition: Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolic function of nutrients. Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings;

**UNIT II**

Water and energy balance: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR Formulation of diets: Classification of balanced diet; Balanced diets for various groups; Diets and disorders. Recommended dietary allowances (RDA); For various age group; According physiological status; Athletic and sports man; Geriatric persons

**UNIT III**

Malnutrition: Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition and immunity.

**UNIT IV**

Nutrition education Assessment of nutritional status: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information

**UNIT V**

Blood constituents; Hormone types; Miscellaneous disorders Food fad and faddism. Potentially toxic substances in human food.

**Textbooks:**

1. Swaminathan M, Advanced Text Book on Food & Nutrition (Volume I and II) , The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006
2. Stewart Truswell, ABC of Nutrition (4th edition) , BMJ Publishing Group 2003, ISBN 0727916645.
3. Martin Eastwood, Principles of Human Nutrition , Blackwell Publishing, Boca Rotan

**Reference:**

1. Mike Lean and E. Combet ,Barasi's Human Nutrition – A Health Perspective , Second Edition CRC Press, London
2. Introduction to Human Nutrition, Micheal J. G., Susan A.L. Aedin C. and Hester H.V, Wiley-Blackwell Publication, UK 2009 , ISBN 9781405168076
3. Bogert L.J., Goerge M.B, Doris H.C., Nutrition and Physical Fitness, W.B. Saunders Company, Toronto, Canada

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

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**(20A54702) NUMERICAL METHODS FOR ENGINEERS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

**Course Outcomes:**

- Apply numerical methods to solve algebraic and transcendental equations.
- Understand fitting of several kinds of curves.
- Derive interpolating polynomials using interpolation formulae.
- Solve differential and integral equations numerically.

**UNIT I                      Solution of Algebraic & Transcendental Equations**

Introduction-Bisection Method-Iterative method-Regula falsi method-Newton Raphson method.  
System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

**UNIT II                      Curve Fitting**

Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.

**UNIT III                      Interpolation**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae  
Gauss forward and backward formula, Stirling's formula, Bessel's formula

**UNIT IV                      Numerical Integration**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

**UNIT V                      Solution of Initial value problems to Ordinary differential equations**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

**Textbooks:**

3. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
4. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE.
5. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

**Reference Books:**

3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

**Online Learning Resources:**

<https://slideplayer.com/slide/8588078/>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

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(20A56702) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS  
(OPEN ELECTIVE-III)

**Course Objectives:**

- To provide exposure to various kinds of sensors and actuators and their engineering applications.
- To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
- To enlighten the operating principles of various sensors and actuators
- To educate the fabrication of sensors
- To identify the required sensor and actuator for interdisciplinary application

**Course Outcomes:**

- To recognize the need of sensors and actuators
- To understand working principles of various sensors and actuators
- To identify different type of sensors and actuators used in real life applications
- To exploit basics in common methods for converting a physical parameter into an electrical quantity
- To make use of sensors and actuators for different applications

**UNIT I Introduction to Sensors and Actuators**

**Sensors:** Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

**Actuators:** Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, piezo-electric and piezo-resistive actuators, Simple applications of Actuators.

**UNIT II Temperature and Mechanical Sensors**

**Temperature Sensors:** Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

**Mechanical Sensors:** Types of Mechanical sensors and their basic principle of working: Force sensors: strain gauges, tactile sensors, Pressure sensors: semiconductor, piezoresistive, capacitive, VRP.

**UNIT III Optical and Acoustic Sensors**

**Optical Sensors:** Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors: thermal, PIR, thermopiles

**Acoustic Sensors:** Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

**UNIT IV Magnetic, Electromagnetic Sensors and Actuators**

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

**UNIT V Chemical and Radiation Sensors**

**Chemical Sensors:** Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

**Radiation Sensors:** Principle and working of Ionization detectors, Scintillation detectors, Geiger-Mueller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

**Textbooks:**

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2<sup>nd</sup> Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

**Reference Books:**

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
5. Principles of Industrial Instrumentation By D. Patranabhis

