PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
think • innovate • transform

# Criterion 1 – Curricular Aspects

| | | |
|---|---|---|
| **Key Indicator** | 1.1 | Curriculum Design and Development |
| **Metric** | 1.1.3 | Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by Electrical and Electronics Engineering. |

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

## SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

1. List of courses for the programmes in order of

| S. No. | Programme Name |
|---|---|
| i. | Bachelor of Technology(Electrical and Electronics Engineering)(Full Time) |
| ii. | Bachelor of Technology(Electrical and Electronics Engineering)(Part Time) |

2. Syllabus of the courses as per the list.

Legend :
Words highlighted with **Blue Color** - Entrepreneurship
Words highlighted with **Red Color** - Employability
Words highlighted with **Purple Color** - Skill Development

**1. List of Courses**

| Name of the Course | Course Code | Name of the Programme | Activities with direct bearing on Employability/ Entrepreneurship/ Skill development | Year of introduction |
|---|---|---|---|---|
| **B.Tech. EEE – FT** | | | | |
| Calculus and Linear Algebra | XMA101 | B.Tech. EEE | ***** | 2007-08 |
| Environmental Sciences | XES102 | B.Tech. EEE | **Employability**-Quiz, Test, Assignment Seminar, Group Discussion | 2013-14 |
| Electrical and Electronics Engineering Systems | XBE103 | B.Tech. EEE | **Entrepreneurship-** Assignment, Seminar Poster Presentation | 2007-08 |
| Applied Physics for Engineers | XAP104 | B.Tech. EEE | **Entrepreneurship-** Assignment, Seminar Poster Presentation | 2007-08 |
| Engineering Graphics | XEG105 | B.Tech. EEE | **Employability**-Drawing Assignment, Model Making | 2007-08 |
| Electrical Circuit Analysis | XEE301 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Analog Electronics | XEE302 | B.Tech. EEE | **Employability**-Assignment, Test, Seminar | 2007-08 |
| Electrical Machines - I | XEE303 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Electromagnetic Fields | XEE304 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Transmission and Distribution | XEE305 | B.Tech. EEE | **Employability**-Assignment, Test, Seminar | 2007-08 |
| In-plant Training - I | XEE306 | B.Tech. EEE | **Employability**-Industrial visit, Viva Voce | 2007-08 |
| Power Systems - I (Apparatus and Modelling) | XEE501 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Control Systems | XEE502 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Microprocessors and Microcontrollers | XEE503 | B.Tech. EEE | **Employability**-Assignment, Test, Seminar | 2007-08 |
| Professional Elective - 1 (Protection and Switchgear) | XEEE11 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |

| | | | | |
|---|---|---|---|---|
| Open Elective - 1 | X** OE* | B.Tech. EEE | ***** | 2007-08 |
| Constitution of India | XUM506 | B.Tech. EEE | **Skill Development-** Quiz, Test, Assignment Seminar | 2007-08 |
| In-plant Training - II | XEE507 | B.Tech. EEE | **Employability**-Industrial visit, Viva Voce | 2015-16 |
| Minor Course - I | XEEM01 | B.Tech. EEE | **Employability**-Test | 2019-20 |
| Open Elective – II | X**OE* | B.Tech. EEE | ***** | 2013-14 |
| Microprocessor and Microcontrollers | XEE702 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Measurement and Instrumentation | XEE703 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Bio-Medical Instrumentation | XEEE31 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2013-14 |
| Special Electrical Machines | XEEE41 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2013-14 |
| Cyber Security | XUM706 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2013-14 |
| Project Phase – I | XEE707 | B.Tech. EEE | **Employability**-Presentation, Viva Voce | 2013-14 |
| Career Development Skills | XGS708 | B.Tech. EEE | **Skill Development-** Presentation, Mock Interviews Group Discussion | 2015-16 |
| In-plant Training – III | XEE709 | B.Tech. EEE | **Employability**-Industrial visit, Viva Voce | 2007-08 |
| Minor Course - II | XEEM02 | B.Tech. EEE | **Employability**-Test | 2019-20 |
| Calculus, Ordinary Differential Equations and Complex Variable | XMA201 | B.Tech. EEE | ***** | 2007-08 |
| Programming for Problem Solving | XCP202 | B.Tech. EEE | **Entrepreneurship**-Test, Assignment, Problem Solving Exercises | 2018-19 |
| English | XGS203 | B.Tech. EEE | **Skill Development-** Vocabulary Building Exercises Interactive Practice Sessions, Writing Practices | 2018-19 |
| Applied Chemistry for Engineers | XAC204 | B.Tech. EEE | **Employability**-Test, Assignment, Seminar, Poster Presentation | 2007-08 |
| Workshop Practices | XWP205 | B.Tech. EEE | **Entrepreneurship**-Machining Processes, Model Making | 2007-08 |
| Mathematics - III | XPS401 | B.Tech. EEE | ***** | 2007-08 |

| | | | | |
|---|---|---|---|---|
| (Probability and Statistics) | | | | |
| Digital Electronics | XEE402 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Power Electronics | XEE403 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Electrical Machines - II | XEE404 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Entrepreneurship Development | XUM405 | B.Tech. EEE | **Entrepreneurship**-Quiz, Test, Assignment Seminar, Group Discussion | 2013-14 |
| Signals and Systems | XEE406 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2018-19 |
| Economics for Engineers | XUM601 | B.Tech. EEE | ***** | 2013-14 |
| Power Systems - II (Operation and Control) | XEE602 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Measurement and Instrumentation | XEEE21 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Industrial Automation | XEEE31 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Open Elective - 2 | X**OE* | B.Tech. EEE | ***** | 2013-14 |
| Disaster Management | XUM606 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2015-16 |
| Minor Course - II | XEEM02 | B.Tech. EEE | **Employability**-Test | 2019-20 |
| Open Elective – III | X**OE* | B.Tech. EEE | ***** | 2013-14 |
| Electric Vehicles and Power Management | XEEE51 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2013-14 |
| High Voltage Engineering | XEEE61 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2013-14 |
| Project Phase – II | XEE804 | B.Tech. EEE | **Employability**-Presentation, Viva Voce | 2013-14 |
| Minor Course - III | XEEM03 | B.Tech. EEE | **Employability**-Test | 2019-20 |

**B.Tech. EEE – PT**

| | | | | |
|---|---|---|---|---|
| Calculus and Linear Algebra | PMA 101 | B.Tech. EEE | ***** | 2007-08 |
| Applied Physics for Engineers | PAP 102 | B.Tech. EEE | **Entrepreneurship-** Assignment, Test, Seminar | 2007-08 |
| Applied Chemistry for Engineers | PAC 103 | B.Tech. EEE | **Entrepreneurship-** Assignment, Test, Seminar | 2007-08 |

| | | | | |
|---|---|---|---|---|
| Electrical Circuit Analysis | PEE 104 | B.Tech. EEE | **Employability**-Quiz, Test, Assignment, Mini Project, Viva Voce | 2007-08 |
| Transmission and Distribution | PEE 301 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Environmental Sciences | PEE 302 | B.Tech. EEE | **Entrepreneurship**-Test, Assignment, Seminar | 2007-08 |
| Signals and Systems | PEE 303 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2018-19 |
| Electrical Machines-II | PEE 304 | B.Tech. EEE | **Employability**-Quiz, Test, Assignment, Mini Project, Viva Voce | 2007-08 |
| Protection & Switchgear | PEE 501 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Elective – 1 (Digital Logic Circuits) | PEE E11 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Industrial Economics and Foreign Trade | PEE 503 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Power Electronics | PEE 504 | B.Tech. EEE | **Employability**-Quiz, Test, Assignment, Mini Project, Viva Voce | 2007-08 |
| Electric Vehicles and Power Management | PEE 701 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2015-16 |
| Power System Operation and Control | PEE 702 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Elective – 3 (Cyber Security) | PEE E31 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Major Project | PEE 704 | B.Tech. EEE | **Employability**-Presentation, Viva Voce | 2007-08 |
| Calculus, Ordinary Differential Equations and Complex Variable | PMA 201 | B.Tech. EEE | ***** | 2007-08 |
| Electromagnetic Fields | PEE 202 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Analog Electronics | PEE 203 | B.Tech. EEE | **Employability**-Assignment, test, Seminar | 2007-08 |
| Electrical Machines-I | PEE 204 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment, Mini Project, Viva Voce | 2007-08 |
| Digital Electronics | PEE 401 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2007-08 |
| Professional Elective-1(Computer Architecture) | PEE E14 | B.Tech. EEE | **Employability**-Assignment, Test, Seminar | 2007-08 |
| Professional Elective-2(High Voltage | PEE E21 | B.Tech. EEE | **Employability**-Assignment, Test, Seminar | 2007-08 |

| | | | | |
|---|---|---|---|---|
| Engineering) | | | | |
| Power Electronics | PEE 404 | B.Tech. EEE | **Employability**-Quiz, Test, Assignment, Mini Project, Viva Voce | 2007-08 |
| Elective – 2 (Microprocessors and Microcontrollers) | PEE E26 | B.Tech. EEE | **Employability**-Assignment, Test, Seminar | 2007-08 |
| E-Waste Management | PEE 602 | B.Tech. EEE | **Employability**-Quiz, Test, Problem Solving Assignment | 2015-16 |
| Disaster Management | PEE 603 | B.Tech. EEE | **Employability**-Assignment, Test, Seminar | 2015-16 |
| Measurements and Instrumentation | PEE 604 | B.Tech. EEE | **Employability**-Quiz, Test, Assignment, Mini Project, Viva Voce | 2007-08 |

**SEMESTER I**

| COURSE CODE | | | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| XMA101 | | | CALCULUS AND LINEAR ALGEBRA | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3 | 0.5 | 0.5 | | 3 | 1 | 0 | 4 |

**PREREQUISITE:** Differentiation and Integration

| Course Outcomes (XMA 101): | | Domain | Level |
|---|---|---|---|
| CO1 | **Apply** orthogonal transformation to reduce quadratic form to canonical forms. | Cognitive | Remembering<br>Applying |
| CO2 | **Apply** power series to tests the convergence of the sequences and series. Half range Fourier sine and cosine series. | Cognitive<br>Psychomotor | Applying<br>Remembering<br>Guided Response |
| CO3 | **Find** the derivative of composite functions and implicit functions. Euler's theorem and Jacobian | Cognitive<br>Psychomotor | Remembering<br>Guided Response |
| CO4 | **Explain** the functions of two variables by Taylors expansion, by finding maxima and minima with and without constraints using Lagrangian Method. Directional derivatives, Gradient, Curl and Divergence. | Cognitive<br><br>Affective | Remembering<br>Understanding<br><br>Receiving |
| CO5 | **Apply** Differential and Integral calculus to notions of Curvature and to improper integrals. | Cognitive | Applying |

| **UNIT -I: MATRICES** | **9+3** |
|---|---|
| Linear Transformation - Eigen values and Eigen vectors -Properties of Eigen values and Eigen vectors - Cayley-Hamilton Theorem – Diagonalisation of Matrices – Real Matrices: Symmetric - Skew-Symmetric and Orthogonal Quadratic form – canonical form - Nature of Quadratic form and Transformation of Quadratic form to Canonical form (Orthogonal only). | |
| **UNIT- II: SEQUENCES AND SERIES** | **9+3** |
| Sequences: Definition and examples-Series: Types and convergence- Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test-. Fourier series: Half range sine and cosine series- Parseval's Theorem. | |
| **UNIT- III: MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION** | **9+3** |
| Limit and continuity –Partial differentiation – Total Derivative – Partial differentiation of Composite Functions: Change of Variables – Differentiation of an Implicit Function - Euler's Theorem- Jacobian. | |
| **UNIT-IV: MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND VECTOR CALCULUS** | **9+3** |
| Taylor's theorem for function of Two variables- Maxima, Minima of functions of two variables: with and without constraints - Lagrange's Method of Undetermined Multipliers – Directional Derivatives - Gradient, Divergence and Curl. | |
| **UNIT-V: DIFFERENTIAL AND INTEGRAL CALCULUS** | **9+3** |
| Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of | |

| revolutions. | | | |
|---|---|---|---|
| | **LECTURE** | **TUTORIAL** | **TOTAL** |
| | **45** | **15** | **60** |

**TEXT BOOKS**

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015**. (Unit-1, Unit-3 and Unit-4).**
2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. **(Unit-2).**
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition,2010. **(Unit-5).**

**REFERENCE BOOKS**

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson Reprint, 2002.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi,2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons,2006.

**Mapping of COs with GAs**

| | **GA1** | **GA2** | **GA3** | **GA4** | **GA5** | **GA6** | **GA7** | **GA8** | **GA9** | **GA10** | **GA11** | **GA12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | | | 2 | | | | | 1 | | 2 |
| **CO 2** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 4** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | | 2 |
| **Total** | 15 | 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 0 | 7 |
| **Scaled Value** | 3 | 2 | | | 1 | | | | | 1 | | 2 |

$1 - 5 \rightarrow 1$, $6 - 10 \rightarrow 2$, $11 - 15 \rightarrow 3$

| COURSE CODE | COURSE NAME | L | T | SS | P | C |
|---|---|---|---|---|---|---|
| XES 102 | ENVIRONMENTAL SCIENCES | 0 | 0 | 0 | 0 | 0 |
| C:P: A | | L | T | SS | P | H |
| 1.4: 0.3: 0.3 | | 3 | 0 | 0 | 0 | 3 |

| Course Outcomes (XES102): | | Domain | Level |
|---|---|---|---|
| CO1 | **Describe** the significance of natural resources and **explain** anthropogenic impacts. | Cognitive | Remember Understand |
| CO2 | **Illustrate** the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance. | Cognitive | Understand |
| CO3 | **Identify** the facts, consequences, preventive measures of major pollutions and **recognize** the disaster phenomenon | Cognitive Affective | Remember Receive |
| CO4 | **Explain** the socio-economic, policy dynamics and **practice** the control measures of global issues for sustainable development. | Cognitive | Understand Apply |
| CO5 | **Recognize** the impact of population and the concept of various welfare programs, and **apply** the modern technology towards environmental protection. | Cognitive | Understand Analysis |

**UNIT – I: INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY** — 12

Definition, scope and importance – Need for public awareness – Forest resources: Use, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: Uses, environmental effects of mining, case studies-iron mining(Goa), bauxite mining(Odisha) – Food resources: effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies – Land resources: Land as a resource, land degradation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

**UNIT – II: ECOSYSTEMS AND BIODIVERSITY** — **7**

Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT – III: ENVIRONMENTAL POLLUTION** — **10**

Definition – Causes, 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– Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.

**UNIT –IV: SOCIAL ISSUES AND THE ENVIRONMENT** — **10**

Rain water harvesting – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents – 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 – Public awareness.

**UNIT –V: HUMAN POPULATION AND THE ENVIRONMENT** — **6**

Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and human health.

| | LECTURE | TUTORIAL | PRACTICAL | SELF STUDY | TOTAL |
|---|---|---|---|---|---|
| | 45 | 0 | 0 | 0 | 45 |

**TEXT BOOKS**


1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.
2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003
3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.
4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006.
5. Introduction to International disaster management, Butterworth Heinemann, 2006.
6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.


**REFERENCE BOOKS**


1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012.
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003.
5. Sundar, Disaster Management, Sarup & Sons, New Delhi, 2007.

6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006.

**E RESOURCES**

1. http://www.e-booksdirectory.com/details.php?ebook=10526
2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science
3. https://www.free-ebooks.net/ebook/What-is-Biodiversity
4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4
5. http://bookboon.com/en/pollution-prevention-and-control-ebook
6. http://www.e-booksdirectory.com/details.php?ebook=8557
7. http://www.e-booksdirectory.com/details.php?ebook=6804
8. http://bookboon.com/en/atmospheric-pollution-ebook
9. http://www.e-booksdirectory.com/details.php?ebook=3749
10. http://www.e-booksdirectory.com/details.php?ebook=2604
11. http://www.e-booksdirectory.com/details.php?ebook=2116
12. http://www.e-booksdirectory.com/details.php?ebook=1026
13. http://www.faadooengineers.com/threads/7894-Environmental-Science

**Mapping of COs with POs**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 2 |
| **CO 2** | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |
| **CO 3** | 2 | 1 | 3 | | | 3 | 1 | | 2 | 1 | | 1 | | |
| **CO 4** | 1 | 1 | 2 | | | 3 | 2 | 3 | | | | 1 | 1 | 1 |
| **CO 5** | 2 | 1 | 1 | | | 3 | | | | | | 1 | | |
| **Total** | **10** | **3** | **6** | 3 | 2 | **11** | **4** | **3** | **2** | **2** | 0 | **5** | 4 | 4 |
| **Scaled** | 2 | 1 | 2 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XBE 103 | ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS | 3 | 1 | 1 | 5 |
| **Prerequisites** | **Physics** | **L** | **T** | **P** | **H** |
| C:P: A<br>3:1:0 | | 3 | 1 | 2 | 6 |

| Course Outcomes (XBE 103): | | Domain | Level |
|---|---|---|---|
| CO1 | **Define and Relate** the fundamentals of electrical parameters and **build** and **explain** AC, DC circuits by Using measuring devices | Cognitive<br>Psychomotor | Remember<br>Understand<br>Mechanism |
| CO2 | **Define and Explain** the operation of DC and AC machines. | Cognitive | Remember<br>Understand |
| CO3 | **Recall and Illustrate** various semiconductor devices and their applications and displays the input output characteristics of basic semiconductor devices. | Cognitive<br>Psychomotor | Remember<br>Understand<br>Mechanism |
| CO4 | **Relate and Explain the** number systems and logic gates. **Construc**t the different digital circuit. | Cognitive<br>Psychomotor | Remember<br>Understand<br>Origination |
| CO5 | **Label and Outline the** different types of microprocessors and their applications. | Cognitive | Remember<br>Understand |

**UNIT-I: FUNDAMENTALS OF DC AND AC CIRCUITS, MEASUREMENTS** **9+9+12**

Fundamentals of DC– Ohm's Law – Kirchhoff's Laws - Sources - Voltage and Current Relations – Star/Delta Transformation - Fundamentals of AC – Average Value, RMS Value, Form Factor - AC power and Power Factor, Phasor Representation of sinusoidal quantities - Simple Series, Parallel, Series Parallel Circuit - Operating Principles of Moving coil and Moving Iron Instruments (Ammeter, Voltmeter) and Dynamometer type meters (Watt meter and Energy meter).

**List of Experiments**

1. Study of Electrical Symbols, Tools and Safety Precautions, Power Supplies.
2. Study of Active and Passive elements – Resistors, Inductors and Capacitors, Bread Board.
3. Verification of AC Voltage, Current and Power in Series and Parallel connection.
4. Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.
5. Fluorescent lamp connection with choke.
6. Staircase Wiring.

**UNIT -II: ELECTRICAL MACHINES** **9 + 6+0**

Construction, Principle of Operation, Basic Equations, Types and Application of DC Generators, DC motors - Basics of Single-Phase Induction Motor and Three Phase Induction Motor- Construction, Principle of Operation of Single-Phase Transformer, Three phase transformers, Auto transformer.

**UNIT- III: SEMICONDUCTOR DEVICES** **9 + 3+8**

Classification of Semiconductors, Construction, Operation and Characteristics: PN Junction Diode – Zener Diode, PNP, NPN Transistors, Field Effect Transistors and Silicon Controlled Rectifier – Applications.

**List of Experiments**

5. Forward and Reverse bias characteristics of PN junction diode.
6. Forward and Reverse bias characteristics of zener diode
7. Input and Output Characteristics of NPN transistor.

| **UNIT- IV: DIGITAL ELECTRONICS** | **9 + 6+10** |
|---|---|

Basic of Concepts of Number Systems, Logic Gates, Boolean Algebra, Adders, Subtractors, multiplexer, demultiplexer, encoder, decoder, Flipflops, Up/Down counters, Shift Registers.

**List of Experiments**

8. Construction and verification of simple logic gates.
9. Construction and verification of adders.
10. Construction and verification of subtractor.

| **UNIT- V: MICROPROCESSORS** | **9+ 6+0** |
|---|---|

Architecture, 8085, 8086 - Interfacing Basics: Data transfer concepts – Simple Programming concepts

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **15** | **30** | **90** |

**TEXT BOOKS**


1. Metha V.K., 2008. Principles of Electronics. Chand and Company.
2. Malvino, A. P., 2006. Electronics Principles. 7th ed. New Delhi: Tata McGraw-Hill.
3. Rajakamal, 2007. Digital System-Principle & Design. 2nd ed. Pearson education.
4. Morris Mano, 1999. Digital Design. Prentice Hall of India.
5. Ramesh, S. Gaonkar, 2000, Microprocessor Architecture, Programming and its Applications with the 8085, 4th ed, India: Penram International Publications.


**REFERENCE BOOKS**


1. Corton, H.,2004 Electrical Technology. CBS Publishers & Distributors.
2. Syed, A. Nasar, 1998, Electrical Circuits. Schaum Series.
3. Jacob Millman and Christos, C. Halkias, 1967, Electronics Devices, New Delhi: McGraw-Hill.
4. Millman, J. and Halkias, C. C., 1972. Integrated Electronics: Analog and Digital Circuits and Systems, Tokyo: McGraw-Hill, Kogakusha Ltd.
5. Mohammed Rafiquzzaman, 1999. Microprocessors - Theory and Applications: Intel and Motorola. Prentice Hall International.


**E-REFERENCES**

1. NTPEL, Basic Electrical Technology (Web Course), Prof. N. K. De, Prof. T. K. Bhattacharya and Prof. G.D. Roy, IIT Kharagpur.
2. Prof.L.Umanand, http://freevideolectures.com/Course/2335/Basic-Electrical-Technology#, IISc Bangalore.
3. http://nptel.ac.in/Onlinecourses/Nagendra/, Dr. Nagendra Krishnapura, IIT Madras.
4. Dr.L.Umanand, http://www.nptelvideos.in/2012/11/basic-electrical-technology.html, IISC Bangalore.