**NPTEL courses links**

[https://onlinecourses.nptel.ac.in/noc21\\_ee32/preview](https://onlinecourses.nptel.ac.in/noc21_ee32/preview)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
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**(20A51702) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To understand synthetic principles of Nanomaterials by various methods
- To characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

**Course Outcomes:**

- Understand the state of art synthesis of nano materials
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
- Analyze nanoscale structure in metals, polymers and ceramics
- Analyze structure-property relationship in coarser scale structures
- Understand structures of carbon nano tubes

**UNIT I**

Introduction: Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Synthetic Methods: Bottom-Up approach: Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

**UNIT II**

Top-Down approach: Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

**UNIT III**

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

**UNIT IV**

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self- assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

**UNIT V**

Engineering Applications of Nanomaterials

**Textbooks:**

1. NANO: The Essentials: T Pradeep, McGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

**References:**

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials Chemistry, C. N. R. Rao, Achim Muller, K. Cheetham, Wiley-VCH, 2007.

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

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**(20A01705) HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT PRACTICES  
(Open Elective Course-IV)**

**Course Objectives:**

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard control, environmental issues and management
- To get exposed to accidents modeling, accident investigation and reporting, concepts of HAZOP and PHA
- To be familiar with safety measures in design and process operations.
- To get exposed to risk assessment and management, principles and methods

**Course Outcomes:**

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard.
- To get exposed to accidents modelling, accident investigation and reporting control, environmental issues and management
- To get concepts of HAZOP and PHA.
- To be familiar with safety measures in design and process operations.

**UNIT I**

Introduction to safety, health and environmental management - Basic terms and their definitions - Importance of safety - Safety assurance and assessment - Safety in design and operation - Organizing for safety.

**UNIT II**

Hazard classification and assessment - Hazard evaluation and hazard control. Environmental issues and Management - Atmospheric pollution - Flaring and fugitive release - Water pollution - Environmental monitoring - Environmental management.

**UNIT III**

Accidents modelling - Release modelling - Fire and explosion modelling - Toxic release and dispersion Modelling

**UNIT IV**

Accident investigation and reporting - concepts of HAZOP and PHA. Safety measures in design and process operations - Inserting, explosion, fire prevention, sprinkler systems.

**UNIT V**

Risk assessment and management - Risk picture - Definition and characteristics - Risk acceptance criteria - Quantified risk assessment - Hazard assessment - Fatality risk assessment - Risk management principles and methods.

**Textbooks:**

1. Process Safety Analysis, by Skelton. B, Gulf Publishing Company, Houston, 210pp., 1997.
2. Risk Management with Applications from Offshore Petroleum Industry, by Terje Aven and Jan Erik Vinnem, Springer, 200pp., 2007.

**Reference Books:**

1. Introduction to Safety and Reliability of Structures, by Jorg Schneider
2. Structural Engineering Documents Vol. 5, International Association for Bridge and Structural Engineering (IABSE), 138pp., 1997.
3. Safety and Health for Engineers, by Roger L. Brauer, John Wiley and Sons Inc. pp. 645-663, 2006.
4. Health, Safety and Environmental Management in Offshore and Petroleum Engineering, Srinivasan Chandrasekaran, John Wiley and Sons, 2016.

**Online Learning Resources:** <https://nptel.ac.in/courses/114106017>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

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**(20A03705) INTRODUCTION TO COMPOSITE MATERIALS**  
**(Open Elective-IV)**

**Course Objectives:**

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

**Course Outcomes:**

- Identify the practical applications of composites. (L3)
- Identify the polymer matrix composites. (L3)
- Classify of bio- degradable composites. (L2)
- Outline the various types of ceramic matrix materials. (L2)

**UNIT I Introduction to composites**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

**UNIT II Polymer matrix composites**

Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Auto clave based methods - Injection moulding – sheet moulding compound – properties and applications of PMCs.

**UNIT III Metal matrix composites**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMCs.

**UNIT IV Ceramic matrix composites**

Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – Insitu chemical reaction techniques – solgel polymer pyrolysis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

**UNIT V Advances & Applications of composites**

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications. Bio degradability, introduction of bio composites, classification, processing of bio composites, applications of bio composites - Mechanical, Biomedical, automobile Engineering.