**Mapping of COs with POs**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 3 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | | 3 | 3 |
| **CO 2** | 3 | 3 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | | 3 | 3 |
| **CO 3** | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | | 3 | 3 |
| **CO 4** | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 3 | 3 |
| **CO 5** | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 3 | 3 |
| **Total** | 12 | 12 | 6 | 5 | 6 | 6 | 3 | 3 | 5 | 5 | 5 | | 15 | 15 |
| **Scaled** | 3 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | | 5 | 5 |

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XAP 104** | **APPLIED PHYSICS FOR ENGINEERS** | **3** | **1** | **2** | **6** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **2.8:0.8:0.4** | | | | | |
| **PREREQUISITE:** | **Basic Physics in HSC level** | **3** | **1** | **4** | **8** |

| **Course Outcomes (XAP104):** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | **Identify** the basics of mechanics, **explain** the principles of elasticity and **determine** its significance in engineering systems and technological advances. | Cognitive<br>Psychomotor | Remember, Understand<br>Mechanism |
| **CO2** | **Illustrate** the laws of electrostatics, magneto-statics and electromagnetic induction; **use** and **locate** basic applications of electromagnetic induction to technology. | Cognitive<br>Psychomotor<br>Affective | Remember, Analyze,<br>Mechanism<br>Respond |
| **CO3** | **Understand** the fundamental phenomena in optics by measurement and **describe** the working principle and application of various lasers and fibre optics. | Cognitive<br>Psychomotor<br>Affective | Understand, Apply<br>Mechanism<br>Receive |
| **CO4** | **Analyze** energy bands in solids, **discuss** and **use** physics principles of latest technology using semiconductor devices. | Cognitive<br>Psychomotor<br>Affective | Understand, Analyze<br>Mechanism<br>Receive |
| **CO5** | **Develop** Knowledge on particle duality and **solve** Schrodinger equation for simple potential. | Cognitive | Understand, Apply |

| **UNIT - I: MECHANICS OF SOLIDS** | **9+3+9** |
|---|---|
| **Mechanics:** Force - Newton's laws of motion - work and energy - impulse and momentum - torque - law of conservation of energy and momentum - Friction.<br>**Elasticity:** Stress - Strain - Hooke's law - Stress strain diagram - Classification of elastic modulus - Moment, couple and torque - Torsion pendulum - Applications of torsion pendulum - Bending of beams - Experimental determination of Young's modulus: Uniform bending and non-uniform bending. | |
| **UNIT -II: ELECTROMAGNETIC THEORY** | **9+3+3** |
| Laws of electrostatics - Electrostatic field and potential of a dipole; Dielectric Polarization, Dielectric constant, internal field - Clausius Mossotti Equation - Laws of magnetism - Ampere's Faraday's law; Lenz's law - Maxwell's equation - Plane electromagnetic waves; their transverse nature - expression for | |

plane, circularly and elliptically polarized light - quarter and half wave plates - production and detection of plane, circularly and elliptically polarized light.

| **UNIT –III: OPTICS, LASERS AND FIBRE OPTICS** | **9+3+12** |
|---|---|

**Optics:** Dispersion- Optical instrument: Spectrometer - Determination of refractive index and dispersive power of a prism- Interference of light in thin films: air wedge - Diffraction: grating.
**LASER**: Introduction - Population inversion -Pumping - Laser action - Nd-YAG laser - $CO_2$ laser – Applications **Fiber Optics:** Principle and propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fiber - Fiber optic communication system (Block diagram).

| **UNIT –IV: SEMICONDUCTOR PHYSICS** | **9+3+6** |
|---|---|

**Semiconductors**: Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Intrinsic semiconductors - Concept of holes - doping - Extrinsic semiconductors - P type and N type semiconductors - Hall effect.
**Diodes and Transistors**: P-N junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave rectifier using P N junction diodes - PNP and NPN transistors - Three different configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

| **UNIT –V: QUANTUM PHYSICS** | **9+3+0** |
|---|---|

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension - Degeneracy.

**TEXT BOOKS**


1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publications, 2009.
2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., New Delhi, 2010.


**REFERENCE BOOKS**


1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.
2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.
3. Senthil Kumar G., "Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.
4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.


**E RESOURCES**

NPTEL, Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

**LABORATORY**

| | |
|---|---|
| 1. | Torsional Pendulum - determination of moment of inertia and rigidity modulus of the given material of the wire. |
| 2. | Uniform Bending - Determination of the Young's Modulus of the material of the beam. |
| 3. | Non-Uniform Bending - Determination of the Young's Modulus of the material of the beam. |
| 4. | Meter Bridge - Determination of specific resistance of the material of the wire. |
| 5. | Spectrometer - Determination of dispersive power of the give prism. |
| 6. | Spectrometer - Determination of wavelength of various colours in Hg source using grating. |
| 7. | Air wedge - Determination of thickness of a given thin wire. |
| 8. | Laser - Determination of wavelength of given laser source and size of the given micro particle using Laser grating. |
| 9. | Post office Box - Determination of band gap of a given semiconductor. |

| | |
|---|---|
| 10. | PN Junction Diode - Determination of V-I characteristics of the given diode. |

**REFERENCE BOOKS**


1. Samir Kumar Ghosh, "A text book of Advanced Practical Physics", New Central Agency (P) Ltd, 2008.
2. Arora C.L., "Practical Physics", S. Chand & Company Ltd., New Delhi, 2013.
3. Umayal Sundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.


| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | **45** | **15** | **30** | **90** |

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PS O1 | PS O 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 1 | | | | | 1 | | | 1 | 3 | 2 |
| **CO 2** | 3 | | 1 | | 1 | | | | | | | 1 | 3 | 3 |
| **CO 3** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | | |
| **CO 4** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 2 | 3 |
| **CO 5** | 3 | | 2 | | | | | | | | | 1 | | |
| **Total** | 15 | 6 | 9 | 6 | 4 | | | | 3 | | | 5 | 8 | 8 |
| **Scaled** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 2 | 2 |

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

| COURSE CODE | | | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| XEG 105 | | | ENGINEERING GRAPHICS | 2 | 0 | 1 | 3 |
| C | P | A | | L | T | P | H |
| 1.75 | 1 | 0.25 | | 2 | 0 | 2 | 4 |

**PREREQUISITE: NIL**

**Course outcomes:**

| | Domain | Level | |
|---|---|---|---|
| **CO1** | Apply the national and international standards, construct and practice various curves | Cognitive, Psychomotor Affective | Applying, Guided response and Responds to Phenomena |
| **CO2** | Interpret, construct and practice orthographic projections of points, straight lines and planes. | Cognitive Psychomotor Affective | Understanding, Mechanism and Responds to Phenomena |
| **CO3** | Construct Sketch and Practice projection of solids in various positions and true shape of sectioned solids. | Cognitive Psychomotor Affective | Applying, Complex Overt Response and Responds to Phenomena |
| **CO4** | Interpret, Sketch and Practice the development of lateral surfaces of simple and truncated solids, intersection of solids. | Cognitive Psychomotor Affective | Understanding, Complex Overt Response and Responds to Phenomena |
| **O5** | Construct sketch and practice isometric and perspective views of simple and truncated solids. | Cognitive Psychomotor Affective | Applying, Complex Overt Response and Responds to Phenomena |

**UNIT-I: INTRODUCTION, FREE HAND SKETCHING OF ENGG. OBJECTS AND CONSTRUCTION OF PLANE CURVE** **6+6**

Importance of graphics in engineering applications – use of drafting instruments – BIS specifications and conventions as per SP 46-2003.Pictorial representation of engineering objects – representation of three-dimensional objects in two-dimensional media – need for multiple views – developing visualization skills through free hand sketching of three-dimensional objects. Polygons & curves used in engineering practice – methods of construction – construction of ellipse, parabola and hyperbola by eccentricity method – cycloidal and involute curves – construction – drawing of tangents to the above curves.

**UNIT –II: PROJECTION OF POINTS, LINES AND PLANE SURFACES** **6+6**

General principles of orthographic projection – first angle projection – layout of views – projections of points, straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection of polygonal surfaces and circular lamina inclined to both the planes of projection.

**UNIT-III: PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS** **6+6**

projection of simple solids like prism, pyramid, cylinder and cone when the axis is inclined to one plane of projection – change of position & auxiliary projection methods – sectioning of above solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections.

**UNIT –IV: DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS** **6+6**

Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes – intersection of solids and curves of intersection –prism with cylinder,

| |
|---|
| cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset |
| **UNIT -V: ISOMETRIC AND PERSPECTIVE PROJECTIONS** **6+6** |
| Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods. |

| | THEORY | PRACTICAL | TOTAL |
|---|---|---|---|
| | **30** | **30** | **60** |

**TEXT BOOKS**

1. Bhatt,N.D, "Engineering Drawing", Charotar Publishing House, 46th Edition-2003.
2. Natarajan,K.V, " A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006 .
3. Dr. P.K. Srividhya, P. Pandiyaraj, "Engineering Graphics", PMU Publications, Vallam, 2013

**REFERENCES**

1. Luzadder and Duff, "Fundamentals of Engineering Drawing" Prentice Hall of India PvtLtd, XI Edition - 2001.
2. Venugopal,K. and Prabhu Raja, V., "Engineering Graphics", New Age International(P) Ltd., 2008.
3. Gopalakrishnan.K.R,. "Engineering Drawing, I & II", Subhas Publications, 1998.
4. Shah,M.B and Rana,B.C.,"Engineering Drawing", Pearson Education,2005.

**E RESOURCES**

1. http://periyarnet/Econtent
2. http://nptel.ac.in/courses/112103019/

**Mapping of COs with POs**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 2 |
| **CO 2** | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| **CO 3** | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| **CO 4** | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| **CO 5** | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| **Total** | 15 | 10 | 7 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 15 | 15 |
| **Scaled value** | 3 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

## SEMESTER II

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XMA 201 | CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE | 3 | 1 | 0 | 4 |

| C | P | A | L | T | P | H |
|---|---|---|---|---|---|---|
| 3 | 0 | 0 | 3 | 1 | 0 | 4 |

**PREREQUISITE: Mathematics I (Calculus and Linear Algebra)**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Find** double and triple integrals and to find line, surface and volume of an integral by **Applying** Greens, Gauss divergence and Stokes theorem. | Cognitive | Applying<br>Remembering |
| CO2 | **Solve** first order differential equations of different types which are solvable for p, y, x and Clairaut's type. | Cognitive | Applying |
| CO3 | **Solve** Second order ordinary differential equations with variable coefficients using various methods. | Cognitive | Remembering |
| CO4 | **Use** CR equations to verify analytic functions and to find harmonic functions and harmonic conjugate.<br>Conformal mapping of translation and rotation. Mobius transformation. | Cognitive<br><br>Psychomotor | Understanding<br>Remembering<br>Guided Response |
| CO5 | **Apply** Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state<br>Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series. | Cognitive<br><br>Affective | Applying<br><br>Receiving |

| **UNIT -I: MULTIVARIABLE CALCULUS (INTEGRATION)** | **12** |
|---|---|
| Multiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. | |
| **UNIT-II: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS** | **12** |
| Exact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equations solvable for p - equations solvable for y- equations solvable for x and Clairaut's type. | |
| **UNIT-III: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS** | **12** |
| Second order linear differential equations with variable coefficients- method of variation of parameters - Cauchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and their properties. | |

| UNIT-IV: COMPLEX VARIABLE – DIFFERENTIATION | 12 |
|---|---|
| Differentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic conjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties- Conformal mappings- Mobius transformations and their properties. | |
| **UNIT-V: COMPLEX VARIABLE – INTEGRATION** | **12** |
| Contour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof)- Liouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's series – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sine and cosine- Evaluation of certain improper integrals using the Bromwich contour. | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | **45** | **15** | **60** |

**TEXT BOOKS**

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th$^{th}$ Edition, 2008.

**REFERENCE BOOKS**


1.G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9$^{th}$ Edition, Pearson, Reprint, 2002.

2. Erwin kreyszig, "Advanced Engineering Mathematics", 9$^{th}$ Edition, John Wiley & Sons, 2006.

3.W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9$^{th}$Edn. Wiley India, 2009.

4. S. L. Ross, "Differential Equations", 3$^{rd}$ Ed., Wiley India, 1984.

5.E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.

6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.

7.J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7$^{th}$ Ed., McGraw Hill, 2004.

8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.


**Mapping of COs with GAs**

| | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | | | 2 | | | | | 1 | | 2 |
| **CO 2** | 3 | 1 | | | | | | | | 1 | | 1 |
| **CO 3** | 3 | 1 | | | | | | | | 1 | | 1 |
| **CO 4** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | | 2 |
| **Total** | 15 | 8 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 0 | 7 |
| **Scaled** | 3 | 2 | | | 1 | | | | | 1 | | |

$1 - 5 \rightarrow 1$, $6 - 10 \rightarrow 2$, $11 - 15 \rightarrow 3$

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XCP 202 | PROGRAMMING FOR PROBLEM SOLVING | 3 | 0 | 2 | 5 |
| **PREREQUISITES** | | **L** | **T** | **P** | **H** |
| C:P: A<br>3:1:1 | | 3 | 0 | 4 | 7 |

| Course Outcomes | | Domain | Level |
|---|---|---|---|
| CO1 | **Define** programming fundamentals and **Solve** simple programs using I/O statements | Cognitive<br>Psychomotor | Remember<br>Understand<br>Apply |
| CO2 | **Define** syntax and **write simple programs** using control structures and arrays | Cognitive<br>Psychomotor | Remember<br>Understand<br>Apply |
| CO3 | **Explain** and **write simple programs** using functions and pointers | Cognitive<br>Psychomotor | Understand<br>Apply |
| CO4 | **Explain** and **write simple programs** using structures and unions | Cognitive<br>Psychomotor | Understand<br>Apply<br>Analyze |
| CO5 | **Explain** and **write simple programs** using files and **Build** simple projects | Cognitive Psychomotor | Remember<br>Understand<br>Create |

## UNIT- I: PROGRAMMING FUNDAMENTALS AND INPUT/ OUTPUT STATEMENTS — 9+6

**Theory**

Introduction to components of a computer system, Program–Flowchart– Pseudocode–Software– Introduction to C language–Character set–Tokens: Identifiers, Keywords, Constants, and Operators– sample program structure-Header files – Data Types-Variables- Output statements –Input statements.

**Practical**

1.Program to display a simple picture using dots.
2.Program for addition of two numbers
3.Program to swap two numbers
4.Program to solve any mathematical formula.

## UNIT- II: CONTROL STRUCTURE AND ARRAYS — 9+6

**Theory**

Control Structures–Conditional Control statements: Branching, Looping-Unconditional control structures: switch, break, continue, goto statements– Arrays: One Dimensional Array–Declaration– Initialization–Accessing Array Elements–Searching–Sorting–Two Dimensional Arrays-Declaration – Initialization– Matrix Operations – Multi Dimensional Arrays-Declaration– Initialization. Storage classes: auto–extern–static. Strings: Basic operations on strings.

**Practical**

1. Program to find greatest of 3 numbers using Branching Statements
2. Program to display divisible numbers between n1and n2 using looping Statement
3. Program to remove duplicate element in an array.
4. Program to perform string operations.

**5.** Performing basic sorting algorithms

| **UNIT- III: FUNCTIONS AND POINTERS** | **9+6** |
|---|---|

**Theory**

Functions: Built in functions–User Defined Functions-Parameter passing methods-Passing arrays to functions–Recursion-Programs using arrays and functions. Pointers-Pointer Declaration-Address Operator-Pointer expressions & pointer arithmetic-Pointers and function-Call by value-Call by Reference-Pointer to arrays-Use of Pointers in self-referential structures-Notion of linked list (no implementation).

**Practical**

1.Program to find factorial of a given number using four function types.

2.Programs using Recursion such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort

3.Programs using Pointers

| **UNIT -IV: STRUCTURES AND UNION** | **9+6** |
|---|---|

**Theory**

Structures and Unions -Giving values to members-Initializing Structure-Functions and structures-Passing structure to elements to functions- Passing entire function to functions- Arrays of structure - Structure within a structure and Union.

**Practical**

1.Program to read and display student mark sheet Structures with variables

2.Program to read and display student marks of a class using Structures with arrays

3.Program to create linked list using Structures with pointers

| **UNIT- V: FILES** | **9+6** |
|---|---|

**Theory**

File management in C-File operation functions in C-Defining and opening a file- Closing a file-The getw and putw functions- The fprintf & fscanf functions - fseek function– Files and Structures.

**Practical**

1.Program for copying contents of one file to another file.

2.Program using files using structure with pointer

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **0** | **30** | **75** |

**TEXT BOOKS/ REFERENCES**


1.ByronGottfried,"ProgrammingwithC", III Edition, (Indian Adapted Edition), TMH publications, 2010

2. Yeshwant Kanethker, "Let us C", BPB Publications, 2008

3. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. 2005

4. Behrouz A. Forouzan and Richard. F. Gilberg,"A Structured Programming Approach Using C", II Edition, Brooks–Cole Thomson Learning Publications, 2001

5. Johnsonbaugh R. and Kalin M., "Applications Programming in ANSIC", III Edition, Pearson Education India, 2003

6. E. Balaguruswamy, Programming in ANSIC, Tata McGraw-Hill

## Mapping of COs with POs

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 2 | 2 | 2 | 1 | | | | | | | | 1 | 0 |
| **CO 2** | 2 | - | 2 | 1 | | | | | | | | 1 | | 1 |
| **CO 3** | 2 | | | | | | | 1 | | | | | | 1 |
| **CO 4** | 2 | 2 | 2 | | 1 | 1 | 1 | | | 1 | | | | |
| **CO 5** | 2 | | | | | | | 1 | | 1 | | | | |
| **Total** | 10 | 4 | 6 | 3 | 2 | 1 | 1 | 2 | | 2 | | 1 | 1 | 2 |
| **Scaled** | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | SS | C |
|---|---|---|---|---|---|---|
| XGS 203 | ENGLISH | 2 | 0 | 1 | 0 | 3 |
| Pre-requisites (if any) | | L | T | P | SS | H |
| C: P: A<br>2.6:0.4:0 | | 2 | 0 | 2 | 0 | 4 |

| Course Outcomes (XGS 203): | | Domain | Level |
|---|---|---|---|
| CO1 | **Ability** to recall the meaning for proper usage | Cognitive | Remember |
| CO2 | **Apply** the techniques in sentence patterns | Cognitive | Apply |
| CO3 | **Identify** the common errors in sentences | Cognitive | Remember |
| CO4 | **Construct** the Nature and Style of sensible Writing | Cognitive | Create |
| CO5 | **Practicing** the writing skills | Psychomotor | Guided Response |
| CO6 | **Grasping** the techniques in learning sounds and etiquettes | Psychomotor | Adapting |

| | |
|---|---|
| **UNIT -I: VOCABULARY BUILDING** | **9** |
| 1.1 The concept of Word Formation<br>1.2 Root words from foreign languages and their use in English<br>1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives<br>1.4 Synonyms, antonyms, and standard abbreviations. | |
| **UNIT -II: BASIC WRITING SKILLS** | **9** |
| 2.1 Sentence Structures<br>2.2 Use of phrases and clauses in sentences<br>2.3 Importance of proper punctuation<br>2.4 Creating coherence<br>2.5 Organizing principles of paragraphs in documents<br>2.6 Techniques for writing precisely | |
| **UNIT -III: IDENTIFYING COMMON ERRORS IN WRITING** | **9** |
| 3.1 subject-verb agreement<br>3.2 Noun-pronoun agreement<br>3.3 Misplaced modifiers<br>3.4 Articles<br>3.5 Prepositions<br>3.6 Redundancies<br>3.7 Clichés | |
| **UNIT -IV: NATURE AND STYLE OF SENSIBLE WRITING** | **9** |
| 4.1 Describing<br>4.2 Defining<br>4.3 Classifying<br>4.4 Providing examples or evidence<br>4.5 Writing introduction and conclusion | |
| **UNIT -V: WRITING PRACTICES** | **9** |
| 5.1 Comprehension<br>5.2 Précis Writing<br>5.3 Essay Writing | |
| **UNIT VI - ORAL COMMUNICATION**<br>(This unit involves interactive practice sessions in Language Lab)<br>• Listening Comprehension | |

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

| | LECTURE | PRACTICAL | TOTAL |
|---|---|---|---|
| | 30 | 30 | 60 |

**Suggested Readings:**

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

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PS O1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO2** | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO3** | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO4** | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 7 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| **Scaled** | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

1-5= 1, 6-10 = 2, 11-15= 3

0-No Relation, 1- Low Relation, 2 – Medium Relation, 3- High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| **XAC 204** | **APPLIED CHEMISTRY FOR ENGINEERS** | **3** | **1** | **1** | **5** |
| **PREREQUISITES** | **Nil** | **L** | **T** | **P** | **H** |
| **C:P: A** | | **3** | **1** | **2** | **6** |

| 3.5:1.0:0.5 | | | |
|---|---|---|---|
| **Course Outcomes (XAC 204):** | | **Domain** | **Level** |
| **CO1** | **Identify**the periodic properties such as ionization energy, electron affinity, oxidation states and electro negativity. **Describe** the various water quality parameters like hardness and alkalinity. | Cognitive<br>Psychomotor | Remember<br>Perception |
| **CO2** | **Explain** and **Measure** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces. | Cognitive<br>Psychomotor | Understand<br>Set |
| **CO3** | **Interpret** bulk properties and processes using thermodynamic and kinetic considerations. | Cognitive<br>Psychomotor<br>Affective | Apply<br>Mechanism<br>Receive |
| **CO4** | **Describe, Illustrate** and **Discuss** the chemical reactions that are used in the synthesis of molecules. | Cognitive<br><br>Psychomotor<br>Affective | Remember<br>Analyze<br>Perception<br>Respond |
| **CO5** | **Apply, Measure** and **Distinguish** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques | Cognitive<br><br>Psychomotor | Remember<br>Apply<br>Mechanism |
| **UNIT – I: PERIODIC PROPERTIES AND WATER CHEMISTRY** | | | **8+3+6** |
| Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **Water Chemistry**-Water quality parameters-Definition and explanation of hardness, determination of hardness by EDTA method-Introduction to alkalinity. | | | |
| **UNIT–II: USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA** | | | **12+3+6** |
| Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion-Types, factors affecting corrosion rate and Control methods. Use of free energy considerations in metallurgy through Ellingham diagrams. Advantages of electroless plating, electroless plating of nickel and copper on Printed Circuit Board (PCB). | | | |
| **UNIT–III: ATOMIC AND MOLECULAR STRUCTURE** | | | **10+3+6** |
| Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.<br>**Intermolecular forces and potential energy surfaces**<br>Ionic, dipolar and Vander waals interactions. Equations of state of real es and critical phenomena. Potential energy surfaces of $H_3$, $H_2F$ and HCN and trajectories on these surfaces. | | | |
| **UNIT-IV: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS** | | | **7+3+6** |
| Principles of spectroscopy and selection rules. Electronic spectroscopy-chromophore, auxochromes, types of electronic transition and application. Fluorescence and its applications in medicine. Vibrational spectroscopy-types of vibrations, Instrumentation and applications. Rotational spectroscopy of diatomic molecules. Nuclear magnetic resonance spectroscopy-concept of chemical shift and applications-magnetic resonance imaging. Diffraction and scattering. | | | |
| **UNIT–V: STEREOCHEMISTRY AND ORGANIC REACTIONS** | | | **8+3+6** |

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

**Organic reactions and synthesis of a drug molecule**

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

| LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|
| 45 | 15 | 30 | 90 |

**TEXT BOOKS**


1. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., 1993
2. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science, 2006.
3. Trapp. C, Cady, M. Giunta. C, Atkins's Physical Chemistry, 10th Edition, Oxford publishers, 2014.
4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd, 1983.
5. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., 1976.
6. Banwell. C.N, Fundamentals of Molecular Spectroscopy, (3th Edition), McGraw-Hill Book Company, Europe 1983.
7. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (4th edition), S./ Chand & Company Ltd. New Delhi, 1977.
8. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age International Publishers, 2017.