**Textbooks:**

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

**Reference Books:**

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME Publications, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bio plastics & Bio composites for Engineering applications, John Wiley publications, 2011.

**Online Learning Resources:**

- <https://nptel.ac.in/courses/112104229>
- <https://nptel.ac.in/courses/112104168>
- <https://nptel.ac.in/courses/101104010>
- <https://nptel.ac.in/courses/105108124>
- <https://nptel.ac.in/courses/112104221>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

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**(20A05705a) CYBER SECURITY**  
**(Open Elective-IV)**

**Course Objectives:**

The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cybercrime.

**Course Outcomes:**

- Classify the cybercrimes and understand the Indian ITA 2000
- Analyse the vulnerabilities in any computing system and find the solutions
- Predict the security threats of the future
- Investigate the protection mechanisms
- Design security solutions for organizations

**UNIT I Introduction to Cybercrime**

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

**UNIT II Cyber Offenses: How Criminals Plan Them**

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

**UNIT III Cybercrime: Mobile and Wireless Devices**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT IV Tools and Methods Used in Cybercrime**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

**UNIT V Cyber Security: Organizational Implications**

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

**Textbooks:**

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

**Reference Books:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin. CRC Press T&F Group

**Online Learning Resources:**

<http://nptel.ac.in/courses/106105031/40>

<http://nptel.ac.in/courses/106105031/39>

<http://nptel.ac.in/courses/106105031/38>

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

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3 0 0 3(20A05705b) INTRODUCTION TO FULL STACK DEVELOPMENT  
(Open Elective Course – IV)**Course Objectives:**

- To build foundation on HTML this will help developer to use HTML concepts for building responsive web application.
- To Develop HTML based Single application for Browsers.
- To Understand OOPs concepts and its applications by building competency in object –oriented Programming.
- To implement frontend and backend scenarios using Web Sockets.
- To become proficient in Bootstrap concepts.

**Course Outcomes:**

- Able to how to program a browser like using JavaScript, jQuery, Angular, or Vue.
- Distinguishing trends in multi-device implementation.
- Create webpages that function using external data.
- Disambiguate the different structures that a no SQL database may represent.
- Derive information from data and implement data into applications.

**UNIT I**

**e The Modern Web:** Rise of the Web, Mobile Web, The State of HTML, Applications vs Web Sites, Keeping Up.

**Planning Your Work: Identifying** Requirements, Defining the Work, Tracking the Work Continuous Improvement, Prioritization & Estimation, Managing Bugs, Continuous Delivery

**User Experience:** Information Architecture, Getting the User Experience Right, Polishing the User Experience, Implementing the User Experience.

**UNIT II**

**Designing Systems:** System Architectures, Identifying Concepts, Identifying User Interactions, Handling Commonalities, Working with Legacy and External Dependencies, Component Interactions, Applications vs. Modules, Cross-Functional Requirements, Caching, Designing for Failure, Designing Modules, Refactoring, Tools, Changing Your Architecture.

**Ethics:** Privacy, Cognitive Load, Energy Usage, Trust.

**Front End:** HTML, From Server to Browser, Styling, Components, Responsive Design, Progressive Enhancement to Progressively Enhance, or Not? Mobile First, Feature Detection, Progressive Enhancement of Style, When Not Using Progressive Enhancement, Search Engine Optimization, Build Tools.

**UNIT III**

**Testing:** Test-Driven Development, Test Pyramid, Behaviour-Driven Development, Three Amigos, Manual Testing, Visual Testing, Cross-Functional Testing,

**JavaScript:** Asynchronicity, JavaScript in the Browser, Offline-First Development, Document Object Model, Server-Side JavaScript, Table of Contents viii JavaScript Modules, Structuring Your JavaScript, JavaScript Types, Object-Oriented Programming, Functional Programming, Communicating Between Components, Connecting Components Together, Testing, Build Tools.

**Accessibility:** Accessible from the Start, Working with Assistive Technologies, Dealing with Interactive UI, Testing for Accessibility, Avoiding Common Mistakes.