**REFERENCE BOOKS**

**E RESOURCES** - MOOCs:

1. http://www.mooc-list.com/course/chemistry-minor-saylororg
2. https://www.canvas.net/courses/exploring-chemistry
3. http://freevideolectures.com/Course/2263/Engineering-Chemistry-I
4. http://freevideolectures.com/Course/3001/Chemistry-I
5. http://freevideolectures.com/Course/3167/Chemistry-II

6. http://ocw.mit.edu/courses/chemistry/

**Mapping of COs with POs**

| | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 1 | 2 |
| **CO2** | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 1 | 1 |
| **CO3** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| **CO4** | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| **CO5** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 14 | 0 | 0 | 0 | 0 | 0 | 10 | 13 | 14 | 0 | 0 | 0 | 2 | 3 |
| **Scaled** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 1 | 1 |

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

0-No Relation, 1- Low Relation, 2-Medium Relation, 3-High Relation

| COURSE CODE | | | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| XWP 205 | | | WORKSHOP PRACTICES | 1 | 0 | 2 | 3 |
| C | P | A | | L | T | P | H |

| 1 | 2 | 0 | | 1 | 0 | 4 | 5 |
|---|---|---|---|---|---|---|---|

**PREREQUISITE:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| **CO1** | **Summarize** the machining methods and **Practice** machining operation. | Cognitive<br>Psychomotor | Understanding<br>Guided response |
| **CO2** | **Defining** metal casting process, moulding methods and **relates** Casting and Smithy applications. | Cognitive<br>Psychomotor | Remembering<br>Perception |
| **CO:** | **Plan** basic carpentry and fitting operation and **Practice** carpentry and fitting operations. | Cognitive<br>Psychomotor | Applying<br>Guided response |
| **CO4** | **Summarize** metal joining operation and **Practice** welding operation. | Cognitive<br>Psychomotor | Understanding<br>Guided response |
| **CO5** | **Illustrate** the, electrical and electronics basics and **Makes** appropriate connections**.** | Cognitive<br>Psychomotor | Understanding<br>Origination |

**COURSE CONTENT**

| EXP.NO. | TITLE | CO RELATION |
|---|---|---|
| 1 | Introduction to machining process | CO1 |
| 2 | Plain turning using lathe operation | CO1 |
| 3 | Introduction to CNC | CO1 |
| 4 | Demonstration of plain turning using CNC | CO1 |
| 5 | Study of metal casting operation | CO2 |
| 6 | Demonstration of moulding process | CO2 |
| 7 | Study of smithy operation | CO2 |
| 8 | Study of carpentry tools | CO3 |
| 9 | Half lap joint – Carpentry | CO3 |
| 10 | Mortise and Tenon joint – Carpentry | CO3 |
| 11 | Study of fitting tools | CO3 |
| 12 | Square fitting | CO3 |
| 13 | Triangular fitting | CO3 |
| 14 | Study of welding tools | CO4 |
| 15 | Square butt joint - welding | CO4 |
| 16 | Tee joint – Welding | CO4 |
| 17 | Introduction to house wiring | CO5 |
| 18 | One lamp controlled by one switch | CO5 |
| 19 | Two lamps controlled by single switch | CO5 |
| 20 | Staircase wiring | CO5 |

| | LECTURE | PRACTICAL | TOTAL |
|---|---|---|---|
| | **15** | **60** | **75** |

**TEXT BOOKS**

1. Workshop Technology I, II, III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay
2. Workshop Technology by Manchanda Vol. I, II, III India Publishing House, Jalandhar.

**REFERENCES**

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi
3. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

**E RESOURCES**

1. **http://nptel.ac.in/courses/112107145/**

**Mapping of COs with POs**

| | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **CO2** | 2 | 1 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| **CO3** | 1 | 2 | 0 | 3 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 |
| **CO4** | 1 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| **CO5** | 2 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **Total** | 9 | 10 | 1 | 11 | 11 | 0 | 0 | 0 | 14 | 0 | 1 | 0 | 7 | 7 |
| **Scaled** | 2 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 2 |

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

0-No Relation, 1- Low Relation, 2-Medium Relation, 3-High Relation

**SEMESTER III**

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XEE 301** | **ELECTRICAL CIRCUIT ANALYSIS** | **3** | **1** | **1** | **5** |
| **C:P: A** | | **L** | **T** | **P** | **CH** |
| **3:1:0** | | **3** | **1** | **2** | **6** |

| **Course Outcomes (XEE 301):** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | Apply network theorems for the analysis of electrical circuits. Respond network theorems for the analysis of electrical circuits. | Cognitive Psychomotor | Apply Guided Response |

| | | | |
|---|---|---|---|
| **CO2** | Comparing the transient and steady-state response of R, RL and RLC electrical circuits.<br>Describe the transient and steady-state response of RL and RC electrical circuits. | Cognitive Psychomotor | Understand Perception |
| **CO3** | Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).<br>Construct and analyze of Single-phase transformer for its Sinusoidal response | Cognitive Psychomotor | Analyze Mechanism |
| **CO4** | Laplace transforms analysis of ac circuits.<br>Construct and analyze of RLC Series and parallel resonance circuits. | Cognitive Psychomotor | Analyze Mechanism |
| **CO5** | To Understand the concept of one port and two port network functions. | Cognitive | Understanding |

| **UNIT- I: NETWORK THEOREMS** | **09+03** |
|---|---|

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

**List of Experiments**

1.Verification of KVL and KCL
2.Verification of Thevenin theorem
3.Verification of Norton theorem
4.Verification of Maximum power transfer theorem

| **UNIT- II: SOLUTION OF FIRST AND SECOND ORDER NETWORKS** | **08+03** |
|---|---|

Solution of first and second order differential equations for Series and parallel R-L, R-C, RL-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

**List of Experiments**

5.Transient analysis of Series RL, RC circuits
6.Sinusoidal analysis of Series RL, RC circuits

| **UNIT- III: SINUSOIDAL STEADY STATE ANALYSIS** | **08+03** |
|---|---|

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

**List of Experiments**

7.Measurement of active power for star and delta connected balanced loads
8.Verification of self, mutual inductance and coefficient of coupling

| **UNIT- IV: ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS** | **08+03** |
|---|---|

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

**List of Experiments**

9.RLC Series and parallel Resonance

| | |
|---|---|
| **UNIT- V: NETWORK FUNCTIONS AND TWO PORT NETWORKS** | **12+03** |
| Concepts of complex frequency, Transform impedance, Networks function of one port and two port networks, concepts of poles and zeros, property of driving point and transfer function. Two Port Networks, terminal pairs, Relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks. | |

| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | **45** | **15** | **30** | **90** |

**TEXTBOOKS**

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.

**REFERENCES**

1. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
2. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.

**E REFERENCES**

1. NPTEL: http://nptel.ac.in/courses/108102042/
2. MOODLE: http://moodle.cecs.pdx.edu/course/view.php?id=16

**REFERENCES**

1. Department Lab Manual
2. Sudhakar.A and Shyam Mohan.S.P, “Circuits and Networks Analysis and Synthesis”, Fourth edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | | | | | | | | | 1 | | 1 | 1 | 1 |
| **CO 2** | 3 | | | | | | | | | 1 | | 1 | 2 | 1 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | 1 | 2 | 3 | 1 |
| **CO 4** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 3 | 3 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 2 | 2 |
| **Total** | 15 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 3 | 6 | 11 | 8 |
| **Scaled** | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 2 |

0 –No Relation  1 – Low Relation  2 – Medium Relation  3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XEE 302 | ANALOG ELECTRONICS | 3 | 0 | 1 | 4 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 0 | 2 | 5 |

| Course Outcomes (XEE 302): | | Domain | Level |
|---|---|---|---|
| CO1 | Understand the characteristics of diode and analyze the rectifier circuits. | Cognitive<br>Psychomotor | Understand<br>Analyze<br>Guided Response |
| CO2 | Understand the characteristics of transistor. | Cognitive<br>Psychomotor | Understand<br>Mechanism |
| CO3 | Understand the concept of MOSFET and analyze the circuits and its characteristics | Cognitive<br>Psychomotor | Understand<br>Analyze<br>Mechanism |
| CO4 | Classify and explain different types of amplifier | Cognitive<br>Psychomotor | Understand<br>Mechanism |
| CO5 | Recall and explain linear and non-linear application of OP-AMP | Cognitive<br>Psychomotor | Understand<br>Mechanism |

**UNIT- I: DIODE CIRCUITS** **9+9**

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

**List of Experiments**

1. Design of full wave rectifier with and without filter.
2. Design of bridge rectifier circuits using with and without filter.
3. Conduct an experiment to test clipping and clamping circuits.

**UNIT- II: BJT CIRCUITS** **8+3**

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.

**List of Experiments**

4. Design of BJT common emitter amplifier using voltage divider bias with and without feedback.

**UNIT- III: MOSFET CIRCUITS** **8+3**

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit.

**List of Experiments**

5.Plot the drain and transfer characteristics of MOSFET.

**UNIT- IV: DIFFERENTIAL, MULTI-STAGE AND OPERATIONAL AMPLIFIERS** **8+3**

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)

**List of Experiments**

6. Conduct experiment on differential amplifier

**UNIT -V: LINEAR AND NONLINEAR APPLICATIONS OF OP-AMP** **9+15**

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wien bridge and phase shift). Analog to Digital Conversion. Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector, Monoshot.

**List of Experiments**

7.Design of Phase shift and Wien bridge oscillators using OP-AMP.
8.Conduct experiment on Inverting, Non inverting amplifier using OP-AMP.
9.Conduct experiment on astable and monostable multivibrator using OP-AMP.
10.Conduct experiment on integrator and differentiator circuit using OP-AMP.
11.Conduct experiment on Schmitt trigger circuit using OP-AMP.

| | LECTURE | PRACTICAL | TOTAL |
|---|---|---|---|
| | 45 | 30 | 75 |

**TEXTBOOKS**


1. A. S. Sedra and K. C. Smith, "Microelectronic Circuits", New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.


**REFERENCES**


1. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
2. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.
3. Department Lab Manual.


**E REFERENCES**

1. www.nptel.ac.in.

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | | | | | | | | | 1 | | 1 | 2 | 2 |
| **CO 2** | 3 | | | | | | | | | 1 | | 1 | 2 | 2 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | 1 | 2 | 2 | 2 |
| **CO 4** | 2 | 2 | | | 1 | | | | | 1 | 1 | 1 | 2 | 2 |
| **CO 5** | 3 | 1 | | | 2 | | | | | 1 | 1 | 1 | 2 | 2 |
| **Total** | 14 | 5 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 3 | 6 | 10 | 10 |
| **Scaled** | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XEE 303 | ELECTRICAL MACHINES - I | 3 | 1 | 1 | 5 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 1 | 2 | 6 |

| Course Outcomes (XEE 303): | | Domain | Level |
|---|---|---|---|
| **CO1** | Understand the operation of DC machines. | Cognitive Psychomotor | Understand Perception |
| **CO2** | Understand the winding concepts of DC machine. | Cognitive Psychomotor | Understand Complex Overt |

| | | | |
|---|---|---|---|
| | | | Response |
| **CO3** | Understand the motoring and generating concepts of DC machine. | Cognitive Psychomotor | Understand Set |
| **CO4** | Analyse single phase and three phase transformers circuits. | Cognitive Psychomotor | Analyse Set |
| **CO5** | Understand the various loss in magnetic circuits | Cognitive Psychomotor | Understand Set |

| **UNIT -I: INTRODUCTION TO DC MACHINES** | **9+3+6** |
|---|---|
| Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil.<br>**List of Experiments**<br>1. Study of D.C. Motor Starters. | |
| **UNIT- II: DC MACHINES – ARMATURE AND WINDING** | **9+3+6** |
| Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction. | |
| **UNIT- III: DC MACHINE - MOTORING AND GENERATION** | **8+3+6** |
| Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines<br>**List of Experiments**<br>2. Open Circuit Characteristics (OCC) and load Characteristics of D.C self-excited generator.<br>3. Load characteristics of D.C shunt generator<br>4. Load characteristics of D.C. shunt motor.<br>5. Load characteristics of D.C series motor.<br>6. Speed control of D.C shunt motor. | |
| **UNIT -IV: TRANSFORMERS AND TEST** | **10+3+6** |
| Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test- separation of hysteresis and eddy current losses<br>**List of Experiments**<br>7.Load test on single-phase transformer. | |

| |
|---|
| 8. Open circuit and short circuit tests on single phase transformer. |
| Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current. |

| **UNIT -V: AUTOTRANSFORMERS** | **9+3+6** |
|---|---|
| Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current. | |

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **15** | **30** | **90** |

| **Course Outcomes (XEE 304):** | **Domain** | **Level** |
|---|---|---|

| **TEXTBOOKS** |
|---|
| 1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.<br>2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004. |
| **REFERENCES** |
| 1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.<br>2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.<br>3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010. |

**Mapping of COs with POs**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 1 | 0 |
| **CO 2** | 3 | - | 2 | 1 | | | | 1 | | | | 1 | | 1 |
| **CO 3** | 3 | | | 1 | | | | 1 | | | 1 | | | 1 |
| **CO 4** | 3 | 2 | 2 | 2 | 1 | | 1 | | | 1 | | 1 | | 1 |
| **CO 5** | 3 | | | 1 | | | | | | 1 | | | | 1 |
| **Total** | 15 | 4 | 6 | 7 | 2 | 0 | 1 | 2 | 1 | 2 | 1 | 3 | 1 | 4 |
| **Scaled** | 3 | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| | | | |
|---|---|---|---|
| **CO1** | To understand the basics of vector and outline different coordinate system. | Cognitive | Remembering Understanding |
| **CO2** | To understand the concept of static electric field for simple configuration using gauss and Coulombs law. | Cognitive | Understanding |
| **CO3** | Define the knowledge of electrostatics using, boundary conditions, Poissons and Laplace equation. | Cognitive | Understanding |
| **CO4** | Recall the magnetic field configuration using Different laws and outline time varying electric and magnetic fields using Maxwell's equation. | Cognitive | Remembering Understanding |
| **CO5** | Recall the concept of magnetization and magnetic field configuration using boundary condition. | Cognitive | Understanding |

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XEE 304** | **ELECTROMAGNETIC FIELDS** | **3** | **1** | **0** | **4** |
| **C:P: A = 3:0:0** | | **L** | **T** | **P** | **H** |
| | | **3** | **1** | **0** | **4** |

| **UNIT- I: REVIEW OF VECTOR CALCULUS** | **9+3** |
|---|---|
| Vector algebra-addition, subject traction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another. | |
| **UNIT- II: STATIC ELECTRIC FIELD** | **9+3** |
| Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density. | |
| **UNIT -III: CONDUCTORS, DIELECTRICS AND CAPACITANCE** | **9+3** |
| Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations. | |
| **UNIT -IV: STATIC MAGNETIC FIELDS, TIME VARYING FIELDS AND MAXWELL'S EQUATIONS** | **9+3** |
| Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Condit ions. Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic circuits, inductances and mutual inductances. | |
| **UNIT -V: ELECTROMAGNETIC WAVES** | **9+3** |
| Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem. | |

| **LECTURE** | **TUTORIAL** | **TOTAL** |
|---|---|---|
| **45** | **15** | **60** |

**TEXTBOOKS**


1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.

| REFERENCES |
|---|
| 1. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.<br>2. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.<br>3. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press,1966.<br>4. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.<br>5. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012. |
| **REFERENCES** |
| 1. NPTEL: http://nptel.ac.in/courses |

**Mapping of COs with POs**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 1 |
| **CO2** | 1 | 2 | - | 1 | - | - | - | - | - | - | 1 | - | 2 | 1 |
| **CO3** | 1 | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |
| **UNIT- I: TRANSMISSION LINE PARAMETERS** | | | | | | | | | | | | | **09** | |
| **CO4** | 1 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO5** | 1 | 2 | 1 | - | - | - | - | | - | - | - | 1 | 1 | 1 |
| **Total** | 6 | 11 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 7 | 7 |
| **Scaled** | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XEE 305** | **TRANSMISSION AND DISTRIBUTION** | **3** | **0** | **0** | **3** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **3:0:0** | | **3** | **0** | **0** | **3** |

| **Course Outcomes (XEE 305):** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | **Explain** the major components of Transmission and Distribution Systems (TDS). **Classify** different types of single and three phase transmission line parameters. | Cognitive | Understanding<br>Understanding |
| **CO2** | **Outline** the types of transmission line efficiency calculations and its performance | Cognitive | Understanding |
| **CO3** | **Explain** the different types of insulators and **solve** for stress and sag in overhead lines. | Cognitive | Understanding<br>Applying |
| **CO4** | **Interpret** different type's underground cables. | Cognitive | Understanding |
| **CO5** | **Summarize the latest technologies in the field of distribution systems.** | Cognitive | Understanding |

| |
|---|
| Structure of electric power system: Various levels such as generation, transmission and distribution; – Resistance, Inductance and Capacitance calculations – Single-phase and three-phase lines – double circuit lines – effect of earth on transmission line capacitance. |
| **UNIT- II: PERFORMANCE OF TRANSMISSION LINES** **09** |
| Regulation and efficiency – Tuned power lines, Power flow through a transmission line – Power circle diagrams, Introduction to Transmission loss and Formation of corona – critical voltages – effect on line performance – travelling waveform phenomena. |
| **UNIT- III: MECHANICAL DESIGN OF OVERHEAD LINES** **09** |
| Line supports – Insulators, Voltage distribution in suspension insulators – Testing of insulators – string efficiency – Stress and sag calculation – effects of wind and ice loading. |
| **UNIT -IV: UNDERGROUND CABLES** **09** |
| Comparison with overhead line – Types of cables – insulation resistance – potential gradient – capacitance of single-core and three-core cables. |
| **UNIT- V: DISTRIBUTION SYSTEM** **09** |
| General aspects – Kelvin's Law – A.C. distribution – Single-phase and three phase – Techniques of voltage control and power factor improvement – Introduction to Distribution loss – Recent trends in transmission and distribution systems |

| LECTURE | TUTORIAL | TOTAL |
|---|---|---|
| 45 | 0 | 45 |

**TEXTBOOKS**

1.D.P. Kothari and I.J. Nagrath, 'Power System Engineering', Tata McGraw–Hill,2 nd Edition, 2008.
2. B.R.Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.
3. S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall India Pvt. Ltd, 2002.

**REFERENCES**

1. Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.
2. Hadisaddak, 'Power System Analysis,' Tata McGraw Hill Publishing Company',2003
3. Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi
4. Tamil Nadu Electricity Board Handbook', 2012.

**E REFERENCES**

1. NPTEL, Power System Generation, Transmission and Distribution Prof. D. P. Kothari Center for Energy Studies Indian Institute of Technology, Delhi.

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | | | | | | | | 1 | | 2 | 2 | 1 |
| **CO2** | 1 | 3 | 1 | | 1 | | | | | | | 1 | 3 | 1 |
| **CO3** | 1 | | | 1 | 1 | | | | | 1 | | | 2 | 1 |
| **CO4** | 1 | 2 | | | | | | | | | 1 | 1 | 2 | 1 |
| **CO5** | 1 | 2 | | | | | | | | | | 1 | 2 | 1 |
| **Total** | 5 | 10 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 2 | 1 | 5 | 11 | 5 |
| **Scaling** | 2 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 2 |

0 – No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XEE 401 | MATHEMATICS – III (PROBABILITY AND STATISTICS) | 3 | 1 | 0 | 4 |
| C:P: A = 3.5:2.5:2.5 | | L | T | P | CH |
| | | 3 | 1 | 0 | 4 |

| Course Outcomes (XPS 401): | | Domain | Level |
|---|---|---|---|
| CO1 | **Explain** conditional probability, independent events; **find** expected values and Moments of Discrete random variables with their properties. | Cognitive | Understanding<br>Remembering |
| CO2 | **Find** distribution function, Marginal density function, conditional density function and to **define** density function of conditional distribution functions normal, exponential and gamma distributions. | Cognitive | Remembering |
| CO3 | **Determine** the statistical parameters of Binomial, Poisson and Normal and to find correlation, regression and Rank Correlation coefficient of two variables.<br>Moments, skewness and Kurtosis. | Cognitive<br>Psychomotor | Understanding<br><br>Guided Response |
| CO4 | **Explain** large sample test for single proportion, difference of proportion, single mean, difference of means and difference of standard deviations with simple problems. | Cognitive | Understanding |
| CO5 | **Explain** small sample test for single mean, difference of mean and correlation coefficients, variance test, chi square test with simple problems. | Cognitive<br><br>Affective | Understanding<br><br>Receiving |

**Learning Objectives**

1. Appreciate the importance of probability and statistics in computing and research
2. Develop skills in presenting quantitative data using appropriate diagrams, tabulations and summaries
3. Use appropriate statistical method in the analysis of simple datasets.
4. Interpret and clearly present output from statistical analyses in a clear concise and understandable manner
5. The main objective of this course is to provide students with the foundations of probabilities and statistical analysis mostly used in varied applications in engineering and science like disease modeling, climate prediction and computer networks etc.

| | | | |
|---|---|---|---|
| **UNIT - I: BASIC PROBABILITY** | | | **12** |
| | | | |
| Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality | | | |
| **UNIT-II: CONTINUOUS PROBABILITY DISTRIBUTIONS & BIVARIATE DISTRIBUTIONS** | | | **12** |
| Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule. | | | |
| **UNIT - III: BASIC STATISTICS** | | | **12** |
| Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation | | | |
| **UNIT- IV: APPLIED STATISTICS** | | | **12** |
| Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. | | | |
| **UNIT-V: SMALL SAMPLES** | | | **12** |
| Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes | | | |
| | **LECTURE** | **TUTORIAL** | **TOTAL** |
| | **45** | **15** | **60** |

**Mapping of COs Vs GAs**

**TEXTBOOKS**

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, 2015.
2. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
3. Veerarajan T., "Probability, Statistics and Random processes", Tata McGraw-Hill, New Delhi, 2010.

**REFERENCES**

1. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall, 2003.
2. S. Ross, "A First Course in Probability", Pearson Education India, 2002.
3. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, Wiley, 1968.
4. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 2006.

**E REFERENCES**

**nptel**
Probability and Statistics by Prof.Somesh kumar, Department of Mathematics, IIT Kharagpur. (http://nptel.ac.in/noc/noc_courselist.php)

| | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 1 | | | | | | 1 | 1 | | 1 |
| **CO 2** | 3 | 2 | 1 | | | | | | 1 | 1 | | 1 |
| **CO 3** | 3 | 2 | 1 | 1 | | | | | 1 | 1 | | 1 |
| **CO 4** | 3 | 2 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | 1 |
| **CO 5** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 |
| **Total** | 15 | 10 | 5 | 3 | 2 | 2 | 1 | | 5 | 5 | 2 | 5 |
| **Scaled** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 |

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XEE 402 | DIGITAL ELECTRONICS | 3 | 0 | 1 | 4 |

| C:P: A | | L | T | P | CH |
|---|---|---|---|---|---|
| 2:1:0 | | 3 | 0 | 2 | 5 |

| Course Outcomes (XEE 402): | | Domain | Level |
|---|---|---|---|
| **CO1** | To Understand numerical values in various number systems and show number conversions between different number Systems. | Cognitive Psychomotor | Understanding Guided Response |
| **CO2** | To Analyze Boolean functions and minimization techniques using k –maps and postulates and theorems of Boolean Algebra, minimization of Boolean functions using basic laws. | Cognitive Psychomotor | Analyze Perception |
| **CO3** | To Apply Logic gates and their applications and construct the simple adders and subtractors using logic gates. | Cognitive Psychomotor | Apply Mechanism |
| **CO4** | To Understand the process of Analog to Digital conversion and its applications. | Cognitive Psychomotor | Understanding Mechanism |
| **CO5** | To Understand the process of Digital to Analog conversion and its applications. | Cognitive Psychomotor | Understanding Mechanism |

**UNIT - I: FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES** **9+9**

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families.

**List of Experiments**

1.Verification and study of logic gates.

2. Binary to Gray and Gray to binary code converters.

3.Excess -3 to BCD and vice-versa code converters.

**UNIT - II: COMBINATIONAL DIGITAL CIRCUITS** **9+6**

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders Q-M method of function realization.

**List of Experiments**

3. Implementation and verification of Multiplexers and Demultiplexer using logic gates.

4. Implementation and verification of Encoders and Decoders using logic gates.

**UNIT - III: SEQUENTIAL CIRCUITS AND SYSTEMS** **9+6**

A 1-bit memory, the circuit properties of Bistable latch, JK, SR, D and T types flip-flops, applications of flip-flops, shift registers, applications of shift registers, Asynchronous counters, synchronous counters design using flip flops, special counter IC's, applications of counters.

**List of Experiments**

5.Design and verify operation of Half / Full adder.

6.Design and verify operation of Half/Full Subtractor.

**UNIT- IV: A/D AND D/A CONVERTERS** **9+6**

Digital to analog converters: weighted resistor/converter, R-2R Ladder DAC, specifications for D/A converters, examples of DAC ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator ADC, successive approximation ADC, specifications of ADC, example of ADC ICs.

**List of Experiments**

8.Verification of state tables of RS, JK, T and D flip flops using NAND and NOR gates.

| **UNIT-V: SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES** | **9+3** |
|---|---|

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, ROM, RAM, content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, PLA, PAL, CPLDS, and FPGA.

**List of Experiments**

9. Shift registers and Counters**.**

| **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|
| **45** | **0** | **30** | **75** |

**TEXTBOOKS**


1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.


**REFERENCES**


5. Taub and Schilling, 'Digital Integrated Circuits', McGraw Hill, 2002.
6. Samuel C. Lee “Digital Circuits and Logic Designs” Prentice Hall of India; 2000.
7. Fletcher, W.I., 'An Engineering Approach to Digital Design', Prentice Hall of India, 2002.
8. Anand Kumar, Fundamental of Digital circuits, PHI 2003.


**E REFERENCES**


**1.** NPTEL, Digital Logic Circuits, Prof. S.Srinivasan, IIT Madras.

**2.** NPTEL, Digital Logic Circuits, Prof. D. Roychoudhury, IIT Kharagpur.


**Mapping of COs with POs**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 1 | 3 | - | - | 1 | 1 | 1 | - | 1 | - | 2 | 2 | 1 |
| **CO 2** | 3 | 2 | 1 | - | - | 2 | 0 | 2 | 1 | - | - | 2 | 1 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 3** | 2 | 2 | 1 | - | - | 1 | 2 | 2 | 1 | 1 | - | 1 | 2 | 2 |
| **CO 4** | 2 | 2 | 3 | - | - | 1 | 1 | 1 | - | - | 1 | 1 | 1 | 2 |
| **CO 5** | 3 | 2 | 2 | - | - | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| **Total** | 12 | 9 | 10 | - | - | 5 | 5 | 7 | 3 | 3 | 2 | 8 | 8 | 9 |
| **Scaled** | 3 | 2 | 2 | 0 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XEE 403** | **POWER ELECTRONICS** | **3** | **0** | **1** | **4** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **2:1:0** | | **3** | **0** | **2** | **5** |

| **Course Outcomes (XEE 403):** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | To Understand the structure, operation and characteristics of power switching devices. | Cognitive Psychomotor | Understanding Response |
| **CO2** | Determine the operation, characteristics and performance parameters of controlled rectifiers. | Cognitive Psychomotor | Understanding Mechanism |
| **CO3** | Analysis the operation of DC - DC choppers. | Cognitive | Analyzing |

| | | | |
|---|---|---|---|
| | | Psychomotor | Mechanism |
| **CO4** | Analysis the operation of various inverters and infer the suitable PWM techniques. | Cognitive Psychomotor | Analyzing Mechanism |
| **CO5** | To Understand the concept of various types of AC voltage controllers. | Cognitive Psychomotor | Understanding Mechanism |

**UNIT – I: POWER SWITCHING DEVICES** **9+9**

Review on Semiconductor devices – I-V characteristics and Switching Characteristics of power Diodes, SCR, TRIAC, power BJT, power MOSFET and IGBT. Triggering and Commutation Circuits.

**List of Experiments**

1.Characteristics of SCR
2.Characteristics of MOSFET
3.Characteristics of IGBT

**UNIT – II: THYRISTOR RECTIFIERS** **9+3**

Single phase half-wave and full-wave thyristor 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.

**List of Experiments**

4. Single phase fully controlled rectifier with R, RL load

**UNIT – III: DC TO DC CHOPPERS** **9+6**

Types of Choppers, Class A to E, step-up and step-down choppers – Analysis of Voltage, Current and Load commutated choppers –Introduction to Resonant converters

**List of Experiments**

5.BUCK- BOOST converter using MOSFET.
6.IGBT based choppers

**UNIT – IV: INVERTERS** **9+6**

Single phase, Three phase voltage source inverters (Both 120º and 180º mode of conductions) – Bipolar sinusoidal modulation and unipolar sinusoidal modulation, Modulation Index - PWM Techniques- Current Source Inverters.

**List of Experiments**

7.Single phase IGBT PWM inverter.
8.Series Inverter/ Parallel Inverter

**UNIT – V:AC VOLTAGE CONTROLLERS** **9+6**

Single-phase and three phase AC voltage controllers -. Multi-stage sequence control – step-up and step-down cycloconverter – Single phase to single phase and Single phase to Three phase cycloconverters.

**List of Experiments**

9.Single phase AC voltage controller using SCR / TRIAC.
10.Single phase cycloconverter.
11.Mini project: Design of basic power converter circuits**.**

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **0** | **30** | **75** |

**TEXTBOOKS**

1. Rashid, M.H., ‘Power Electronics: Circuits, Devices and Applications’, Pearson Education India,

2009.

2. Singh, M.D and Kanchandani, 'Power Electronics', Tata McGraw Hill & Hill publication Company Ltd New Delhi, 2009.

**REFERENCES**

1. Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., 'Thyristorised Power Controllers', Wiley Eastern Limited, 1986.
2. Lander,W., 'Power Electronics', McGraw Hill and Company, Third Edition, 2009.
3. Sen.P.C., 'Power Electronics', Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2005.
4. Joseph Vithayathil, 'Power Electronics', McGraw-Hill New York, 1996.
5. Erickson, R.W and Maksimovic, D., 'Fundamentals of Power Electronics', Springer Science & Business Media, 2007.
6. Umanand, L., 'Power Electronics: Essentials and Applications', Wiley India, 2009.
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1. **Lecture** Series on **Power Electronics** by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay.
2. http://www.nptel.ac.in/courses/108105066/PDF/L-1(SSG)(PE)%20((EE)NPTEL).pdf
3. Bimbhra, P.S, 'Power Electronics', Khanna Publishers, 2007.
4. Ned Mohan, Tore M. Undeland and William P.Robbins, 'Power Electronics: Converters, Applications and Design', New Jersey, John Wiley and Sons, 2007.

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 3 | 1 |
| **CO 2** | 2 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **CO 3** | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **CO 4** | 1 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| **CO 5** | 1 | 2 | 3 | 1 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | 10 | 9 | 9 | 2 | 3 | 2 | 5 | 1 | 0 | 0 | 0 | 1 | 11 | 8 |
| **Scaled** | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 3 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XEE 404** | **ELECTRICAL MACHINES – II** | **3** | **1** | **1** | **5** |
| **C:P: A = 2:1:0** | | **L** | **T** | **P** | **H** |
| | | **3** | **1** | **2** | **6** |

| **Course Outcomes (XEE 404):** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | To Understand the fundamentals of different types of slots and windings used for AC machines. | Cognitive Psychomotor | Understanding Mechanism |
| **CO2** | To Understand the concepts of pulsating and revolving magnetic fields. | Cognitive Psychomotor | Understanding Mechanism |
| **CO3** | To Understand the operation of induction machines, ttorque slip characteristics, equivalent circuit and its phasor diagram. | Cognitive Psychomotor | Understanding Mechanism |
| **CO4** | To Understand the different typesof starting, braking and speed control for induction motors. React the generator operation, self-excitation and doubly-fed Induction machines. | Cognitive Psychomotor | Understanding Mechanism |
| **CO5** | To Understand the operation of single-phase induction motors and its performance parameters. | Cognitive Psychomotor | Understanding Mechanism |

**UNIT – I: FUNDAMENTALS OF AC MACHINE WINDINGS** **9+3+12**

Physical arrangement of windings in stator and cylindrical rotor–Slots for windings –Single-turn coil – Active portion and overhang –Full-pitch coils–Types of windings– 3D visualization of the above winding types– Air-gap MMF distribution with fixed current through winding –Winding distribution factor.

**List of Experiments**

1.Load test on three phase squirrel cage induction motor.
2.Load test on three phase slip ring induction motor.
3.Load test of a three-phase alternator.
4.Load test on single-phase induction motor.

**UNIT – II: PULSATING AND REVOLVING MAGNETIC FIELDS** **9+3+6**

Types of magnetic fields –Alternating current in windings with spatial displacement – Magnetic field produced by a single winding – Fixed current and alternating current. Pulsating fields produced by spatially displaced windings– Windings spatially shifted by 90° – Three windings spatially shifted by 120° (carrying three-phase balanced currents) – Revolving magnetic field.

**List of Experiments**

5.No load and blocked rotor test on three phase induction motor.
6.No load and blocked rotor test on single phase induction motor.

**UNIT – III: INDUCTION MACHINES** **12+3+3**

Constructional details –Types of rotors (squirrel cage and slip-ring) – Torque Slip Characteristics – Equivalent circuit – Phasor Diagram– Effect of parameter variation on torque speed characteristics – Methods of starting, braking and speed control for induction motors–Generator operation –Self-excitation– Doubly-Fed Induction Machines.

**List of Experiments**

7.Regulation of three phase alternator by EMF /MMF methods.

| | |
|---|---|
| **UNIT – IV: SINGLE PHASE INDUCTION MOTORS** | **6+3+6** |
| Constructional details of single-phase induction motor – Double revolving field theory and operation – Equivalent circuit – Determination of parameters – Split-phase starting methods and applications.<br>**List of Experiments**<br>8.OCC and load characteristics of three phase alternator<br>9.V and inverted V curves of three phase synchronous motor. | |
| **UNIT – V: SYNCHRONOUS MACHINES** | **9+3+3** |
| Constructional details – Cylindrical rotor synchronous machine– EMF equation –Equivalent circuit – Phasor diagram–Armature reaction–Voltage regulation– V-curves. Salient pole machine – Two reaction theory –Phasor diagram –Power angle characteristics. Synchronizing and parallel operation.<br>(Basic operation of synchronous motors)<br>**List of Experiments**<br>10.Study of induction motor starters. | |

| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | 45 | 15 | 30 | 90 |

**TEXTBOOKS**


1. I. J. Nagrath and D. P. Kothari, ‘Electric Machines’, Tata McGraw Hill Publishing Company Ltd, 2010.
2. M. G. Say, ‘Performance and Design of AC Machines’, CBS Publishers, 2002.
3. P. S. Bimbhra, ‘Electrical Machinery’, Khanna Publishers, 2011.
4. B.L.Theraja, ‘A Textbook of Electrical Technology’, Vol. I & II, M/s S.Chand, Delhi,2013.


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1. A. E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, ‘Electric Machinery’, Tata McGraw Hill publishing Company Ltd, 2013.
2. A. S. Langsdorf, ‘Alternating Current Machines’, Tata McGraw Hill publishing Company Ltd, 1984.
3. P. C. Sen, “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007.
4. J.B. Gupta, ‘Theory and Performance of Electrical Machines’, S.K.Kataria and Sons, 2002.
5. DeshPande M.V., ‘Electrical Machines’, PHI Learning Pvt Ltd., New Delhi – 2011.
6. A. G. Warren, ‘Problems in Electrical Engineering’, Parker and Smith Solutions, Newyork, 1940.
7. K. Murugesh Kumar, ‘Electric Machines’, Vikas Publishing House Pvt Ltd, 2002.
8. Department Laboratory Manual.


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1. http://freevideolectures.com/Course/2335/Basic-Electrical-Technology35-38,

   Prof. L. Umanand, IISc Bangalore.

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 |
| **CO 2** | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |
| **CO 3** | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| **CO 4** | 2 | 2 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| **CO 5** | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| **Total** | 14 | 8 | 7 | 9 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 7 | 5 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XUM 405 | | 3 | 0 | 0 | 3 |
| C:P: A = 2:0:1 | | L | T | P | H |
| | | 3 | 0 | 0 | 3 |

| | ENTREPRENEURSHIP DEVELOPMENT | | | | |
|---|---|---|---|---|---|

| Course Outcomes (XUM 405): | | Domain | Level |
|---|---|---|---|
| **CO1** | ***Recognise*** and ***describe*** the personal traits of an entrepreneur. | Cognitive Affective | Understand Receiving |
| **CO2** | ***Determine*** the new venture ideas and ***analyze*** the feasibility report. | Cognitive | Understand Analyze |
| **CO3** | ***Develop*** the business plan and ***analyze*** the plan as an individual or in team. | Cognitive Affective | Receiving Analyze |
| **CO4** | ***Describe*** various parameters to be taken into consideration for launching and managing small business. | Cognitive | Understand |
| **CO5** | ***Describe*** Technological management and Intellectual Property Rights | Cognitive | Understand |

| **UNIT – I: ENTREPRENEURIAL TRAITS AND FUNCTIONS** | **9** |
|---|---|
| Definition of Entrepreneurship; competencies and traits of an entrepreneur; factors affecting Entrepreneurship Development; Role of Family and Society; Achievement Motivation; Entrepreneurship as a career and national development. | |
| **UNIT – II: NEW PRODUCT DEVELOPMENT AND VENTURE CREATION** | **9** |
| Ideation to Concept development; Sources and Criteria for Selection of Product; market assessment; Feasibility Report; Project Profile; processes involved in starting a new venture; legal formalities; Ownership; Case Study. | |
| **UNIT – III: ENTREPRENEURIAL FINANCE** | **9** |
| Financial forecasting for a new venture; Finance mobilization; Business plan preparation; Sources of Financing, Angel Investors and Venture Capital; Government support in start-up promotion. | |
| **UNIT – IV: LAUNCHING OF SMALL BUSINESS AND ITS MANGEMENT** | **9** |
| Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units. | |
| **UNIT–V: TECHNOLOGY MANAGEMENT, IPR PORTFOLIO FOR NEW PRODUCT VENTURE** | **9** |
| Technology management; Impact of technology on society and business; Role of Government in supporting Technology Development and IPR protection; Entrepreneurship Development Training and Other Support Services. | |

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **0** | **0** | **45** |

**TEXTBOOKS**


1. Hisrich, 2016, Entrepreneurship, Tata McGraw Hill, New Delhi.

2. S.S.Khanka, 2013, Entrepreneurial Development, S.Chand and Company Limited, New Delhi.


**REFERENCES**

1. Mathew Manimala, 2005, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis,
2. Biztrantra ,2nd Edition.
3. Prasanna Chandra, 2009, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill.
4. P.Saravanavel, 1997, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai.
5. Arya Kumar,2012, Entrepreneurship: Creating and Leading an Entrepreneurial Organisation, Pearson Education India.
6. Donald F Kuratko, T.V Rao, 2012, Entrepreneurship: A South Asian perspective, Cengage Learning India.
7. Dinesh Awasthi, Raman Jaggi, V.Padmanand, Suggested Reading / Reference Material
8. for Entrepreneurship Development Programmes (EDP/WEDP/TEDP), EDI Publication, Entrepreneurship Development Institute of India, Ahmedabad. Available from: http://www.ediindia.org/doc/EDP-TEDP.pdf

**E REFERENCES**

1. Jeff Hawkins, "Characteristics of a successful entrepreneur", ALISON Online entrepreneurship courses, "https://alison.com/learn/entrepreneurial-skills
2. Jeff Cornwall, "Entrepreneurship -- From Idea to Launch", Udemy online Education, https://www.udemy.com/entrepreneurship-from-idea-to-launch/

**Mapping of COs with POs**

| | GA 1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 1 |
| **CO 2** | 0 | 0 | 1 | 2 | 3 | 2 | 1 | 1 | 1 | 2 | 3 | 0 |
| **CO 3** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | 3 | 0 | 2 |
| **CO 4** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 0 | 3 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 5** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 3 |
| **Total** | 0 | 0 | 1 | 2 | 3 | 5 | 3 | 8 | 10 | 8 | 9 | 9 |
| **Scaled** | 0 | 0 | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XEE 406** | **SIGNALS AND SYSTEMS** | **2** | **1** | **0** | **3** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **3:0:0** | | **2** | **1** | **0** | **3** |

| **Course Outcomes (XEE 406):** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | Understand the concepts of continuous time and discrete time systems. | Cognitive | Understand |
| **CO2** | Analyse systems in complex frequency domain. | Cognitive | Analyse |
| **CO3** | Learn about Fourier transformation techniques | Cognitive | Remembering |
| **CO4** | Learn about Laplace transformation techniques | Cognitive | Remembering |
| **CO5** | Learn about Z- transformation techniques | Cognitive | Remembering |

| **UNIT -I: INTRODUCTION TO SIGNALS AND SYSTEMS** | **09** |
|---|---|

| |
|---|
| Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples. |
| **UNIT- II: BEHAVIOUR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS** **09** |
| Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its Relation to the impulse response. |
| **UNIT -III: FOURIER TRANSFORMS** **09** |
| Fourier series representation of periodic signals, Waveform Symmetries, Fourier Coefficients, harmonic spectrum and THD. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Application to simple circuits. |
| **UNIT- IV: LAPLACE TRANSFORMS** **06** |
| Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behaviour. Application to simple circuits. |
| **UNIT -V: Z- TRANSFORMS AND SAMPLING RECONSTRUCTION** **12** |
| The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis. The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems. |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | **30** | **15** | **45** |

**TEXTBOOKS**


1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, “Signals and systems”, Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, Pearson, 2006.
3. H. P. Hsu, “Signals and systems”, Schaum’s series, McGraw Hill Education, 2010.
4. S. Haykin and B. V. Veen, “Signals and Systems”, John Wiley and Sons, 2007.


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1. A. V. Oppenheim and R. W. Schafer, “Discrete-Time Signal Processing”, Prentice Hall, 2009.
2. M. J. Robert “Fundamentals of Signals and Systems”, McGraw Hill Education, 2007.
3. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 1 | 0 |
| **CO 2** | 3 | 3 | 2 | 1 | | 3 | | 1 | | | | 2 | | 1 |
| **CO 3** | 3 | | | 1 | | 3 | | 1 | | | 1 | | | 1 |
| **CO 4** | 3 | 2 | 2 | 2 | 1 | | 1 | | | 2 | | 2 | | 1 |
| **CO 5** | 3 | | | 1 | | | | | | 2 | | | | 1 |
| **Total** | 15 | 7 | 6 | 7 | 2 | 6 | 1 | 2 | 1 | 4 | 1 | 5 | 1 | 4 |
| **Scaled** | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High

**SEMESTER V**

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XEE 501 | POWER SYSTEMS-I (APPARATUS AND MODELLING) | 3 | 1 | 1 | 5 |
| C:P: A | | L | T | P | H |
| 3:1:0 | | 3 | 1 | 2 | 6 |

| Course Outcomes (XEE 501): | | Domain | Level |
|---|---|---|---|
| CO1 | **Demonstrate** the per phase analysis of power system | Cognitive | Understanding |
| CO2 | **Develop** the model of various components of power system and **Construct** the Y Bus and Z Bus for a power system. | Cognitive | Applying |
| CO3 | **Analyse** the power system network with symmetrical and unsymmetrical faults. **Calibrate** the fault current in a power system. | Cognitive psychomotor | Analysing Complex |
| CO4 | **Summarize** the power flow equation. **Assess** the voltage profile of a power system by performing the load flow analysis and **Identify** the line loss and line flow. | Cognitive psychomotor | Understanding Evaluating Perception |
| CO5 | **Classify** and **determine** the stability of power system. **Detect** the transient behaviour of power system when it is subjected to a fault. | Cognitive psychomotor | Understanding Evaluating Perception |

**Learning Objectives**:

Establish and use power system models based on nodal admittance and impedance matrices for the analysis of large-scale power networks. Model generators, transformers, lines and cables in the positive, negative and zero sequence systems as basis for the analysis of symmetrical and unsymmetrical faults. Perform analysis of power systems subject to symmetrical and unsymmetrical faults.

Use simulation tools to perform comprehensive short circuit studies, load flow studies, and optimal power flow studies.

**UNIT - I: INTRODUCTION** **9+3**

Need for system analysis in planning and operation of modern power system – per phase analysis - Single line diagram - Per unit representation and Per unit calculations – Change of base – introduction to Electricity Deregulation.

**UNIT -II: MODELLING OF POWER SYSTEM COMPONENTS** **12+3+6**

Primitive network and its matrices – bus incidence matrix – bus admittance and bus impedance matrix formation – Z – Bus building algorithm - Modelling of generator, load, transformer, transmission line for different power system studies.

**List of Experiments**

1. Formation of Bus Admittance Matrix.
2. Formation of Bus Impedance Matrix using building Algorithm

**UNIT - III: FAULT ANALYSIS-UNSYMMETRICAL FAULTS** **12+3+6**

Need for short circuit study - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents. Introduction to

symmetrical components – sequence impedances – sequence networks Unsymmetrical fault analysis: L-G, L-L and L-L-G faults.

**List of Experiments**

3. Symmetrical Fault Analysis.
4. Unsymmetrical Fault Analysis.

| **UNIT- IV: POWER FLOW ANALYSIS** | **9+3+9** |
|---|---|

Need for Power Flow Analysis – bus classification – derivation of power flow equation – solution by Gauss–Seidel, Newton–Raphson and Fast Decoupled Power Flow methods – comparison of three methods

**List of Experiments**

5. Solution of power flow using Gauss-Seidel Method.
6. Solution of power flow using Newton Raphson Method.
7. Solution of power flow using Fast Decoupled Power Flow Method.

| **UNIT -V: STABILITY ANALYSIS** | **9+3+3** |
|---|---|

Types of stability - Swing equation in state space form - equal area criterion - stability analysis of single machine connected to infinite bus by modified Euler's method using classical machine model– critical clearing angle and time. Causes of voltage instability – voltage stability proximity indices for two-bus system – methods of improving power system stability.

**List of Experiments**

9. Transient Stability Analysis of Single-Machine Infinite Bus System

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **15** | **30** | **90** |

**TEXT BOOKS**


1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw-Hill Education; 2nd edition (December 28, 2015)
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1st July 2017.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 2nd Edition, 2009.