**UNIT IV**

**APIs:** API Responsibilities, designing a REST API, Securing Your API, Event-Based APIs, Discovering APIs, Using APIs

**Storing Data:** Types of Databases, To SQL, or NoSQL?, Where to Store Your Data, Accessing Data from Your App, Managing Your Data, Protecting Your Data.

**Security:** Trust, Responding to Incidents, The Golden Rule, Threats, Security Checklists, Passwords, Indirect Attacks.

## UNIT V

**Deployment:** Twelve Factor Apps, Developer Machines, Production Environments, Moving Code into Production, Configuring Your Box, Infrastructure, Immutable Infrastructure, Continuous Delivery & Continuous Deployment.

**In Production:** Fire Drills, Run Books, Monitoring, Responding to Incidents

**Constant Learning:** Collecting, Experiments, Analysing Results, Hypothesis-Driven.

### **Textbook:**

1. Chris Northwood, The full Stack Developer, Apress, 2018.

### **Reference Books:**

1. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Frank Zammetti.
2. Full Stack Web Development for Beginners, Riaz Ahmed.

### **Online Learning Resources:**

1. [Learn Full Stack Web Development with 40+ Projects and Exercises | Udemy](#)

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

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**(20A05705c) INDUSTRIAL IOT**  
**(Open Elective-IV)**

**Course Objectives:**

- Acquire theoretical knowledge on Industrial Internet of Things.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms for sensors and data transmission.

**Course Outcomes:**

- Understand the characteristics of Internet of Things and its industry strategies.
- Apply various Internet of Things models to appropriate problems.
- Identify and integrate more than one technology to enhance the performance.
- Understand the sensors and data transmission used in Internet of Things.
- Analyse the co-occurrence of data to find interesting frequent patterns.
- Pre-process the data before applying to any real-world problem and can evaluate its performance.

**UNIT I Overview of Internet of Things**

Introduction, IOT Architecture, Application –based IOT protocols, Cloud Computing, Fog Computing, Sensor Cloud, Big Data.

Overview of Industry 4.0 and Industrial Internet of Things: IIoT- Prerequisites of IIOT, Basics of CPS, CPS and IIOT, Applications of IIoT.

**UNIT II Industrial Internet of Things**

Introduction, Industrial Internet Systems, Industrial sensing, Industrial sensing, Industrial Processes. Business Models and Reference Architecture of IIoT: Definition of a business model, Business models of IOT, Business models of IIOT.

**UNIT III Key and On-site Technologies**

Key Technologies: Off-site Technologies- Introduction, Cloud Computing- Necessity, Cloud Computing and IIot, Industrial Cloud Platform Providers, SLA, Requirements of Industry 4.0, Fog Computing.

On-site Technologies- Introduction, Augmented Reality- History, Categorization, Applications, Virtual Reality- History, Categorization, Applications.

**UNIT IV Sensors and Data Transmission**

Sensors: Introduction to Sensors, Characteristics-Sensor calibration, Sensor profile, Operating voltage, Sensor Categories. Actuators: Introduction, Thermal Actuators, Hydraulic Actuators, Pneumatic Actuators, Electromechanical Actuators.

Industrial Data Transmission: Foundation fieldbus, Profibus, HART, Interbus, Bitbus.

**UNIT V Machine learning and Data science, applications in healthcare**

Machine Learning and Data Science in Industries: Introduction, Machine Learning, Categorization on ML, Applications and Data Science of ML in industries, Deep Learning, Applications of Deep Learning in industries.

Applications of Healthcare in Industries: Smart Devices, Advanced Technologies using in Healthcare, Open Research Issues to be Addressed.

**Textbooks:**

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

**Reference Books:**

1. Industrial IoT. Available online: <https://medium.com/iotforall/whatproduct-managers-need-to-know-about-industrial-iot-8c92eec1d9d2>
2. IIoT Cloud Platforms. Available online: <https://fr.farnell.com/willthere-be-a-dominant-iiot-cloud-platform>.
3. Kajima, T. and Kawamura, Y., 1995. Development of a high-speed solenoid valve: Investigation of solenoids. IEEE Transactions on industrial electronics, 42(1), pp.1-8.

**Online Learning Resources:**

1. <https://www.coursera.org/learn/industrial-internet-of-things>
2. <https://www.coursera.org/specializations/developing-industrial-iiot>

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

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## (20A27705) WASTE AND EFFLUENT MANAGEMENT

(OPEN ELECTIVE-IV)

**Course Objectives:**

- To understand the wastewater treatment process.
- To gain knowledge on waste disposal in various ways.
- To know about advances in wastewater treatment.

**Course Outcomes:**

- Acquires knowledge on technologies used for chemical and biological methods of wastewater and effluent treatment

**UNIT I**

Wastewater Treatment an Overview: Terminology – Regulations – Health and Environment Concerns in wastewater management – Constituents in waste water inorganic – Organic and metallic constituents. Process Analysis and Selection: Components of waste water flows – Analysis of Data – Reactors used in waste water treatment – Mass Balance Analysis – Modeling of ideal and non ideal flow in Reactors – Process Selection

**UNIT II**

Waste disposal methods – Physical, Chemical & Biological; Economical aspects of waste treatment and disposal. Treatment methods of solid wastes: Biological composting, drying and incineration; Design of Solid Waste Management System: Landfill Digester, Vermicomposting Pit.

**UNIT III**

Introduction: Classification and characterization of food industrial wastes from Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry. Chemical Unit Processes: Role of unit processes in waste water treatment chemical coagulation – Chemical precipitation for improved plant performance chemical oxidation – Neutralization – Chemical Storage

**UNIT IV**

Biological Treatment: Overview of biological Treatment – Microbial metabolism – Bacterial growth and energetics – Aerobic biological oxidation – Anaerobic fermentation and oxidation – Trickling filters – Rotating biological contractors – Combined aerobic processes – Activated sludge film packing.

**UNIT V**

Advanced Wastewater Treatment: Technologies used in advanced treatment – Classification of technologies. Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration-Absorption – Ion Exchange – Advanced oxidation process.

**Textbooks:**

1. Herzka A & Booth RG; “Food Industry Wastes: Disposal and Recovery”; Applied Science Pub Ltd. 1981,
2. Fair GM, Geyer JC & Okun DA; “Water & Wastewater Engineering”; John Wiley & Sons, Inc. 1986,

**References:**

1. GE; “Symposium: Processing Agricultural & Municipal Wastes”; AVI. 1973,
2. Inglett Green JH & Kramer A; “Food Processing Waste Management”; AVI. 1979,
3. Rittmann BE & McCarty PL; “Environmental Biotechnology: Principles and Applications”; Mc-Graw-Hill International editions 2001,.
4. Bhattacharyya B C & Banerjee R; “Environmental Biotechnology”; Oxford University Press.
5. Bartlett RE; “Wastewater Treatment; Applied Science” Pub Ltd.
6. G. Tchobanoglous, FI Biston, “Waste water Engineering Treatment and Reuse”: Mc Graw Hill, 2002.
7. “Industrial Waste Water Management Treatment and Disposal by Waste Water” 3<sup>rd</sup> Edition Mc Graw Hill 2008

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

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3 0 0 3

(20A54703) NUMBER THEORY AND ITS APPLICATIONS  
(OPEN ELECTIVE-IV)**Course Objectives:**

This course enables the students to learn the concepts of number theory and its applications to information security.

**Course Outcomes:**

- Understand number theory and its properties.
- Understand principles on congruences
- Develop the knowledge to apply various applications
- Develop various encryption methods and its applications.

**UNIT I Integers, Greatest common divisors and prime Factorization**

The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations

**UNIT II Congruences**

Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences

**UNIT III Applications of Congruences**

Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem- Pseudo primes- Euler's theorem-Euler's  $\phi$ -function- The sum and number of divisors- Perfect numbers and Mersenne primes.

**UNIT IV Finite fields & Primality, factoring**

Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases.

**UNIT V Cryptology**

Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers-Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.

**Textbooks:**

1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories.
2. A course in Number theory & Cryptography, Neal Koblitz, Springer.