**REFERENCES**


1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 4th Edition (29 June 2011)
2. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 5 **edition** (December 26, 2012)


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**Mapping of COs with POs**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | | | | | | | | | 1 | | 1 | 3 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 2** | 3 | | | | | | | | | 1 | | 1 | 3 | 2 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | 1 | 2 | 3 | 2 |
| **CO 4** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 3 | 2 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 3 | 2 |
| **Total** | 15 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 3 | 6 | 15 | 10 |
| **Scaled** | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 3 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XEE 502** | **CONTROL SYSTEMS** | **3** | **0** | **1** | **4** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **3:1:0** | | **3** | **0** | **2** | **5** |

| **Course Outcomes (XEE 502):** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | **Identify** the basic elements, derive the transfer function and **Compute** the overall gain of the control system and **Construct** the transfer function of DC motors and DC generators. | Cognitive Psychomotor | Understanding |
| **CO2** | **Explain** the performance of First and Second order system with | Cognitive | Understanding |

| | | | |
|---|---|---|---|
| | static and dynamic error coefficients. | Psychomotor | Set |
| **CO3** | **Describe** the frequency domain specifications and show the response of frequency response. | Cognitive<br>Psychomotor | Remembering<br>Understanding<br>Set |
| **CO4** | **Determine** the stability of the systems and **Design** the suitable compensator and controller for the given performance criteria of the control system | Cognitive<br>Psychomotor | Understanding<br>Design<br>Perception |
| **CO5** | **Describe** State transition matrix. **Explain** State space model **and construct** and **verify** the canonical state model and Kalman's test for controllability and observability. | Cognitive | Remembering |

**Learning Objectives:** Control Systems is the engineering discipline that applies control theory to design systems with desired behaviours. To make students understand the concept of system representation for stability analysis and state –space analysis, to design the compensator in time and frequency domain, to design the PID compensator

**UNIT - I: SYSTEMS AND THEIR REPRESENTATION** **9+9**

Basic elements in control systems – Open and closed loop systems – Principles of feedback, Transfer function Block diagram reduction techniques – Signal flow graphs. Mason gain formula, Modelling of electric systems translation and rotational mechanical systems.

**List of Experiments**

1. Transfer function and modelling of separately excited DC Generator.
2. Transfer function and modelling of Armature & field-controlled DC Motor.
3. Transfer function of AC Servomotor

**UNIT – II: TIME RESPONSE ANALYSIS** **9+9**

Time response – Time domain specifications - Standard test signals. Time response of first and second order systems for standard test inputs. Error coefficients – Generalized error series – Steady state error

**List of Experiments**

4. Analysis of Synchro Transmitter and Receiver.
5. Performance of DC Stepper Motor
6. Digital simulation of I order and II order system by using Scilab.

**UNIT - III: FREQUENCY-RESPONSE ANALYSIS** **9+6**

Frequency domain specification – Bode plot – Polar plot – Determination of closed loop response from open loop response – CorRelation between frequency domain and time domain specifications

**List of Experiments**

7. Frequency response of Lag, Lead & Lag – Lead networks.
8. Determination of Phase margin and Gain margin of the Bode plot using Scilab.

**UNIT – IV: STABILITY ANALYSIS AND CONTROLLER DESIGN** **9**

Characteristics equation – Location of roots in S plane for stability –Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition –Nyquist stability criterion. Introduction to design of Proportional, Integral and Derivative Controllers- Lead and Lag compensator- Analog and Digital implementation of controllers.

**UNIT – V: STATE VARIABLE ANALYSIS** **9+6**

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Physical variable phase variable and canonical variable

forms State Space representation of continuous time system. Transfer function from state variable representation –. Concept of controllability and observability.

**List of Experiments**

9. Transfer function and modeling of Ward – Leonard speed control system applied to DC motor.
10. DC Position using feedback Control system.

| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | 45 | 0 | 30 | 75 |

**TEXTBOOKS**


1. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', New Age International Publishers Pvt Ltd; Sixth edition (1 September, 2018)

2. Norman S. Nise, "Control System Engineering" Seventh edition, John Wiley &Sons, Inc, 2015.

3. M. Gopal, "Control Systems, Principles & Design", Tata McGraw Hill, New Delhi, 2002.

4. Richard C. Dorf & Robert H. Bishop, "Modern Control Systems", Addison– Wesley, 2012.


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1. B.C. Kuo, 'Automatic Control Systems', Prentice Hall of India Ltd., New Delhi, 2014.

2. K. Ogata, 'Modern Control Engineering', 4th edition, Pearson Education, New Delhi, 2003 / PHI.

3. N. Bandyopadhyay, 'Control Engineering Theory and Practice', Prentice Hall of India, 2009

4. John J.D'azzo & Constantine H.Houpis, 'Linear control system analysis and design', Tata McGrow-Hill, Inc., 2013


**E - REFERENCES**


1. NTPEL, Control Systems Engineering (Web Course), Prof. M. Gopal, IIT Kharagpur.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 1 | | | 1 | 1 | 1 | | | 1 | | |
| **CO2** | 2 | 3 | 1 | | 2 | 1 | 1 | 1 | 1 | 1 | | 2 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | | | 1 | | 3 | | | | 2 | 2 |
| **CO4** | 1 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 2 |
| **CO5** | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | | 1 | 2 | 2 |
| **Total** | 10 | 10 | 9 | 7 | 4 | 4 | 5 | 4 | 9 | 3 | 1 | 6 | 7 | 7 |
| **Scaled** | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XEE 503 | MICROPROCESSORS AND MICROCONTROLLERS | 3 | 0 | 1 | 4 |
| C:P: A | | L | T | P | H |
| 3:1:0 | | 3 | 0 | 2 | 5 |

| Course Outcomes (XEE 503): | | Domain | Level |
|---|---|---|---|
| CO1 | To understand the fundamentals of microprocessors, microcontrollers and embedded systems | Cognitive | Understanding |
| CO2 | To understand the architecture, Timing diagrams and Execution cycles of 8051 | Cognitive | Understanding |
| CO3 | To understand the types of addressing modes, Instruction types and to understand the basic concepts of programming | Cognitive<br>Psychomotor<br>Affective | Understanding<br>Set<br>Responding |
| CO4 | To understand interfacing design of peripherals like I/O, A/D, D/A, timer etc. | Cognitive<br>Psychomotor<br>Affective | Understanding<br>Set<br>Responding |
| CO5 | To understand communication protocols and interfacing with external devices | Cognitive<br>Psychomotor<br>Affective | Understanding<br>Set<br>Responding |

**Learning Outcomes:** Able to do assembly language programming, do interfacing design of peripherals like I/O, A/D, D/A, timer etc. and to develop systems using different microcontrollers.

**UNIT- I: FUNDAMENTALS OF MICROPROCESSORS** — **9**

Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

**UNIT -II: THE 8051 ARCHITECTURE** — **9**

Internal Block Diagram, CPU, ALU, address, data and control bus, working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

**UNIT- III: INSTRUCTION SET AND PROGRAMMING** — **9+12**

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and Debugging tools.

**List of Experiments**

1. Simple arithmetic operations with 8085 Microprocessors: Multi precision addition / subtraction / multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions.
3. Demonstration of basic instructions with 8051 Micro controller execution, including: a. Conditional jumps, looping b. Calling subroutines. c. Stack parameter testing
4. Design program for code conversions.

**UNIT -IV: MEMORY AND I/O INTERFACING** — **9+3**

Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.

**List of Experiments**

5. Interfacing Converters of 8-bit D/A and A/D.

| **UNIT -V: EXTERNAL COMMUNICATION INTERFACE AND APPLICATIONS** | **9+15** |
|---|---|

Synchronous and Asynchronous Communication. RS232, SPI, I2C.Introduction and interfacing to protocols like Blue-tooth and Zig-bee LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

**List of Experiments**

6. Interfacing of Keyboard with 8085
7. Interfacing of seven segment display with 8085.
8. Serial communication, I/O Port operations.
9. Design and implementation of Traffic Light control.
10. Design and implementation of Stepper motor control

| | **LECTURE** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|
| | **45** | **30** | **75** |

**TEXTBOOKS**


1. M.A.Mazidi, J.G.Mazidi and R.D.McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007.
2. K.J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.
3. R. Kamal, "Embedded System", McGraw Hill Education, Third Edition, 2017.
4. R.S. Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 6th Edition, 2013


**REFERENCES**


1. D.A.Patterson and J.H.Hennessy, "Computer Organization and Design: The Hardware /Software interface", Morgan Kaufman Publishers, 5th Edition, 2013.
2. D.V.Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education,2005.


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www.nptel.ac.in

https://onlinecourses.nptel.ac.in/noc19_ee11

https://nptel.ac.in/courses/Webcourse-contents/IISc BANG/notused/Microprocessors%20and%20Microcontrollers-/Learning%20Material%20-%20Microprocessors%20and%20microcontrollers.pdf

**Mapping of COs with POs**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 2** | 1 | 2 | 1 | 3 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 1 | 1 |
| **CO 3** | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 |
| **CO 4** | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 0 | 1 |
| **CO 5** | 1 | 2 | 2 | 1 | 0 | 0 | 3 | 0 | 3 | 2 | 1 | 0 | 0 | 1 |
| **Total** | 4 | 5 | 7 | 6 | 2 | 1 | 5 | 0 | 8 | 7 | 6 | 2 | 3 | 5 |
| **Scaled** | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 0 | 2 | 2 | 1 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XUM 506 | CONSTITUTION OF INDIA | 3 | 0 | 0 | 3 |
| C:P: A | | L | T | P | H |
| 3:0:0 | | 3 | 0 | 0 | 3 |

| Course Outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | ***Understand*** the Constitutional History | Cognitive | Understanding |
| CO2 | ***Understand*** the Powers and Functions | Cognitive | Understanding |
| CO3 | ***Understand*** the Legislature | Affective | Remembering |
| CO4 | ***Understand*** the Judiciary | Affective | Remembering |
| CO5 | ***Understand*** the Centre State relations | Cognitive | Understanding |

| **UNIT-I** | **9** |
|---|---|
| Constitutional History- The Constitutional Rights- Preamble- Fundamental Rights- Fundamental Duties- Directive principles of State Policy. | |
| **UNIT-II** | **9** |
| The Union Executive- The President of India (powers and functions)- Vice-President of India-The Council of Ministers-Prime Minister- Powers and Functions. | |
| **UNIT-III** | **9** |
| Union Legislature- Structure and Functions of Lok Sabha- Structure and Functions of Rajya Sabha- Legislative Procedure in India- Important Committees of Lok Sabha- Speaker of the Lok Sabha. | |
| **UNIT-IV** | **9** |
| The Union Judiciary- Powers of the Supreme Court- Original Jurisdiction- Appellate jurisdictions- Advisory Jurisdiction- Judicial review. | |
| **UNIT-V** | **9** |
| Centre State relations- Political Parties- Role of governor, powers and functions of Chief Minister- Legislative Assembly- State Judiciary- Powers and Functions of the High Courts. | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 0 | 45 |

**REFERENCES**


1. W.H.Morris Shores- Government and politics of India, NewDelhi,B.1.Publishers,1974.
2. M.V.Pylee- Constitutional Government in India, Bombay, Asia Publishing House, 1977.
3. R.Thanker- The Government and politics of India, London:Macmillon, 1995.
4. A.C.Kapur- Select Constitutions S,Chand & Co.,NewDelhi, 1995
5. V.D.Mahajan- Select Modern Governments,S,Chand &Co, NewDelhi,1995.
6. B.C.Rout- Democractic Constitution of India.
7. Gopal K.Puri- Constitution of India, India 2005.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO 2** | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO 3** | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO 4** | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO 5** | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 10 | 2 | 0 | 5 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| **Scaled** | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

**SEMESTER VI**

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XUM 601** | **ECONOMICS FOR ENGINEERS** | **3** | **0** | **0** | **3** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **3:0:0** | | **3** | **0** | **0** | **3** |
| **Course Outcomes:** | | **Domain** | | **Level** | |

| | | | |
|---|---|---|---|
| **CO1** | ***Understand*** the concepts of economics in engineering. | Cognitive | Remembering |
| **CO2** | ***Interpret*** Break-even analysis. | Cognitive | Understanding |
| **CO3** | ***Illustrate*** value engineering procedure. | Cognitive | Understanding |
| **CO4** | ***Understand*** *and* ***analyze*** replacement problem. | Cognitive | Understanding |
| **CO5** | ***Explain*** depreciation. | Cognitive | Understanding |

| **UNIT- I: INTRODUCTION TO ECONOMICS** | **8** |
|---|---|
| Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- types of costing, element of costs, preparation of cost sheet and estimation, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost | |
| **UNIT- II: BREAK-EVEN ANALYSIS & SOCIAL COST BENEFIT ANALYSIS** | **12** |
| Margin of Safety, Profit, Cost & Quantity Analysis-Product Mix decisions and CVP analysis, Profit/Volume Ratio (P/V Ratio), Application of Marginal costing, Limitations<br>**Social Cost Benefit Analysis**: compare different project alternatives, Calculate direct, indirect and external effects; Monetizing effects; Result of a social cost benefit analysis. | |
| **UNIT- III: VALUE ENGINEERING & COST ACCOUNTING** | **10** |
| Value engineering – Function, aims, Value engineering procedure - Make or buy decision Business operating costs, Business overhead costs, Equipment operating costs | |
| **UNIT- IV: REPLACEMENT ANALYSIS** | **7** |
| Replacement analysis –Types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset. | |
| **UNIT- V: DEPRECIATION** | **8** |
| Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation, Annuity method of depreciation, service output method of depreciation. | |

| | **LECTURE** | **TUTORIAL** | **TOTAL** |
|---|---|---|---|
| | **45** | **0** | **45** |

**TEXTBOOKS**


1. 1 Sp Gupta, Ajay Sharma & Satish Ahuja, "Cost Accounting", V K Global Publications, Faridabad, Haryana, 2012
2. S.P.Jain & Narang, "Cost accounting – Principles and Practice", Kalyani Publishers, Calcutta, 2012
3. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
4. William G.Sullivan, James A.Bontadelli & Elin M.Wicks, "Engineering Economy", Prentice Hall International, New York, 2001.


**REFERENCES**


1. Luke M Froeb / Brian T Mccann, "Managerial Economics – A problem solving

approach" Thomson learning 2007

2. Truett & Truett, "Managerial economics- Analysis, problems & cases "Wiley India 8th edition 2004.
3. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
4. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002

**E REFERENCES**

-

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| XEE 602 | POWER SYSTEMS-II (OPERATION AND CONTROL) | 3 | 1 | 1 | 5 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 1 | 2 | 6 |

| Course Outcomes (XEE 602): | | Domain | Level |
|---|---|---|---|
| CO1 | **Explain** power system load characteristics and generation reserve requirements. | Cognitive | Understanding |
| CO2 | **Demonstrate** and **Apply** the mathematical knowledge to model and analysis of power system for frequency control. | Cognitive | Understanding Applying |
| CO3 | **Identify** fundamental aspects of reactive power and its effect on system voltage and **Select** the suitable voltage control method for the system operating condition. | Cognitive | Applying |
| CO4 | **Formulate** economic dispatch and unit commitment problem and its solution. | Cognitive | Creating |
| CO5 | **Apply** computer control methods for power system operation and control | Cognitive | Applying |

**Learning Objectives:** To provide the knowledge of optimization techniques used in the power system and Load Frequency Control (LFC). To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbine models. To provide the knowledge of Hydrothermal scheduling, reactive power control.

**UNIT - I: INTRODUCTION** **9+3**

An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves - Importance of load forecasting - quadratic and exponential curve fitting techniques for forecasting – plant level and system level controls.

**UNIT - II: REAL POWER - FREQUENCY CONTROL** **12+3+9**

Basics of speed governing mechanism and modelling - speed-load characteristics – load sharing between two synchronous machines in parallel - concept of control area - LFC control of a single-area system: static and dynamic analysis of uncontrolled and controlled cases - two-area system: modelling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model.

**List of Experiments**

1. Simulink model of single area load frequency control with PI controller.
2. Simulink model of single area load frequency control without PI controller.
3. Simulink model for two area load frequency control.

**UNIT - III: REACTIVE POWER–VOLTAGE CONTROL** **9+3+6**

Generation and absorption of reactive power - basics of reactive power control - excitation systems– modelling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, injection reactive power - SVC (TCR + TSC) and STATCOM – secondary voltage control.

**List of Experiments**

4. Modelling of reactive power compensation using STATCOM in MATLAB.
5. Modelling of reactive power compensation using SVC in MATLAB.

| **UNIT -IV: UNIT COMMITMENT AND ECONOMIC DISPATCH** | **12+3+9** |
|---|---|

Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve - coordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-list method - forward dynamic programming.

**List of Experiments**

6. MATLAB program to find optimum loading of generators with penalty factor.
7. MATLAB program to find optimum loading of generators neglecting transmission losses.
8. MATLAB program to find economic load dispatch problem.

| **UNIT- V: COMPUTER CONTROL OF POWER SYSTEMS** | **9 +3** |
|---|---|

Need for computer control of power systems - concept of energy control centre – functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **15** | **30** | **90** |

**TEXT BOOKS**


1. Olle.I.Elgerd, ‘Electric Energy Systems theory - An introduction’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.

2. Allen. J. Wood and Bruce F. Wollenberg, ‘Power Generation, Operation and Control’, John Wiley & Sons, Inc., 3rd Edition ,2013.

3. Kundur P., ‘Power System Stability and Control, Tata McGraw Hill, New Delhi, 5th reprint, 2014.


**REFERENCES**


1. Nagrath I.J. and Kothari D.P., ‘Modern Power System Analysis’, Tata McGraw-Hill, Fourth Edition,2011.

2. Hadi Saadat, ‘Power System Analysis’, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

3. Abhijit Chakrabarti, Sunita Halder, ‘Power System Analysis Operation and Control’, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.


**E REFERENCES**

1. www.nptel.ac.in

2. NPTEL : http://nptel.ac.in/courses/108104052/

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 2 | - | - | - | - | 1 | - | - | 2 | 1 |
| **CO2** | 2 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | 1 | - | 2 | - |
| **CO3** | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | 1 | 1 | 2 | - |
| **CO4** | 2 | 2 | 3 | 3 | 2 | - | - | - | - | 1 | - | - | 1 | - |
| **CO5** | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | 1 | 1 |
| **Total** | 10 | 12 | 10 | 10 | 11 | 0 | 0 | 0 | 1 | 3 | 2 | 2 | 8 | 2 |
| **Scaled** | 2 | 3 | 2 | 1 | 3 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| **COURSE CODE** | **COURSE NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|
| **XUM 606** | **DISASTER MANAGEMENT** | **3** | **0** | **0** | **3** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **3:0:0** | | **3** | **0** | **0** | **3** |

| **Course Outcomes:** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | Understanding the concepts of application of types of disaster preparedness | Cognitive | Application |

| | | | |
|---|---|---|---|
| **CO2** | On completion of this course the students will be able to understand planning essentials of disaster. | Cognitive | Analyze |
| **CO3** | Have a good understanding of importance of seismic waves occurring globally | Cognitive | Analyze |
| **CO4** | On completion of this course, the students will be able to perform drill essential for disaster mitigation | Cognitive | Application |
| **CO5** | Have a keen knowledge on essentials of risk reduction | Cognitive | Application |

| | |
|---|---|
| **UNIT- I: INTRODUCTION** | **9** |
| Introduction – Disaster preparedness – Goals and objectives of ISDR Programme- Risk identification – Risk sharing – Disaster and development: Development plans and disaster management – Alternative to dominant approach– disaster-development linkages -Principle of risk partnership | |
| **UNIT- II: APPLICATION OF TECHNOLOGY IN DISASTER RISK REDUCTION** | **9** |
| Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems – Intranets and extranets – video teleconferencing. Trigger mechanism – Remote sensing-an insight – contribution of remote sensing and GIS - Case study | |
| **UNIT- III: AWARENESS OF RISK REDUCTION** | **9** |
| Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness | |
| **UNIT- IV: DEVELOPMENT PLANNING ON DISASTER** | **9** |
| Implication of development planning – Financial arrangements – Areas of improvement – Disaster preparedness – Community based disaster management– Emergency response. | |
| **UNIT- V: SEISMICITY** | **9** |
| Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes | |

| | **LECTURE** | **TUTORIAL** | **TOTAL** |
|---|---|---|---|
| | **45** | **0** | **45** |

**TEXTBOOKS**


1. Siddhartha Gautam and K Leelakrishna Rao, “Disaster Management Programmes and Policies”, Vista International Pub House, 2012,
2. Arun Kumar, “Global Disaster Management”, SBS Publishers, 2008


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1. Encyclopaedia of Disaster Management, Neha Publishers & Distributors, 2008
2. Pradeep Sahni, Madhavi Malalgoda and Ariyabandu, “Disaster risk reduction in South Asia”, PHI, 2002
3. Amita Sinvhal, “Understanding earthquake disasters” TMH, 2010.

4. Pardeep Sahni, Alka Dhameja and Uma Medury, “Disaster mitigation: Experiences and reflections”, PHI, 2000

**E REFERENCES**

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | | 1 | 1 | | | | | 1 | | | 1 | 1 | 2 | 2 |
| **CO 2** | | | 2 | | 3 | | | | | | 2 | 2 | 2 | 2 |
| **CO 3** | | | | | | 2 | 2 | | | | 1 | 1 | | 1 |
| **CO 4** | | 2 | 2 | | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 1 | |
| **CO 5** | | | | | | 2 | 3 | 3 | | 2 | 1 | 1 | 2 | 2 |
| **Total** | 0 | 3 | 5 | 0 | 4 | 5 | 6 | 6 | 1 | 3 | 8 | 6 | 7 | 7 |
| **Scaled** | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| **SUB. CODE** | | | **SUB NAME** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|---|---|---|
| **XEE 702** | | | **MICROPROCESSORS AND MICROCONTROLLERS** | **3** | **0** | **1** | **4** |
| **C** | **P** | **A** | | **L** | **T** | **P** | **H** |
| **3** | **1** | **0** | | **3** | **0** | **2** | **5** |

| **Course Outcomes (XEE 702)** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | To ***understand*** the architecture and basic concepts of 8085 microprocessor. | Cognitive | Understanding |
| **CO2** | To ***understand*** the memory organization, flags, stack, and special function registers, I/O ports, connecting external memory, counters and timers, serial data I/O, Interrupts present in 8051 microcontroller. | Cognitive | Understanding |

| | | | |
|---|---|---|---|
| **CO3** | To ***understand*** the 8051 Microcontroller instructions to ***develop*** *and* ***show*** assembly language programs for basic logical and arithmetic operations, by using jump and call instructions. | Cognitive Psychomotor | Understanding Applying Set |
| **CO4** | To ***identify*** timer and counter programming, Interrupt programming and ***show*** the I/O interfacing techniques with 8051 microcontroller. | Cognitive Psychomotor | Applying Set |
| **CO5** | To ***design*** and ***test*** assembly language program in 8051 microcontroller for ***displaying*** Waveform generation, speed control of DC motor, Stepper motor control, seven segments LED display | Cognitive Psychomotor | Creating Mechanism |

| | | |
|---|---|---|
| **UNIT I** | **INTEL 8085 PROCESSOR** | **09** |
| Architecture – Instruction format addressing modes – Basic timing diagram – input/output – 8085 based simple programs. | | |
| **UNIT II** | **8051 MICROCONTROLLER ARCHITECTURE** | **12** |
| 8051 architecture, memory organization, flags, stack, and special function registers, I/O ports - connecting external memory, counters and timers, serial data I/O, Interrupts | | |
| **UNIT III** | **8051 MICROCONTROLLER INSTRUCTIONS AND ADDRESSING MODES** | **21** |
| Microcontroller instructions - addressing modes, moving data, logical operations, arithmetic operations, jump and call instructions – subroutines - Interrupts and returns. | | |
| **UNIT IV** | **MICROCONTROLLER PROGRAMMING AND INTERFACING BASICS** | **18** |
| Microcontroller programming - Assembly Language Programming, timer and counter programming, connection to RS 232 and RS 485, Interrupt programming | | |

| UNIT V | INTERFACING PERIPHERALS AND MICROCONTROLLER APPLICATIONS | 9+6 |
|---|---|---|

Serial and parallel I/O (8251 and 8255), Programmable DMA controller, Programmable interrupt controller, ADC/DAC interfacing. Programming concepts Regarding Waveform generation, speed control of DC motor, Stepper motor control, seven segments LED display.

1. Simple arithmetic operations: Multi precision addition / subtraction / multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions.
3. Design program for code conversions.
4. Interfacing of Keyboard with 8085.
5. Interfacing of Keyboard with 8051.
6. Interfacing of seven segment display with 8085.
7. Interfacing of seven segment display with 8051.
8. Interfacing of 8 bit D/A and A/D Converters.
9. Serial communication, I/O Port operations.
10. Demonstration of basic instructions with 8051 Micro controller execution, including:
    a. Conditional jumps, looping
    b. Calling subroutines.
    c. Stack parameter testing
11. Design and implementation of Traffic Light control.
12. Design and implementation of Stepper motor control.

**Lecture = 45; Lab = 30; Total = 75 Hours**

**TEXT BOOKS**


1. Ramesh .S. Gaonkar, 'Microprocessor architecture, Programming and its applications with the 8085' Penram International Publications (India), 4thEdition,2000
2. N.Senthilkumar, M.Saravanan, S.Jeevananthan'Microprocessors and microcontroller', Oxford university press, 2010
3. Kenneth Ayala, 'The 8051 Microcontroller', Cengage Learning Publications, 3rd Edition, 2007.
4. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay 'The 8051 Microcontroller and Embedded Systems using Assembly and C', Prentice Hall Publications, 2nd Edition, 2008.


**REFERENCE BOOKS**


1. Ray A. K., Bhurchandi K. M., 'Advanced Microprocessor and Peripherals', Tata McGraw-Hill Publications, 3 r d E d i t i o n , 2013.
2. Sencer Yeralan, Helen Emery, 'Programming and interfacing the 8051 Microcontroller', Addison-Wesley Publications, 1st Edition, 2000.
3. Krishna Kant, 'Microprocessors and Microcontrollers, Architecture, Programming and System Design-8085, 8086, 8051, 8096', Prentice Hall India Ltd Publications, 1st Edition, 2010.
4. Douglas. V. Hall - Microprocessors and Interfacing - Tata McGraw Hill- Revised 2nd edition, 2006


**E-REFERENCES:**

1. NTPEL, Microprocessor (Web Course), Prof. S.P.Da,IIT Kharagpur.

**Mapping of COs with POs**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | - | 2 | - | - | - | - | - | - | 1 | 1 | - | 1 | 1 |
| **CO2** | 1 | 2 | 1 | 3 | 1 | - | - | - | 2 | 1 | 2 | 1 | 1 | 1 |
| **CO3** | - | - | - | - | - | 1 | 2 | - | 1 | 2 | - | - | 1 | 1 |
| **CO4** | 1 | 1 | 2 | 2 | 1 | - | - | - | 2 | 1 | 2 | 1 | - | 1 |
| **CO5** | 1 | 2 | 2 | 1 | - | - | 3 | - | 3 | 2 | 1 | - | - | 1 |
| **Total** | 4 | 5 | 5 | 6 | 2 | 1 | 5 | - | 8 | 7 | 6 | 2 | 3 | 5 |
| **Scaling** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **-** | **1** | **1** | **1** | **1** | **1** | **1** |

0 –No relation1 – Low relation2 – Medium relation3 – High Relation

| SUB.CODE | | | SUB NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| XEE 603 | | | MEASUREMENT AND INSTRUMENTATION | 3 | 1 | 1 | 5 |
| C | P | A | | L | T | P | H |
| 3 | 1 | 0 | | 3 | 2 | 2 | 7 |

| Course Outcomes (XEE703) | | Domain | Level |
|---|---|---|---|
| CO1 | ***Describe*** functional elements of measuring Instruments. ***Design*** of bridge circuits for the measurement of unknown parameters. | Cognitive | Remembering |
| CO2 | ***Explain*** the construction and working of different types of indicating and integrating instruments. | Cognitive | Understanding |
| CO3 | ***Describe*** the operation of A/D and D/A converters and to ***perform*** its characteristics. | Cognitive | Remembering |
| CO4 | ***Explain*** the construction and operation of recording Instruments. **Carryout** calibration test for measuring instruments. | Cognitive | Understanding |
| CO5 | ***Explain*** the different types of transducers. | Cognitive | Remembering |

| UNIT I | INTRODUCTION | 09+06 |
|---|---|---|

Functional elements of an instrument - errors in measurement - static and dynamic characteristics statistical evaluation of measurement data - standard and calibration

| UNIT 2 | ELECTRICAL AND ELECTRONIC INSTRUMENTS | 09 |
|---|---|---|

DC Ammeter – Multirange ammeter – Extension of ammeter range – RF ammeter – Voltmeter – Analog Electromechanical instruments-Galvanometer- multirange voltmeter – Extending Voltmeter range – Transistor voltmeter – Dual slope integrating type DVM — instrument transformer –Magnetic measurement- instruments for measurement of frequency and phase.

| UNIT 3 | SIGNAL CONDITIONING CIRCUITS | 09+18 |
|---|---|---|

Bridge circuits – Wheatstone's bridge – Maxwell's Bridge - Wien's bridge, Resonance Bridge – Hay's Bridge – Schering Bridge –De saulty bridge- differential ampflier – instrumentation amplifier – filter circuits, data acquisition system –Spectrum analyzer-Wagner's Earth (Ground) connection- Earthing techniques.

| UNIT 4 | STORAGE AND DISPLAY DEVICES | 09+06 |
|---|---|---|

CRO – introduction – Block diagrams of Oscilloscope – simple CRO – circuit displays – storage oscilloscope – digital CRO – X-Y recorder – magnetic recorder – strip chart recorder – printers – LED, LCD and Dot matrix displays – Data logger-Virtual Instruments

| UNIT 5 | TRANSDUCERS | 09 |
|---|---|---|

Classification of transducers – selection of transducers – resistive, capacitive and inductive transducers – piezo electric transducers – optical and digital transducers. pH electrodes – Load cell-transducers for measurement of displacement, temperature, level, flow, pressure, velocity, acceleration, torque, speed, Smart Sensors.

1. Study of Voltmeter , Ammeter and Wattmeter Range Extension.
2. Characteristics of Thermal Transducers (Thermocouples).
3. Measurement of Pressure using LVDT.
4. AC Bridges:
   a) Maxwell Inductance Bridge
   b) Anderson Bridge
5. Wheatstone bridge.
6. Instrumentation Amplifiers.
7. A/D and D/A converters.
8. Calibration of Single phase and Three phase Energy meter.
9. Calibration of Current Transformer and potential transformer.
10. Measurement of Three phase power and power factor by two watt meter method.

**Lecture = 45; Tutorial = 30;Practical = 30; Total = 105 Hours**

**TEXT BOOKS**


1. Sawhney A.K 'A Course in Electrical & Electronic Measurements and Instrumentation' Dhanpat Rai and Sons,2007.
2. Doebeling, E.O., 'Measurement Systems – Application and Design', McGraw Hill Publishing Company.
3. H.S. Kalsi, 'Electronic Instrumentation', Tata Mc Graw Hill Co., 1995.
4. B Gupta, 'A course in Electronic and Electrical Measurement', S.K.Kataria & sons,Delhi-2003


**REFERENCES BOOKS**


1. Golding E.W and Wills F.E 'Measurements and Measuring Instruments' Sir Isaac Pitman and Sons(P) Ltd, 1997.
2. Moorthy, D.V.S., 'Transducers and Instrumentation', Prentice Hall of India Pvt. Ltd., 1995
3. Dalley, J.W., Riley, W.F. and Meconnel, K.G., 'Instrumentation for Engineering Measurement', John Wiley & Sons, 1993


**E REFERENCES**


1. NPTEL, Measurements and Instruments, Prof.T.Anjaneyulu, Department of EEE, Indian Institute of Technology, Delhi.

## Mapping of COs with POs

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 1 | | | 1 | | 1 | 1 | | | 3 | | | 2 | 3 |
| **CO 2** | 1 | 1 | | | | | | | | | | 1 | 2 | 3 |
| **CO 3** | 1 | | 1 | | 1 | | | 2 | | 1 | | | 2 | 2 |
| **CO 4** | 1 | 2 | | | | | | | | | | 1 | 2 | 2 |
| **CO 5** | | | | | | | | | 1 | | 1 | 1 | 2 | 3 |
| **Total** | 4 | 3 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 4 | 1 | 3 | 10 | 13 |
| **Scaling** | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 3 |

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

| SUB. CODE | | | SUB NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| XUM 706 | | | CYBER SECURITY | 3 | 0 | 0 | 3 |
| C | P | A | | L | T | P | H |
| 3 | 0 | 0 | | 3 | 0 | 0 | 3 |

| Course Outcomes (XUM706) | | Domain | Level |
|---|---|---|---|
| CO1 | To learn the basic concepts of networks and cyber-attacks. | Cognitive | Remembering |
| CO2 | To define the concepts of system vulnerability scanning and the scanning tools | Cognitive | Remembering |
| CO3 | To understand the network defense mechanisms and the tools used to detect and quarantine network attacks. | Cognitive | Remembering |
| CO4 | To learn the different tools for scanning. | Cognitive | Remembering |
| CO5 | To identify the types of cybercrimes, cyber laws and cyber-crime investigations. | Cognitive | Remembering |

| UNIT I | INTRODUCTION | 09 |
|---|---|---|

History of Information Systems and its Importance, Basics, Changing Nature of Information Systems, Need for Distributed Information Systems: Role of Internet and Web Services. Information System Treats and attacks, Classification of Threats and assessing Damages Security in mobile and Wireless Computing-Security Challenges in Mobile Devices, authentication service Security, Security Implication for Organizations, Laptops security Concepts in Internet and World Wide Web: Brief review of Internet Protocols TCP/IP, IPV4, and IPV6. Functions of various networking components-routers, bridges, switches, hub, gateway and Modulation Techniques.

| UNIT II | SYSTEMS VULNERABILITY SCANNING | 09 |
|---|---|---|

Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC- Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet.

| UNIT III | NETWORK DEFENCE TOOLS | 09 |
|---|---|---|

Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System, Cryptool.

| UNIT IV | TOOLS FOR SCANNING | 09 |
|---|---|---|
| Scanning for web vulnerabilities tools: Metasploit tool, Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, THC-Hydra. | | |
| **UNIT V** | **INTRODUCTION TO CYBER CRIME AND LAW** | **09** |
| Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.<br>Introduction to Cyber Crime Investigation: Password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks | | |
| **Lecture = 45; Tutorial = 0; Total = 45 Hours** | | |

**TEXT BOOKS**


1. Nina Godbole, "Information Systems Security: Security Management, Metrics, Frameworks and Best Practices, w/cd", Wiley Publications, 2008, ISBN 10: 8126516925, ISBN 13 : 9788126516926
2. Thomas J. Mowbray, "Cybersecurity: Managing Systems, Conducting Testing and Investigating Intrusions", Wiley Publications, 2013, Kindle Edition, ISBN 10: 812654919X, ISBN 13 : 9788126549191
3. D.S. Yadav, "Foundations of Information Technology", New Age International publishers, 3rd Edition, 2006, ISBN-10: 8122417620, ISBN-13: 978-8122417623.


**REFERENCE BOOKS**


1. Mike Shema, "Anti-Hacker Tool Kit", McGraw Hill Education, 4th edition, 2014,
2. Nina Godbole, Sunit Belapure, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley publilcations, 2013, ISBN 10 : 8126521791, ISBN 13 : 9788126521791.
3. Corey Schou, Daniel Shoemaker, "Information Assurance for the Enterprise: A Roadmap to Information Security (McGraw-Hill Information Assurance & Security)", Tata McGraw Hill, 2013, ISBN-10: 0072255242, ISBN-13: 978-0072255249.
4. Vivek Sood, "Cyber Laws Simplified", McGraw Hill Education (INDIA) Private Limited in 2001, ISBN-10: 0070435065, ISBN-13: 978-0070435063.
5. Steven M.Furnell, "Computer Insecurity", Springer Publisher, 2005 Edition.

**E REFERENCES**


1. https://www.cryptool.org/en/
2. https://www.metasploit.com/
3. http://sectools.org/tool/hydra/
4. http://www.hping.org/
5. http://www.winpcap.org/windump/install/
6. http://www.tcpdump.org/
7. https://www.wireshark.org/
8. https://ettercap.github.io/ettercap/
9. https://www.concise-courses.com/hacking-tools/top-ten/
10. https://www.cirt.net/Nikto2
11. http://sqlmap.org/


**Mapping COs versus POs**

| | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| **CO2** | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| **CO3** | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| **CO4** | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **CO5** | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 0 | 0 | 1 |
| **Total** | 9 | 8 | 8 | 7 | 5 | 4 | 4 | 5 | 5 | 0 | 0 | 5 |
| **Original** | 9 | 8 | 8 | 7 | 5 | 4 | 4 | 5 | 5 | 0 | 0 | 5 |
| **Scaled to 0,1,2,3 scale** | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |

0 –No relation1 – Low relation2 – Medium relation3 – High Relation

| SUB. CODE | | | SUBJECT NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| XGS708 | | | CAREER DEVELOPMENT SKILLS | 0 | 0 | 0 | 0 |
| C | P | A | | L | T | P | H |
| 1.8 | 0.8 | 0.4 | | 2 | 0 | 2 | 4 |

| Course Outcomes (XCD 708) | | Domain | Level |
|---|---|---|---|
| CO1 | *Knowledge* on a career related communication and learning the different formats of CV | Cognitive | Remembering |
| CO2 | *Prepare* how to face an interview and to learn how to prepare for an interview | Psychomotor | Set |
| CO3 | *Communicates* with the group of people in discussion | Affective | Responding |

| UNIT I | | 10 |
|---|---|---|
| CV Writing; difference between resume and CV; characteristics of resume and CV; basic elements of CV and resume, use of graphics in resume and CV; forms and functions of Cover Letters | | |
| **UNIT II** | | **10** |
| Interview skills; tips for various types of interviews. Types of questions asked ; body language, etiquette and dress code in interview, interview mistakes, telephonic interview , frequently asked questions. Planning for the interview. | | |
| **UNITIII** | | **10** |
| Mock interviews - workshop on CV writing – Group Discussion | | |
| **Lecture = 20; Workshop = 10; Total = 30 Hours** | | |

**TEXT BOOKS**


1. Paul McGee, How To Write a CV That Really Works: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Hachette UK, 2014
2. Mary Ellen Guffey, Dana Loewy Essentials of Business Communication, , Cengage Learning, 2012
3. Michael Spiropoulos, Interview Skills that win the job: Simple techniques for answering all the tough questions, Allen & Unwin, 2005
4. William L. Fleisher,Effective Interviewing and Interrogation Techniques, , Nathan J. Gordon, Academic Press, 2010.


**REFERENCE WEBSITES**

1. http://www.utsa.edu/careercenter/PDFs/Interviewing/Types%20of%20Interviews.pdf
2. http://www.amu.apus.edu/career-services/interviewing/types.htm
3. http://www.careerthinker.com/interviewing/types-of-interview/

| SUB. CODE | | | SUB NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| E51 | | | ELECTRIC VEHICLES AND POWER MANAGEMENT | 3 | 0 | 0 | 3 |
| C | P | A | | L | T | P | H |
| 3 | 0 | 0 | | 3 | 2 | 0 | 5 |

| Course Outcomes (E51) | | Domain | Level |
|---|---|---|---|
| CO1 | **Explain** power system load characteristics and generation reserve requirements. | Cognitive | Understanding |
| CO2 | **Demonstrate** and **Apply** the mathematical knowledge to model and analysis of power system for frequency control. | Cognitive | Understanding<br>Applying |
| CO3 | **Identify** fundamental aspects of reactive power and its effect on system voltage and **Select** the suitable voltage control method for the system operating condition. | Cognitive | Applying |
| CO4 | **Formulate** economic dispatch and unit commitment problem and its solution. | Cognitive | Creating |
| CO5 | **Apply** computer control methods for power system operation and control. | Cognitive | Applying |

| UNIT I | INTRODUCTION | 09+06 |
|---|---|---|

An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves - Importance of load forecasting - quadratic and exponential curve fitting techniques for forecasting – plant level and system level controls.

| UNIT II | REAL POWER - FREQUENCY CONTROL | 09+06 |
|---|---|---|

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel - concept of control area - LFC control of a single-area system: static and dynamic analysis of uncontrolled and controlled cases - two- area system: modeling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model

| UNIT III | REACTIVE POWER–VOLTAGE CONTROL | 09+06 |
|---|---|---|

Generation and absorption of reactive power - basics of reactive power control - excitation systems – modeling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, injection reactive power - SVC (TCR + TSC) and STATCOM – secondary voltage control.

| UNIT IV | UNIT COMMITMENT AND ECONOMIC DISPATCH | 09+06 |
|---|---|---|
| Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve - coordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-listmethod - forward dynamic programming. | | |
| **UNIT V** | **COMPUTER CONTROL OF POWER SYSTEMS** | **09+06** |
| Need for computer control of power systems - concept of energy control centre – functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies. | | |
| **Lecture = 45; Tutorial = 30; Lab = 0; Total =75 Hours** | | |

**TEXT BOOKS**


1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. Kundur P., 'Power System Stability and Control, Tata McGraw Hill, New Delhi, 5th reprint, 2008.


**REFERENCE BOOKS:**


1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition,2011.
2. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
3. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.


**E-REFERENCES:**

1. NPTEL : http://nptel.ac.in/courses/108104052/

**Mapping COs versus PO, PSO**

| CO/ PO/PSO | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 2 | - | - | - | - | 1 | - | - | **2** | **1** |
| **CO2** | 2 | 3 | 2 | 2 | 2 | - | - | - | 1 | 1 | 1 | - | **2** | **-** |
| **CO3** | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | 1 | 1 | **2** | **-** |
| **CO4** | 2 | 2 | 3 | 3 | 2 | - | - | - | - | 1 | - | - | **1** | **-** |
| **CO5** | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | **1** | **1** |
| **Total** | **10** | **12** | **10** | **10** | **11** | **0** | **0** | **0** | **1** | **3** | **2** | **2** | **8** | **2** |
| **Scaling** | **2** | **3** | **2** | **1** | **3** | **0** | **0** | **0** | **1** | **1** | **1** | **1** | **2** | **1** |

0 –No relation1 – Low relation2 – Medium relation3 – High Relation

| SUB CODE | | | SUB NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| E61 | | | HIGH VOLTAGE ENGINEERING | 3 | 0 | 0 | 3 |
| C | P | A | | L | T | P | H |
| 3 | 0 | 0 | | 3 | 0 | 0 | 3 |

| Course Outcomes (E61) | | Domain | Level |
|---|---|---|---|
| CO1 | ***Explain*** the different causes of overvoltage and ***Illustrate*** overvoltage control due to switching. ***classify*** the various methods for protection of lightning overvoltage | Cognitive | Understanding |
| CO2 | ***Explain*** and ***Classify*** breakdown mechanisms in solid, liquid and gases dielectrics *and list out the application of insulating materials* | Cognitive | Understanding |
| CO3 | **Able** to define **and *Classify*** the different methods to generate the various types of high voltages and high currents. | Cognitive | Understanding |
| CO4 | ***Classify*** and ***analyze*** the different techniques used to measure the various types of high voltages and high currents. | Cognitive | Understanding<br>Analyzing |
| CO5 | ***Recall*** **and** ***Illustrate*** the different testing methods to test the various high voltage components of power System and ***define*** the International, Indian standards and insulation co-ordination. | Cognitive | Remembering<br>Understanding |

| UNIT I | OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS | 09 |
|---|---|---|
| Natural Causes of overvoltage-Lightning phenomena and its effects on power system – Over voltage due to switching surge-power frequency overvoltage-control of overvoltage due to switching – protection of<br>transmission lines against overvoltage – Becoleys lattice diagram. | | |
| **UNIT II** | **ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS** | **09** |
| Gaseous breakdown in uniform and non-uniform fields - corona discharges - Vacuum breakdown - conduction and breakdown in pure and commercial liquids - Breakdown mechanisms in solid and composite dielectrics-Applications of insulating materials. | | |
| **UNIT III** | **GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS** | **09** |
| Generation of High DC, AC, impulse voltages and currents. Tripping and control of impulse generators. | | |
| **UNIT IV** | **MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS** | **09** |
| Measurement of High direct current voltages – measurement of voltages: alternating and impulse voltages- Measurement of High currents: direct, alternating and impulse currents.<br>Digital techniques in high voltage measurement. | | |

| UNIT V | HIGH VOLTAGE TESTING OF ELECTRICAL APPARATUS | 09 |
|---|---|---|
| High voltage testing of electrical power apparatus – power frequency, impulse voltage and DC testing – International and Indian Standards-Insulation co-ordination. | | |
| **Lecture = 45; Tutorial = 00; Total = 45 Hours** | | |

**TEXT BOOKS**


1. E. Kuffel and M. Abdullah, 'High Voltage Engineering', Pergamon press, Oxford,2010.
2. M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill,4thEdition, 2004.
3. E. Kuffel and W.S. Zaengl, 'High Voltage Engineering Fundamentals', Pergamon Press, Oxford, London, 2012
4. August F.Metraux. "Some problems and actual limits of test techniques at extra high voltages",Haefely publications EIS 14.


**REFERENCE BOOKS**


1. C.L.Wadhwa, 'High Voltage Engineering', New Age International (P) Ltd, 2nd Edition2006.
2. Ravindra Arora, Wolfgang Mosch, "High Voltage Insulation Engineering", New Age International (P) Limited, 2011.
3. Chinnappa ,K.M., Need for next higher voltage level in India", National seminar on high voltage AC and Dc Transmission, New Delhi.


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1. Web Content - http://www.library.dce.edu/e-resources/books/ee/
2. NPTEL-High Voltage Engineering, C.L. Wadhwa -IIT Madras.