**Reference Books:**

1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers
2. Introduction to Analytic number theory-Tom M Apostol, springer
3. Elementary number theory, VK Krishnan, Universities press

**Online Learning Resources:**

<https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications>

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

L T P C

3 0 0 3

## (20A56703) SMART MATERIALS AND DEVICES

(OPEN ELECTIVE-IV)

**Course Objectives:**

- To provide exposure to smart materials and their engineering applications.
- To impart knowledge on the basics and phenomenon behind the working of smart materials
- To enlighten the properties exhibited by smart materials
- To educate various techniques used to synthesize and characterize smart materials
- To identify the required smart material for distinct applications/devices

**Course Outcomes:**

- to recognize the need of smart materials
- to understand the working principles of smart materials
- to know different techniques used to synthesize and characterize smart materials
- to exploit the properties of smart materials
- to make use of smart materials for different applications

**UNIT I**

**Introduction:** Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

**UNIT II: Properties of Smart Materials:** Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials

**UNIT III: Synthesis of smart materials:** Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Co-precipitation. Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Sol-gel, spray pyrolysis.

**UNIT IV: Characterization techniques:** X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

**UNIT V: Materials and Devices:** Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials. Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

**Textbooks:**

1. Encyclopaedia of Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002
2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Chapman and Hall, 1992

**References:**

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, , Elsevier, 2005.
2. Characterization and Application of smart Materials -R. Rai, Synthesis, , Nova Science, 2011.
3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, 2<sup>nd</sup>Edn., John Wiley & Sons, 2003.
4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1. Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, 2002.
5. Optical Metamaterials: Fundamentals and Applications -W. Cai and V. Shalaev, springer,2010.
6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

**NPTEL courses links**

<https://nptel.ac.in/courses/112/104/112104173/>

<https://nptel.ac.in/courses/112/104/112104251/>

[https://nptel.ac.in/content/storage2/courses/112104173/Mod\\_1\\_smart\\_mat\\_lec](https://nptel.ac.in/content/storage2/courses/112104173/Mod_1_smart_mat_lec)

## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

L T P C

3 0 0 3

**(20A51703) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OPEN ELECTIVE-IV)****Course Objectives:**

- Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

**Course Outcomes:**

- Recognize and acquire green chemistry concepts and apply these ideas to develop respect for the inter connectedness of our world and an ethic of environmental care and sustainability.

**UNIT I: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

**UNIT II: CATALYSIS AND GREEN CHEMISTRY**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

**UNIT III: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water-based coatings, Ionic liquids as catalyst and solvent

**UNIT IV: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES**

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

**UNIT V: GREEN PROCESSES FOR GREEN NANOSCIENCE**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

**Textbooks:**

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4<sup>th</sup> Edition, Oxford University Press, USA

**References:**

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:Green Nanoscience, wiley-VCH, 2013.

# HONORS

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)****L T P C**  
**3 1 0 4****(20A02H01) ELECTRIC VEHICLE TECHNOLOGY & MOBILITY****Course Objectives:**

- Understand the fundamental concepts and principles of Electric vehicles
- Apply the concepts to implement battery technology
- Apply the concepts to implement charging technology
- Understand the future trends in EVs

**Course Outcomes:**

The students will be able to:

- Understand the operation principle of electric vehicles, different policy perspectives and innovation in future mobility
- Choose suitable motors and analyse different power electronics in EVs.
- Understand the battery technology.
- Understand future technology for EVs such as smart charging, wireless charging and solar EVs.

**UNIT I INTRODUCTION**

Introduction to electric vehicles: EV verses gasoline vehicles, vehicle dynamics fundamentals, e-drivetrain, Electric motor, Power electronic in electric vehicles, Regenerative braking.

**UNIT II BATTERY TECHNOLOGY**

Battery Technology for EVs: Storage technologies for EV, Battery working principles, Battery losses, Li-ion batteries, Battery pack and battery management system.

**UNIT III CHARGING TECHNOLOGY**

Charging Technology of EVs: AC charging - Type 1,2,3, DC charging, Fast charging and its limitations, Smart charging and applications, Vehicle to X(V2X), X2V technology.

**UNIT IV FUTURE TRENDS IN EVs**

Future trends in e-Vehicles: Wireless charging of EV, On-road charging of EV, Battery swap technology, Solar powered EVs, Charging EVs from renewables.

**UNIT V E-MOBILITY**

E-mobility: electrification challenges, business, connected mobility and autonomous mobility case study in Indian Roadmap Perspective, Policy- EVs in infrastructure system, integration of EVs in smart grid, social dimensions of EVs.

**Textbooks:**

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
2. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.

**Reference Books:**

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
3. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000
4. Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/108106170>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)**

**L T P C**  
**3 1 0 4**

**(20A02H02) BATTERY MANAGEMENT SYSTEMS**

**Course Objectives:**

- Understand the basics of batteries and its parameters
- Apply the concepts to create Battery Management System
- Create Physical and Simulation models for Battery Management System
- Design different Battery Management Systems

**Course Outcomes:**

After completion of this course, student will be able to

- Understand the role of battery management system
- Identify the requirements of Battery Management System
- Interpret the concept associated with battery charging / discharging process
- Analyze various parameters of battery and battery pack
- Design the model of battery pack

**UNIT I INTRODUCTION**

Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging

**UNIT II BATTERY MANAGEMENT SYSTEM**

Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power

**UNIT III BATTERY STATE OF CHARGE AND STATE OF HEALTH ESTIMATION**

Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing

**UNIT IV MODELLING AND SIMULATION**

Equivalent-circuit models (ECMs), Physics-based models (PBM), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs

**UNIT V DESIGN OF BATTERY MANAGEMENT SYSTEMS**

Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system

**Textbooks:**

1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015.
2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.

**Reference Books:**

1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L “Battery Management Systems -Design by Modelling” Philips Research Book Series 2002.
2. Davide Andrea,” Battery Management Systems for Large Lithium-ion Battery Packs” Artech House, 2010
3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.

Online Learning Resources:

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech (EEE)****L T P C**  
**3 1 0 4****(20A02H03) SPECIAL MACHINES FOR ELECTRIC VEHICLES****Course Objectives:**

- Understand various Motor Drives useful for EV applications
- Apply the concepts to implement various designs
- Analyze performance of various Motor Drives
- Evaluate the usage of specific drive for EV application

**Course Outcomes:**

After completion of this course, student will be able to

- Understand different special machines for electric vehicle application
- Evaluate the performance of special machines for EVs
- Determine the special machine and their drive requirement for EV application
- Analyze the performance of multiphase machine for EVs

**UNIT I PERMANENT MAGNET (PM) BRUSHLESS MOTOR DRIVES**

Structure of PM Brushless Machines, Principle of PM Brushless Machines Modeling of PM Brushless Machines, Inverters for PM Brushless Motors Motor Control, Design Criteria of PM Brushless Motor Drives for EVs, Design Examples of PM Brushless Motor Drives for EVs, Application, Advantages and Limitations for EVs.

**UNIT II SWITCHED RELUCTANCE MOTOR DRIVE**

Structure of SR Machines, Principle of SR Machines, SR Converters Topologies, SR Motor Control, Design Criteria of SR Motor Drives for EVs, Examples of SR Motor Drives for EVs, Application, Advantages and Limitations for EVs.

**UNIT III STATOR-PM MOTOR DRIVES**

Doubly-Salient PM Motor Drives, Flux-Reversal PM Motor Drives, Flux-Switching PM Motor Drives, Hybrid-Excited PM Motor Drives Flux-Mnemonic PM Motor Drives, Design Criteria of Stator-PM Motor Drives for EVs, Application, Advantages and Limitations for EVs.

**UNIT IV MAGNETIC-GEARED MOTOR DRIVES**

Principle of MG Machines, Modeling of MG Machines, Inverters for MG Motors, MG Motor Control, Design Criteria of MG Motor Drives for EVs, Application, Advantages and Limitations for EVs

**ADVANCED MAGNETLESS MOTOR DRIVES AND****UNIT V MULTIPHASE MOTOR DRIVES**

Introduction of Advanced Magnetless technology, Synchronous Reluctance Motor Drives, Doubly-Salient DC Motor Drives, Flux-Switching DC Motor Drives, Design Criteria of Advanced Magnetless Motor Drives for EVs, Application, Advantages and Limitations for EVs.