**Mapping COs versus PO, PSO**

| CO/ PO/PSO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | 1 | - | 1 | - | - | - | 2 | 2 | 2 |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |
| **CO3** | 2 | 2 | - | - | 1 | 1 | - | 1 | - | - | - | 1 | 1 | 1 |
| **CO4** | 2 | 2 | - | - | - | - | 1 | - | - | - | - | 1 | 2 | 2 |
| **CO5** | 2 | 2 | - | 2 | - | 1 | - | - | - | - | - | 2 | 2 | 2 |
| **Total** | 12 | 10 | 2 | 2 | 1 | 3 | 1 | 2 | 0 | 0 | 0 | 7 | 8 | 9 |
| **Scaling** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 2 |

0 –No relation 1 – Low relation 2 – Medium relation 3 – High Relation

## SEMESTER I

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PMA 101 | CALCULUS AND LINEAR ALGEBRA | 3 | 1 | 0 | 4 |
| C:P: A = 3:0:0.5 | | L | T | P | H |
| **PREREQUISITE:** Differentiation and Integration | | 3 | 1 | 0 | 4 |

| Course Outcomes (PMA 101): | | Domain | Level |
|---|---|---|---|
| CO1 | **Apply** orthogonal transformation to reduce quadratic form to canonical forms. | Cognitive | Remembering<br>Applying |
| CO2 | **Apply** power series to tests the convergence of the sequences and series. Half range Fourier sine and cosine series. | Cognitive<br><br>Psychomotor | Applying<br>Remembering<br>Guided Response |
| CO3 | **Find** the derivative of composite functions and implicit functions. Euler's theorem and Jacobian | Cognitive<br>Psychomotor | Remembering<br>Guided Response |
| CO4 | **Explain** the functions of two variables by Taylors expansion, by finding maxima and minima with and without constraints using Lagrangian Method. Directional derivatives, Gradient, Curl and Divergence. | Cognitive<br>Affective | Remembering<br>Understanding<br>Receiving |
| CO5 | **Apply** Differential and Integral calculus to notions of Curvature and to improper integrals. | Cognitive | Applying |

| **UNIT- I: MATRICES** | **12** |
|---|---|
| Linear Transformation - Eigen values and Eigen vectors -Properties of Eigen values and Eigen vectors - Cayley-Hamilton Theorem – Diagonalisation of Matrices – Real Matrices: Symmetric - Skew-Symmetric and Orthogonal Quadratic form – canonical form - Nature of Quadratic form and Transformation of Quadratic form to Canonical form (Orthogonal only). | |
| **UNIT – II: SEQUENCES AND SERIES** | **12** |
| Sequences: Definition and examples-Series: Types and convergence- Series of positive terms – Tests of convergence: Comparison test, Integral test and D'Alembert's ratio test-. Fourier series: Half range sine and cosine series- Parseval's Theorem. | |
| **UNIT- III: MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION** | **12** |
| Limit and continuity –Partial differentiation – Total Derivative – Partial differentiation of Composite Functions: Change of Variables – Differentiation of an Implicit Function - Euler's Theorem- Jacobian. | |
| **UNIT – IV: MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND VECTOR CALCULUS** | **12** |
| Taylor's theorem for function of Two variables- Maxima, Minima of functions of two variables: with and without constraints - Lagrange's Method of Undetermined Multipliers – Directional Derivatives - Gradient, Divergence and Curl. | |
| **UNIT - V: DIFFERENTIAL AND INTEGRAL CALCULUS** | **12** |
| Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions | |

| |
|---|
| and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. |

| LECTURE | TUTORIAL | TOTAL |
|---|---|---|
| 45 | 15 | 60 |

**TEXTBOOKS**


1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015**. (Unit I, Unit III and Unit IV).**
2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. **(Unit II).**
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. **(Unit V).**


**REFERENCES**


1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | | | 2 | | | | | 1 | | 2 |
| **CO 2** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 4** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | | 2 |
| | 15 | 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 0 | 7 |
| **Scaled Value** | 3 | 2 | | | 1 | | | | | 1 | | |

$1 - 5 \rightarrow 1$ $6 - 10 \rightarrow 2$ $11 - 15 \rightarrow 3$

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PAP 102 | APPLIED PHYSICS FOR ENGINEERS | 3 | 1 | 0 | 4 |
| C:P: A = 3:0:0 | | L | T | P | H |
| PREREQUISITE: | Basic Physics in HSC level | 3 | 1 | 0 | 4 |

| Course Outcomes (PAP 102): | | Domain | Level |
|---|---|---|---|
| CO1 | **Identify** the basics of mechanics, **explain** the principles of elasticity and **determine** its significance in engineering systems and technological advances. | Cognitive | Remember Understand |
| CO2 | **Illustrate** the laws of electrostatics, magneto-statics and electromagnetic induction; **use** and **locate** basic applications of electromagnetic induction to technology. | Cognitive | Remember Analyze |
| CO3 | **Understand** the fundamental phenomena in optics by measurement and **describe** the working principle and application of various lasers and fiber optics. | Cognitive | Understand Apply |
| CO4 | **Analyze** energy bands in solids, **discuss** and **use** physics principles of latest technology using semiconductor devices. | Cognitive | Understand Analyze |
| CO5 | **Develop** Knowledge on particle duality and **solve** Schrodinger equation for simple potential. | Cognitive | Understand Apply |

**UNIT- I: MECHANICS OF SOLIDS** — **9+3**

**Mechanics:** Force - Newton's laws of motion - work and energy - impulse and momentum - torque - law of conservation of energy and momentum - Friction.
**Elasticity:** Stress - Strain - Hooke's law - Stress strain diagram - Classification of elastic modulus - Moment, couple and torque - Torsion pendulum - Applications of torsion pendulum - Bending of beams - Experimental determination of Young's modulus: Uniform bending and non-uniform bending.

**UNIT – II: ELECTROMAGNETIC THEORY** — **9+3**

Laws of electrostatics - Electrostatic field and potential of a dipole; Dielectric Polarization, Dielectric constant, internal field - Clausius Mossotti Equation - Laws of magnetism - Ampere's Faraday's law; Lenz's law - Maxwell's equation - Plane electromagnetic waves; their transverse nature - expression for plane, circularly and elliptically polarized light - quarter and half wave plates - production and detection of plane, circularly and elliptically polarized light.

**UNIT – III: OPTICS, LASERS AND FIBRE OPTICS** — **9+3**

**Optics:** Dispersion- Optical instrument: Spectrometer - Determination of refractive index and dispersive power of a prism- Interference of light in thin films: air wedge - Diffraction: grating. **LASER**: Introduction - Population inversion -Pumping - Laser action - Nd-YAG laser - $CO_2$ laser – Applications
**Fibre Optics:** Principle and propagation of light in optical fibre - Numerical aperture and acceptance angle - Types of optical fibre - Fibre optic communication system (Block diagram).

**UNIT- IV: SEMICONDUCTOR PHYSICS** — **9+3**

**Semiconductors**: Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Intrinsic semiconductors - Concept of holes - doping - Extrinsic semiconductors - P type and N type semiconductors - Hall effect.
**Diodes and Transistors**: P-N junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave rectifier using P N junction diodes - PNP and NPN transistors - Three

different configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

| **UNIT- V: QUANTUM PHYSICS** | **9+3** |
|---|---|

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension - Degeneracy.

**TEXT BOOKS**


1. Gaur R. K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publications, 2009.
2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., New Delhi, 2010.


**REFERENCE BOOKS**


1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.
2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.
3. Senthil Kumar G., " Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.
4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.


**E RESOURCES**

NPTEL, Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

**REFERENCE BOOKS**


1. Samir Kumar Ghosh, "A text book of Advanced Practical Physics", New Central Agency (P) Ltd, 2008.
2. Arora C.L., "Practical Physics", S. Chand & Company Ltd., New Delhi, 2013.
3. UmayalSundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.


| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | **45** | **15** | **0** | **60** |

## Mapping of COs with POs

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 1 | | | | | 1 | | | 1 | 3 | 2 |
| **CO 2** | 3 | | 1 | | 1 | | | | | | | 1 | 3 | 3 |
| **CO 3** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | | |
| **CO 4** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 2 | 3 |
| **CO 5** | 3 | | 2 | | | | | | | | | 1 | | |
| **Total** | 15 | 6 | 9 | 6 | 4 | | | | 3 | | | 5 | 8 | 8 |
| **Scaled** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 2 | 2 |

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PAC 103 | APPLIED CHEMISTRY FOR ENGINEERS | 3 | 1 | 0 | 4 |
| PREREQUISITES | Nil | L | T | P | H |
| C:P: A = 3:0:0 | | 3 | 1 | 0 | 4 |

| Course Outcomes (PAC 103): | | Domain | Level |
|---|---|---|---|
| CO1 | **Identify** the periodic properties such as ionization energy, electron affinity, oxidation states and electro negativity. **Describe** the various water quality parameters like hardness and alkalinity. | Cognitive | Remember |
| CO2 | **Explain** and **Measure** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces. | Cognitive | Understand |
| CO3 | **Interpret** bulk properties and processes using thermodynamic and kinetic considerations. | Cognitive | Apply |
| CO4 | **Describe, Illustrate** and **Discuss** the chemical reactions that are used in the synthesis of molecules. | Cognitive | Remember Analyze |
| CO5 | **Apply, Measure** and **Distinguish** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques | Cognitive | Remember Apply |

| UNIT - I: PERIODIC PROPERTIES AND WATER CHEMISTRY | 9+3 |
|---|---|
| Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **Water Chemistry**-Water quality parameters-Definition and explanation of hardness, determination of hardness by EDTA method-Introduction to alkalinity. | |
| **UNIT – II: USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA** | **9+3** |
| Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion-Types, factors affecting corrosion rate and Control methods. Use of free energy considerations in metallurgy through Ellingham diagrams. Advantages of electroless plating, electroless plating of nickel and copper on Printed Circuit Board (PCB). | |

| UNIT- III: ATOMIC AND MOLECULAR STRUCTURE | 9+3 |
|---|---|

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

**Intermolecular forces and potential energy surfaces**

Ionic, dipolar and Vander waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of $H_3$, $H_2F$ and HCN and trajectories on these surfaces.

| UNIT – IV: SPECTROSCOPIC TECHNIQUES AND APPLICATIONS | 9+3 |
|---|---|

Principles of spectroscopy and selection rules. Electronic spectroscopy-chromophore, auxochromes, types of electronic transition and application. Fluorescence and its applications in medicine. Vibrational spectroscopy-types of vibrations, Instrumentation and applications. Rotational spectroscopy of diatomic molecules. Nuclear magnetic resonance spectroscopy-concept of chemical shift and applications-magnetic resonance imaging. Diffraction and scattering.

| UNIT – V: STEREOCHEMISTRY AND ORGANIC REACTIONS | 9+3 |
|---|---|

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

**Organic reactions and synthesis of a drug molecule**

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

| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | 45 | 15 | 0 | 60 |

**TEXT BOOKS**


9. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., 1993
10. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science, 2006.
11. Trapp. C, Cady, M. Giunta. C, Atkins's Physical Chemistry, 10th Edition, Oxford publishers, 2014.
12. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd, 1983.
13. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., 1976.
14. Banwell. C.N, Fundamentals of Molecular Spectroscopy, (3th Edition), McGraw-Hill Book Company, Europe 1983.
15. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (4th edition), S./ Chand & Company Ltd.

New Delhi, 1977.

16. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age International Publishers, 2017.

**REFERENCE BOOKS**

1. Puri B R Sharma L R and Madan S Pathania, "Principles of Physical Chemistry", Vishal publishing Co., Edition 2004
2. Kuriocose, J C and Rajaram, J, "Engineering Chemistry", Volume I/II, Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 2000

**E RESOURCES - MOOCS:**

7. http://www.mooc-list.com/course/chemistry-minor-saylororg
8. https://www.canvas.net/courses/exploring-chemistry
9. http://freevideolectures.com/Course/2263/Engineering-Chemistry-I
10. http://freevideolectures.com/Course/3001/Chemistry-I
11. http://freevideolectures.com/Course/3167/Chemistry-II
12. http://ocw.mit.edu/courses/chemistry/

**REFERENCE BOOKS**

1. Mendham, Denney R.C. Barnes J.D and Thomas N.J.K., "Vogel's Textbook of Quantitative Chemical Analysis", 6th Edition, Pearson Education, 2004.
2. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. "Experiments in Physical Chemistry", 8th Ed.; McGraw-Hill: New York, 2003.

**E RESOURCES - MOOCS**:

1.http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques
2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011
3.http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

**Mapping of COs with POs**

| | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 1 | 2 |
| **CO2** | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 1 | 1 |
| **CO3** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| **CO4** | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 |
| **CO5** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| **Total** | 14 | 0 | 0 | 0 | 0 | 0 | 10 | 13 | 14 | 0 | 0 | 0 | 2 | 3 |
| **Scaled** | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 1 | 1 |

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

0-No Relation, 1- Low Relation, 2-Medium Relation, 3-High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 104 | ELECTRICAL CIRCUIT ANALYSIS | 3 | 1 | 1 | 5 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 1 | 2 | 6 |

| Course Outcomes (PEE 104): | | Domain | Level |
|---|---|---|---|
| CO1 | Apply network theorems for the analysis of electrical circuits.<br>Respond network theorems for the analysis of electrical circuits. | Cognitive<br>Psychomotor | Apply<br>Guided Response |
| CO2 | Comparing the transient and steady-state response of R, RL and RLC electrical circuits.<br>Describe the transient and steady-state response of RL and RC electrical circuits. | Cognitive<br>Psychomotor | Understand<br>Perception |
| CO3 | Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).<br>Construct and analyze of Single-phase transformer for its Sinusoidal response | Cognitive<br>Psychomotor | Analyze<br>Mechanism |
| CO4 | Laplace transforms analysis of ac circuits.<br>Construct and analyze of RLC Series and parallel resonance circuits. | Cognitive<br>Psychomotor | Analyze<br>Mechanism |
| CO5 | To Understand the concept of one port and two port network functions. | Cognitive | Understanding |

**UNIT - I: NETWORK THEOREMS** **9+3+6**

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

**List Of Experiments**

1.Verification of KVL and KCL using hardware and Digital simulation
2.Verification of Thevenin theorem by hardware and Digital simulation
3.Verification of Norton theorem by hardware and Digital simulation
4.Verification of Maximum power transfer theorem by hardware and Digital simulation

**UNIT- II: SOLUTION OF FIRST AND SECOND ORDER NETWORKS** **9+3+6**

Solution of first and second order differential equations for Series and parallel R-L, R-C, RL-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

**List Of Experiments**

5.Transient analysis of Series RL, RC circuits by hardware and Digital simulation
6.Sinusoidal analysis of Series RL, RC circuits by hardware and Digital simulation

**UNIT- III: SINUSOIDAL STEADY STATE ANALYSIS** **9+3+6**

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, effective or RMS values, average power and complex power. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

**List Of Experiments**

7.Measurement of active power for star and delta connected balanced loads
8.Verification of self, mutual inductance and coefficient of coupling by using hardware and Digital

simulation

| UNIT – IV: ELECTRICAL CIRCUIT ANALYSIS USING LAPLACE TRANSFORMS | 9+3+6 |
|---|---|

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances

**List Of Experiments**

9.RLC Series and parallel Resonance by hardware and Digital simulation

| UNIT - V: NETWORK FUNCTIONS AND TWO PORT NETWORKS | 9+3+6 |
|---|---|

Concepts of complex frequency, Transform impedance, Networks function of one port and two port networks, concepts of poles and zeros, property of driving point and transfer function. Two Port Networks, terminal pairs, Relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks.

| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | 45 | 15 | 30 | 90 |

**TEXTBOOKS**


1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.


**REFERENCES**


1. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
2. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.


**E REFERENCES**

1. NPTEL :http://nptel.ac.in/courses/108102042/
2. MOODLE : http://moodle.cecs.pdx.edu/course/view.php?id=16

**REFERENCES**


1. Department Lab Manual
2. Sudhakar.A and ShyamMohan.S.P, “Circuits and Networks Analysis and Synthesis”, Fourth edition, Tata McGraw Hill Publishing Company Ltd., NewDelhi, 2010.

## Mapping of COs with POs

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | | | | | | | | | 1 | | 1 | 1 | 1 |
| **CO 2** | 3 | | | | | | | | | 1 | | 1 | 2 | 1 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | 1 | 2 | 3 | 1 |
| **CO 4** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 3 | 3 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 2 | 2 |
| | 15 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 3 | 6 | 11 | 8 |

0 –No Relation  1 – Low Relation  2 – Medium Relation  3 – High Relation

## SEMESTER II

| COURSE CODE | | | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|---|---|
| PMA 201 | | | CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3 | 0 | 0 | | 3 | 1 | 0 | 4 |

**PREREQUISITE: Mathematics I (Calculus and Linear Algebra)**

| COURSE OUTCOMES: | | DOMAIN | LEVEL |
|---|---|---|---|
| CO1 | Find double and triple integrals and to find line, surface and volume of an integral by Applying Greens, Gauss divergence and Stokes theorem. | Cognitive | Applying<br>Remembering |
| CO2 | Solve first order differential equations of different types which are solvable for p, y, x and Clairaut's type. | Cognitive | Applying |
| CO3 | Solve Second order ordinary differential equations with variable coefficients using various methods. | Cognitive | Remembering |
| CO4 | Use CR equations to verify analytic functions and to find harmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation. | Cognitive | Understanding<br>Remembering |
| CO5 | Apply Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem.<br>Taylor's series, zeros of analytic functions, singularities, Laurent's series. | Cognitive | Applying |

| UNIT – I: MULTIVARIABLE CALCULUS (INTEGRATION) | 12 |
|---|---|
| Multiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes. | |
| **UNIT – II: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS** | **12** |
| Exact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equations solvable for p - equations solvable for y- equations solvable for x and Clairaut's type. | |
| **UNIT –III: ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS** | **12** |
| Second order linear differential equations with variable coefficients- method of variation of parameters - Cauchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and their properties. | |
| **UNIT – IV: COMPLEX VARIABLE – DIFFERENTIATION** | **12** |
| Differentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic conjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties- Conformal mappings- Mobius transformations and their properties. | |
| **UNIT - V: COMPLEX VARIABLE – INTEGRATION** | **12** |
| Contour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof)-Liouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's series – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sine and cosine- Evaluation of certain improper integrals using the Bromwich contour. | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **45** | **15** | **60** |

**Text Book:**

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th$^{th}$ Edition, 2008.

**Reference Books:**


1.G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9$^{th}$ Edition, Pearson, Reprint, 2002.

2. Erwin kreyszig, "Advanced Engineering Mathematics", 9$^{th}$ Edition, John Wiley & Sons, 2006.

3.W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9$^{th}$Edn. Wiley India, 2009.

4. S. L. Ross, "Differential Equations", 3$^{rd}$ Ed., Wiley India, 1984.

5.E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.

6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.

7.J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7$^{th}$ Ed., McGraw Hill, 2004.

8. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.


**Mapping of COs with GAs**

| | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | | | 2 | | | | | 1 | | 2 |
| **CO 2** | 3 | 1 | | | | | | | | 1 | | 1 |
| **CO 3** | 3 | 1 | | | | | | | | 1 | | 1 |
| **CO 4** | 3 | 2 | | | | | | | | 1 | | 1 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | | 2 |
| **TOTAL** | 15 | 8 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 0 | 7 |
| **Scale Value** | 3 | 2 | | | 1 | | | | | 1 | | |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 202 | ELECTROMAGNETIC FIELDS | 3 | 1 | 0 | 4 |
| C:P: A = 3:0:0 | | L | T | P | H |
| | | 3 | 1 | 0 | 4 |

| Course Outcomes (PEE 202): | | DOMAIN | LEVEL |
|---|---|---|---|
| CO1 | To understand the basics of vector and outline different coordinate system. | Cognitive | Remembering Understanding |
| CO2 | To understand the concept of static electric field for simple configuration using Gauss and Coulombs law. | Cognitive | Understanding |
| CO3 | Define the knowledge of electrostatics using, boundary conditions, Poisson's and Laplace equation. | Cognitive | Understanding |
| CO4 | Recall the magnetic field configuration using Different laws and outline time varying electric and magnetic fields using Maxwell's equation. | Cognitive | Remembering Understanding |
| CO5 | Recall the concept of magnetization and magnetic field configuration using boundary condition. | Cognitive | Understanding |

| UNIT- I: REVIEW OF VECTOR CALCULUS | 9+3 |
|---|---|
| Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications, triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation, integration, vector operator del, gradient, divergence and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another. | |
| **UNIT- II: STATIC ELECTRIC FIELD** | **9+3** |
| Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density. | |
| **UNIT – III: CONDUCTORS, DIELECTRICS AND CAPACITANCE** | **9+3** |
| Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations. | |
| **UNIT–IV: STATIC MAGNETIC FIELDS, TIME VARYING FIELDS AND MAXWELL'S EQUATIONS** | **9+3** |
| Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Condit ions. Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic circuits, inductances and mutual inductances. | |
| **UNIT - V: ELECTROMAGNETIC WAVES** | **9+3** |
| Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem. | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|

| | 45 | 15 | 60 |
|---|---|---|---|

**TEXTBOOKS**

1. M. N. O. Sadiku, “Elements of Electromagnetics”, Oxford University Publication, 2014.
2. A. Pramanik, “Electromagnetism - Theory and applications”, PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, “Electromagnetism-Problems with solution”, Prentice Hall India, 2012.
4. G. W. Carter, “The electromagnetic field in its engineering aspects”, Longmans, 1954.

**REFERENCES**

1. W. J. Duffin, “Electricity and Magnetism”, McGraw Hill Publication, 1980.
2. W. J. Duffin, “Advanced Electricity and Magnetism”, McGraw Hill, 1968.
3. E. G. Cullwick, “The Fundamentals of Electromagnetism”, Cambridge University Press,1966.
4. B. D. Popovic, “Introductory Engineering Electromagnetics”, Addison-Wesley Educational Publishers, International Edition, 1971.
5. W. Hayt, “Engineering Electromagnetics”, McGraw Hill Education, 2012.

**REFERENCES**

1. NPTEL :http://nptel.ac.in/courses

**Mapping of COs with POs**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | 1 | - | - | - | - | - | 1 | - | 1 | 1 | 1 |
| **CO2** | 1 | 2 | - | 1 | - | - | - | - | - | - | 1 | - | 2 | 1 |
| **CO3** | 1 | 2 | - | - | - | - | - | - | - | - | - | 1 | 1 | 2 |
| **CO4** | 1 | 3 | - | - | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO5** | 1 | 2 | 1 | - | - | - | - | | - | - | - | 1 | 1 | 1 |
| **Total** | 6 | 11 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 7 | 7 |
| **Scaled** | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|

| PEE 203 | ANALOG ELECTRONICS | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|
| C:P: A = 3:0:0 | | L | T | P | H |
| | | 3 | 0 | 0 | 3 |

| Course Outcomes (PEE 203): | | Domain | Level |
|---|---|---|---|
| CO1 | Understand the characteristics of diode and analyze the rectifier circuits. | Cognitive | Understand Analyze |
| CO2 | Understand the characteristics of transistor. | Cognitive | Understand |
| CO3 | Understand the concept of MOSFET and analyze the circuits and its characteristics | Cognitive | Understand Analyze |
| CO4 | Classify and explain different types of amplifier | Cognitive | Understand |
| CO5 | Recall and explain linear and non-linear application of OP-Amp | Cognitive | Understand |

| UNIT –I: DIODE CIRCUITS | 6 |
|---|---|
| P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, Special diodes, clamping and clipping circuits. | |
| **UNIT – II: BJT CIRCUITS** | **8** |
| Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits. | |
| **UNIT - III: MOSFET CIRCUITS** | **8** |
| MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit. | |
| **UNIT- IV: DIFFERENTIAL, MULTI-STAGE AND OPERATIONAL AMPLIFIERS** | **8** |
| Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product) | |
| **UNIT - V: LINEAR ANDNONLINEARAPPLICATIONS OF OP-AMP** | **15** |
| Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wien bridge and phase shift). Analog to Digital Conversion. Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector, Monoshot. | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 0 | 45 |

**TEXTBOOKS**

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.