Multiphase Induction Motor drives – principle, operation and control, Multiphase PMSM machine – principle, operation and control, Fault tolerant operation of multiphase drives

**Textbooks:**

1. Mehrdad Ehsani, Yimin Gao, Sebastien Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel cell vehicles: Fundamentals, Theory and Design”, CRC Press, 2004.
2. James Larminie and John Louny, “Electric Vehicle Technology – Explained”, John Wiley & Sons Ltd, 2003.

**Reference Books:**

1. Sandeep Dhameja, "Electric Vehicle Battery Systems", Butterworth – Heinemann, 2002.
2. Ronald K Jurgen, "Electric and Hybrid – Electric Vehicles", SAE, 2002.
3. Ron Hodgkinson and John Fenton, "Light Weight Electric/Hybrid Vehicle Design", Butterworth – Heinemann, 2001.
4. Iqbal Husain, "Electric and Hybrid Vehicles- Design Fundamentals" CRC Press, 2011.

Online Learning Resources:

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (EEE)**

**L T P C**  
**3 1 0 4**

**(20A02H04) GRID INTERFACE OF ELECTRIC VEHICLES**

**Course Objectives:**

- Understand the Grid interfacing concept of EVs
- Analyze the EV impact on grid
- Design new types of charging facilities for EVs
- Evaluate the role of EV as ancillary service

**Course Outcomes:**

After completion of this course, student will be able to

- Understand the role of PEV as source in smart grid
- Analyze Impact of EV on smart grid
- Analyze the performance of EV parking lot on smart distribution system
- Evaluate the role of EV as ancillary service

**UNIT I INTRODUCTION TO SMART GRID AND PEV**

Introduction to smart grid and microgrid, Impact of PEVs on Distributed Energy Resources in the Smart Grid, V2G Technology and PEVs Charging Infrastructures

**UNIT II IMPACT OF EV AND V2G ON THE SMART GRID AND RENEWABLE ENERGY SYSTEMS**

Types of Electric Vehicles, Motor Vehicle Ownership and EV Migration, Impact of Estimated EVs on Electrical Network, Impact on Drivers and the Smart Grid, Standardization and Plug-and-Play

**UNIT III POWER CONVERSION TECHNOLOGY IN THE SMART GRID AND EV**

Impacts of EV Penetration on Grid Power Profile, Requirements of Its Control and Monitoring, Hybrid EV Powertrain Architectures, Control, Monitoring and Management Strategies of EV, V2G Communication System, System model of EV, Case study of three phase fault and its impact

**UNIT IV PLANNING, CONTROL AND MANAGEMENT STRATEGIES FOR PARKING LOTS FOR PEVs**

Introduction to PEV Charging Facility, Long-Term Planning for PEV Parking Lots, Control and Management of PEV Parking Lots - stages of implementation

**UNIT V PEV AS ANCILLARY SERVICE IN SMART GRID**

Introduction to Ancillary Services, PEV Charger Optimization, PEV as ancillary source, Control Strategies for PEVs to Follow the Individual Operation Values, Systems and Control Algorithm for Smart PEV Chargers, Avoiding the Harmonic Propagation Within the Grid, Case study

**Textbooks:**

1. Lu, J. and Hossain, J., Vehicle-to-grid: linking electric vehicles to the smart grid. Institution of Engineering and Technology, 2015.
2. Rajakaruna, S., Shahnian, F. and Ghosh, A. eds., Plug In Electric Vehicles in Smart Grids: Integration Techniques. Springer, 2014.

**Reference Books:**

1. Rajakaruna, S., Shahnian, F. and Ghosh, A. eds., Plug in electric vehicles in smart grids: charging strategies. Springer, 2014.
2. Salman, S.K., Introduction to the Smart Grid: Concepts, Technologies and Evolution (Vol. 94). IET., 2017.