2. J. V. Wait, L. P. Huelsman and G. A. Korn, "Introduction to Operational Amplifier theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.

**REFERENCES**

1. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
2. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.
3.Department Lab Manual.

**E REFERENCES**

**2.** www.nptel.ac.in.

## Mapping of COs with POs

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | | | | | | | | | 1 | | 1 | 3 | 3 |
| **CO 2** | 3 | | | | | | | | | 1 | | 1 | 3 | 3 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | 1 | 2 | 3 | 3 |
| **CO 4** | 2 | 2 | | | 1 | | | | | 1 | 1 | 1 | 3 | 3 |
| **CO 5** | | | | | | | | | | | | | 3 | 3 |
| **Total** | 11 | 4 | | | 1 | | | | | 4 | 2 | 5 | 15 | 15 |
| **Scaled** | 2 | 1 | | | 1 | | | | | 1 | 1 | 1 | 3 | 3 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|

| PEE 204 | ELECTRICAL MACHINES - I | 3 | 0 | 1 | 4 |
|---|---|---|---|---|---|
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 0 | 2 | 5 |

| Course Outcomes (PEE 204): | | Domain | Level |
|---|---|---|---|
| CO1 | Understand the operation of DC machines. | Cognitive Psychomotor | Understand Perception |
| CO2 | Understand the winding concepts of DC machine. | Cognitive Psychomotor | Understand Complex Overt Response |
| CO3 | Understand the motoring and generating concepts of DC machine. | Cognitive Psychomotor | Understand Set |
| CO4 | Analyse single phase and three phase transformers circuits. | Cognitive Psychomotor | Analyse Set |
| CO5 | Understand the various losses in magnetic circuits | Cognitive Psychomotor | Understand Set |

**UNIT - I: DC MACHINES – INTRODUCTION** **9+6**

Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil.

**List of Experiments**

1. Study of D.C. Motor Starters

**UNIT - II: DC MACHINES – ARMATURE AND WINDING** **9+6**

Armature winding and commutation – Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

**UNIT - III: DC MACHINE - MOTORING AND GENERATION** **8+6**

Armature circuit equation for motoring and generation, Types of field excitations – separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed. V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

**List of Experiments**

2. Open Circuit Characteristics (OCC) and load Characteristics of D.C self-excited generator.
3. Load characteristics of D.C. shunt generator
4. Load characteristics of D.C. shunt motor
5. Load characteristics of D.C. series motor
6. Speed control of D.C. shunt motor

**UNIT- IV: TRANSFORMERS AND TESTS** **11+6**

Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers. Losses and efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test- separation of hysteresis and eddy current

losses

**List of Experiments**

7. Load test on single-phase transformer.
8. Open circuit and short circuit tests on single phase transformer.

| **UNIT - V: AUTOTRANSFORMERS** | **8+6** |
|---|---|

Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **0** | **30** | **75** |

**TEXTBOOKS**

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.

**REFERENCES**

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
3. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

**Mapping of COs with POs**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 1 | 0 |
| **CO 2** | 3 | - | 2 | 1 | | | | 1 | | | | 1 | | 1 |
| **CO 3** | 3 | | | 1 | | | | 1 | | | 1 | | | 1 |
| **CO 4** | 3 | 2 | 2 | 2 | 1 | | 1 | | | 1 | | 1 | | 1 |
| **CO 5** | 3 | | | 1 | | | | | | 1 | | | | 1 |
| **Total** | 15 | 4 | 6 | 7 | 2 | | 1 | 2 | 1 | 2 | 1 | 3 | 1 | 4 |
| **Scaled** | 3 | 1 | 1 | 2 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

**SEMESTER III**

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 301 | TRANSMISSION AND DISTRIBUTION | 3 | 0 | 0 | 3 |
| C:P: A = 3:0:0 | | L | T | P | H |
| | | 3 | 0 | 0 | 3 |

| Course Outcomes (PEE 301): | | Domain | Level |
|---|---|---|---|
| CO1 | **Explain** the major components of Transmission and Distribution Systems (TDS). **Classify** different types of single and three phase transmission line parameters. | Cognitive | Understanding<br>Understanding |
| CO2 | **Outline** the types of transmission line efficiency calculations and its performance | Cognitive | Understanding |
| CO3 | **Explain** the different types of insulators and **solve** for stress and sag in overhead lines. | Cognitive | Understanding<br>Applying |
| CO4 | **Interpret** different types underground cables. | Cognitive | Understanding |
| CO5 | **Summarize** the latest technologies in the field of distribution systems. | Cognitive | Understanding |

| **UNIT –I: TRANSMISSION LINE PARAMETERS** | **9** |
|---|---|
| Structure of electric power system: Various levels such as generation, transmission and distribution; – Resistance, Inductance and Capacitance calculations – Single-phase and three-phase lines – double circuit lines – effect of earth on transmission line capacitance. | |
| **UNIT- II: PERFORMANCE OF TRANSMISSION LINES** | **9** |
| Regulation and efficiency – Tuned power lines, Power flow through a transmission line – Power circle diagrams, Introduction to Transmission loss and Formation of corona – critical voltages – effect on line performance – travelling waveform phenomena. | |
| **UNIT –III: MECHANICAL DESIGN OF OVERHEAD LINES** | **9** |
| Line supports – Insulators, Voltage distribution in suspension insulators – Testing of insulators – string efficiency – Stress and sag calculation – effects of wind and ice loading. | |
| **UNIT – IV: UNDERGROUND CABLES** | **9** |
| Comparison with overhead line – Types of cables – insulation resistance – potential gradient – capacitance of single-core and three-core cables. | |
| **UNIT –V: DISTRIBUTION SYSTEM** | **9** |
| General aspects – Kelvin's Law – A.C. distribution – Single-phase and three phase – Techniques of voltage control and power factor improvement – Introduction to Distribution loss – Recent trends in transmission and distribution systems | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 0 | 45 |

| TEXTBOOKS |
|---|
| 1.D.P. Kothari and I.J. Nagrath, 'Power System Engineering', Tata McGraw Hill, 2nd Edition, 2008.<br>2.B.R. Gupta, 'Power System Analysis and Design', S.Chand, New Delhi, 2003.<br>3.S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall India Pvt. Ltd, 2002. |
| **REFERENCES** |
| 1.Luces M.Fualkenberry ,Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 1996.<br>2.Hadisaddak, 'Power System Analysis,' Tata McGraw Hill Publishing Company',2003<br>3.Central Electricity Authority (CEA), 'Guidelines for Transmission System Planning', New Delhi<br>4.Tamil Nadu Electricity Board Handbook', 2012. |
| **E REFERENCES** |
| 1.NPTEL, Power System Generation, Transmission and Distribution Prof. D. P. Kothari Center for Energy Studies Indian Institute of Technology, Delhi. |

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | | | | | | | | 1 | | 2 | 2 | 1 |
| **CO2** | 1 | 3 | 1 | | 1 | | | | | | | 1 | 3 | 1 |
| **CO3** | 1 | | | 1 | 1 | | | | | 1 | | | 2 | 1 |
| **CO4** | 1 | 2 | | | | | | | | | 1 | 1 | 2 | 1 |
| **CO5** | 1 | 2 | | | | | | | | | | 1 | 2 | 1 |
| **Total** | 5 | 10 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 1 | 5 | 11 | 5 |
| **Scaled** | 2 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 302 | ENVIRONMENTAL SCIENCES | 3 | 0 | 0 | 3 |
| C:P: A = 1:0:0 | | L | T | P | H |
| | | 3 | 0 | 0 | 3 |

| Course Outcomes (PEE 302 ): | | DOMAIN | LEVEL |
|---|---|---|---|
| CO1 | **Describe** the significance of natural resources and **explain** anthropogenic impacts. | Cognitive | Remember Understand |
| CO2 | **Illustrate** the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance. | Cognitive | Understand |
| CO3 | **Identify** the facts, consequences, preventive measures of major pollutions and **recognize** the disaster phenomenon | Cognitive Affective | Remember Receive |
| CO4 | **Explain** the socio-economic, policy dynamics and **practice** the control measures of global issues for sustainable development. | Cognitive | Understand Apply |
| CO5 | **Recognize** the impact of population and the concept of various welfare programs, and **apply** the modern technology towards environmental protection. | Cognitive | Understand Analysis |

| UNIT – I: INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY | 12 |
|---|---|
| Definition, scope and importance – Need for public awareness – Forest resources: Use, deforestation, case studies. – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: Uses, environmental effects of mining, case studies-iron mining(Goa), bauxite mining(Odisha) – Food resources: effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies – Land resources: Land as a resource, land degradation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. | |
| **UNIT – II: ECOSYSTEMS AND BIODIVERSITY** | **7** |
| Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. | |
| **UNIT – III: ENVIRONMENTAL POLLUTION** | **10** |
| Definition – Causes, 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– Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide. | |
| **UNIT – IV: SOCIAL ISSUES AND THE ENVIRONMENT** | **10** |
| Rain water harvesting – Resettlement and rehabilitation of people; its problems and concerns, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents – 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 – Public awareness. | |

| UNIT – V: HUMAN POPULATION AND THE ENVIRONMENT | 6 |
|---|---|
| Population growth, variation among nations – Population explosion– Environment and human health – HIV / AIDS– Role of Information Technology in Environment and human health. | |

| | LECTURE | TUTORIAL | PRACTICAL | SELF STUDY | TOTAL |
|---|---|---|---|---|---|
| | 45 | 0 | 0 | 0 | 45 |

**TEXT BOOKS**


1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.
2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003
3. Trivedi R. K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.
4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006.
5. Introduction to International disaster management, Butterworth Heinemann, 2006.
6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.


**REFERENCE BOOKS**


1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001.
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012.
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003.
5. Sundar, Disaster Management, Sarup& Sons, New Delhi, 2007.
6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006.


**E RESOURCES**

1. http://www.e-booksdirectory.com/details.php?ebook=10526
2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science
3. https://www.free-ebooks.net/ebook/What-is-Biodiversity
4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4

5. http://bookboon.com/en/pollution-prevention-and-control-ebook
6. http://www.e-booksdirectory.com/details.php?ebook=8557
7. http://www.e-booksdirectory.com/details.php?ebook=6804
8. http://bookboon.com/en/atmospheric-pollution-ebook
9. http://www.e-booksdirectory.com/details.php?ebook=3749
10. http://www.e-booksdirectory.com/details.php?ebook=2604
11. http://www.e-booksdirectory.com/details.php?ebook=2116
12. http://www.e-booksdirectory.com/details.php?ebook=1026
13. http://www.faadooengineers.com/threads/7894-Environmental-Science

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 303 | SIGNALS AND SYSTEMS | 2 | 1 | 0 | 3 |
| C:P: A = 3:0:0 | | L | T | P | H |
| | | 2 | 1 | 0 | 3 |

| Course Outcomes (PEE 303): | | Domain | Level |
|---|---|---|---|
| CO1 | Understand the concepts of continuous time and discrete time systems. | Cognitive | Understand |
| CO2 | Analyse systems in complex frequency domain. | Cognitive | Analyse |
| CO3 | Learn about Fourier transformation techniques | Cognitive | Remembering |
| CO4 | Learn about Laplace transformation techniques | Cognitive | Remembering |
| CO5 | Learn about Z- transformation techniques | Cognitive | Remembering |

| UNIT - I: INTRODUCTION TO SIGNALS AND SYSTEMS | 9 |
|---|---|
| Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, reliability. Examples. | |
| **UNIT – II: BEHAVIOUR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS** | **9** |
| Impulse response and step response, convolution, input-output behaviour with a periodic convergent input, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its Relation to the impulse response. | |
| **UNIT – III: FOURIER TRANSFORMS** | **9** |
| Fourier series representation of periodic signals, Waveform Symmetries, Fourier Coefficients, harmonic spectrum and THD. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Application to simple circuits. | |
| **UNIT – IV: LAPLACE TRANSFORMS** | **6** |
| Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behaviour. Application to simple circuits. | |
| **UNIT – V: Z - TRANSFORMS AND SAMPLING RECONSTRUCTION** | **12** |
| The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis. The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems. | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|

| | 30 | 15 | 45 |
|---|---|---|---|
| **TEXTBOOKS** | | | |
| 3. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall<br><br>India, 1997.<br>4. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms,<br><br>and Applications", Pearson, 2006.<br>3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.<br>4. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007. | | | |
| **REFERENCES** | | | |
| 2. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.<br><br>2. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education,2007.<br>3. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009. | | | |

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | 1 | | | | 1 | | | 1 | 1 | 0 |
| **CO 2** | 3 | 3 | 2 | 1 | | 3 | | 1 | | | | 2 | | 1 |
| **CO 3** | 3 | | | 1 | | 3 | | 1 | | | 1 | | | 1 |
| **CO 4** | 3 | 2 | 2 | 2 | 1 | | 1 | | | 2 | | 2 | | 1 |
| **CO 5** | 3 | | | 1 | | | | | | 2 | | | | 1 |
| **Total** | 15 | 7 | 6 | 7 | 2 | 6 | 1 | 2 | 1 | 4 | 1 | 5 | 1 | 4 |
| **Scaled** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 304 | ELECTRICAL MACHINES – II | 3 | 0 | 1 | 4 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 0 | 2 | 5 |

| Course Outcomes (PEE 304): | | Domain | Level |
|---|---|---|---|
| CO1 | To Understand the fundamentals of different types of slots and windings used for AC machines. | Cognitive Psychomotor | Understanding Mechanism |
| CO2 | To Understand the concepts of pulsating and revolving magnetic fields. | Cognitive Psychomotor | Understanding Mechanism |
| CO3 | To Understand the operation of induction machines, ttorque slip characteristics, equivalent circuit and its phasor diagram. | Cognitive Psychomotor | Understanding Mechanism |
| CO4 | To Understand the different typesof starting, braking and speed control for induction motors. React the generator operation, self-excitation and doubly-fed Induction machines. | Cognitive Psychomotor | Understanding Response |
| CO5 | To Understand the operation of single-phase induction motors and its performance parameters. | Cognitive Psychomotor | Understanding Perception |

**UNIT - I: FUNDAMENTALS OF AC MACHINE WINDINGS** **9+6**

Physical arrangement of windings in stator and cylindrical rotor–Slots for windings –Single-turn coil –Active portion and overhang –Full-pitch coils–Types of windings– 3D visualization of the above winding types– Air-gap MMF distribution with fixed current through winding –Winding distribution factor.

**List of Experiments**

1.Load test on three phase squirrel cage induction motor.
2. Load test on three phase slip ring induction motor.
3. Load test of a three-phase alternator.
4. Load test on single-phase induction motor.

**UNIT – II: PULSATING AND REVOLVING MAGNETIC FIELDS** **9+6**

Types of magnetic fields –Alternating current in windings with spatial displacement – Magnetic field produced by a single winding – Fixed current and alternating current. Pulsating fields produced by spatially displaced windings– Windings spatially shifted by 90° – Three windings spatially shifted by 120° (carrying three-phase balanced currents) – Revolving magnetic field.

**List of Experiments**

5. No load and blocked rotor test on single phase induction motor.
6. No load and blocked rotor test on three phase induction motor.

**UNIT- III: INDUCTION MACHINES** **9+6**

Constructional details –Types of rotors (squirrel cage and slip-ring) – Torque Slip Characteristics – Equivalent circuit – Phasor Diagram– Effect of parameter variation on torque speed characteristics – Methods of starting, braking and speed control for induction motors–Generator operation –Self-excitation– Doubly-Fed Induction Machines.

**List of Experiments**

7. Regulation of three phase alternator by EMF /MMF methods.
8. V and inverted V curves of three phase synchronous motor.

| **UNIT – IV: SINGLE PHASE INDUCTION MOTORS** | **9+6** |
|---|---|

Constructional details of single-phase induction motor – Double revolving field theory and operation – Equivalent circuit – Determination of parameters – Split-phase starting methods and applications.

**List of Experiments**

9. OCC and load characteristics of three phase alternator.

| **UNIT – V: SYNCHRONOUS MACHINES** | **9+6** |
|---|---|

Constructional details – Cylindrical rotor synchronous machine– EMF equation –Equivalent circuit – Phasor diagram–Armature reaction–Voltage regulation– V-curves. Salient pole machine – Two reaction theory –Phasor diagram –Power angle characteristics. Synchronizing and parallel operation. (Basic operation of synchronous motors)

**List of Experiments**

10. Study of induction motor starters.

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **0** | **30** | **75** |

**TEXTBOOKS:**


1. I. J. Nagrath and D. P. Kothari, ‘Electric Machines’, Tata McGraw Hill Publishing Company Ltd, 2010.
2. M. G. Say, ‘Performance and Design of AC Machines’, CBS Publishers, 2002.
3. P. S. Bimbhra, ‘Electrical Machinery’, Khanna Publishers, 2011.
4. B.L.Theraja, ‘A Textbook of Electrical Technology’, Vol. I & II, M/s S.Chand, Delhi,2013.


**REFERENCES:**


1. A. E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, ‘Electric Machinery’, Tata McGraw Hill publishing Company Ltd, 2013.
2. A. S. Langsdorf, ‘Alternating Current Machines’, Tata McGraw Hill publishing Company Ltd, 1984.
3. P. C. Sen, “Principles of Electric Machines and Power Electronics”, John Wiley & Sons, 2007.
4. J.B. Gupta, ‘Theory and Performance of Electrical Machines’, S.K.Kataria and Sons, 2002.
5. Deshpande M.V., ‘Electrical Machines’, PHI Learning Pvt Ltd., New Delhi – 2011.
6. A. G. Warren, ‘Problems in Electrical Engineering’, Parker and Smith Solutions, New York, 1940.
7. K. Murugesh Kumar, ‘Electric Machines’, Vikas Publishing House Pvt Ltd, 2002.
8. Department Laboratory Manual.


**E REFERENCES:**

http://freevideolectures.com/Course/2335/Basic-Electrical-Technology35-38,

Prof. L. Umanand, IISc Bangalore.

## Mapping of COs with POs

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 |
| **CO 2** | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |
| **CO 3** | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| **CO 4** | 2 | 2 | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| **CO 5** | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| **Total** | 14 | 8 | 7 | 9 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 7 | 5 |
| **Scaled** | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

## SEMESTER IV

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 401 | DIGITAL ELECTRONICS | 3 | 0 | 0 | 3 |
| C:P: A = 3:0:0 | | L | T | P | CH |
| | | 3 | 0 | 0 | 3 |

| Course Outcomes (PEE 401): | | Domain | Level |
|---|---|---|---|
| CO1 | Understand numerical values in various number systems and show number conversions between different number Systems. | Cognitive | Understanding |
| CO2 | Analyze Boolean functions and minimization techniques using k –maps and postulates and theorems of Boolean Algebra, minimization of Boolean functions using basic laws. | Cognitive | Analyze |
| CO3 | TO Apply Logic gates and their applications and construct the simple adders and sub tractors using logic gates. | Cognitive | Apply |
| CO4 | To Understand the process of Analog to Digital conversion and its applications. | Cognitive | Understanding |
| CO5 | To Understand the process of Digital to Analog conversion and its applications. | Cognitive | Understanding |

| UNIT - I: FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES | 9 |
|---|---|
| Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families. | |
| **UNIT – II: COMBINATIONAL DIGITAL CIRCUITS** | **9** |
| Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer,De-Multiplexer/Decoders, Adders, Subtractors, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders Q-M method of function realization. | |
| **UNIT – III: SEQUENTIAL CIRCUITS AND SYSTEMS** | **9** |
| A 1-bit memory, the circuit properties of Bistable latch, JK, SR, D and T types flip-flops, applications of flip-flops, shift registers, applications of shift registers, Asynchronous counters, synchronous counters design using flip flops, special counter IC's, applications of counters. | |
| **UNIT – IV: A/D AND D/A CONVERTERS** | **9** |
| Digital to analog converters: weighted resistor/converter, R-2R Ladder DAC, specifications for D/A converters, examples of DAC lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator ADC, successive approximation ADC, specifications of ADC, example of ADC ICs. | |
| **UNIT – V: SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES** | **9** |
| Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, ROM, RAM, content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, PLA, PAL, CPLDS, and | |

| FPGA. | | | | |
|---|---|---|---|---|
| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
| | **45** | **0** | **0** | **45** |
| **TEXTBOOKS** | | | | |
| 1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.<br>2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.<br>3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016. | | | | |
| **REFERENCES** | | | | |
| 1. Taub and Schilling, 'Digital Integrated Circuits', McGraw Hill, 2002.<br>2. Samuel C. Lee “Digital Circuits and Logic Designs” Prentice Hall of India; 2000.<br>3. Fletcher, W.I., 'An Engineering Approach to Digital Design', Prentice Hall of India, 2002.<br>4. Anand Kumar, Fundamental of Digital circuits, PHI 2003. | | | | |
| **E REFERENCES** | | | | |
| **1.** NPTEL, Digital Logic Circuits, Prof. S.Srinivasan, IIT Madras.<br>**2.** NPTEL, Digital Logic Circuits, Prof. D. Roychoudhury, IIT Kharagpur. | | | | |

**Mapping of COs with POs**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | - | - | 1 | 1 | 1 | - | 1 | - | 2 | 2 | 1 |
| **CO2** | 3 | 2 | 1 | - | - | 2 | 0 | 2 | 1 | - | - | 2 | 1 | 2 |
| **CO3** | 2 | 2 | 1 | - | - | 1 | 2 | 2 | 1 | 1 | - | 1 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | - | - | 1 | 1 | 1 | - | - | 1 | 1 | 1 | 2 |
| **CO5** | 3 | 2 | 2 | - | - | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| **Total** | 12 | 9 | 10 | - | - | 4 | 5 | 7 | 3 | 3 | 2 | 8 | 8 | 9 |
| **Scaled** | 3 | 2 | 2 | | | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 404 | POWER ELECTRONICS | 3 | 0 | 1 | 4 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 0 | 2 | 5 |

| Course Outcomes (PEE 404): | | Domain | Level |
|---|---|---|---|
| CO1 | To Understand the structure, operation and characteristics of power switching devices. | Cognitive Psychomotor | Understanding |
| CO2 | Determine the operation, characteristics and performance parameters of controlled rectifiers. | Cognitive Psychomotor | Understanding Response |
| CO3 | Analysis the operation of DC - DC choppers. | Cognitive Psychomotor | Analyzing Mechanism |
| CO4 | Analysis the operation of various inverters and infer the suitable PWM techniques. | Cognitive Psychomotor | Analyzing Mechanism |
| CO5 | To Understand the concept of various types of AC voltage controllers. | Cognitive Psychomotor | Understanding Mechanism |

**UNIT - I: POWER SWITCHING DEVICES** **9+6**

Review on Semiconductor devices – I-V characteristics and Switching Characteristics of power Diodes, SCR, TRIAC, power BJT, power MOSFET and IGBT. Triggering and Commutation Circuits.

**List of Experiments**

1.Characteristics of SCR.

2. Characteristics of MOSFET

3. Characteristics of IGBT

**UNIT – II: THYRISTOR RECTIFIERS** **9+6**

Single phase half-wave and full-wave thyristor 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.

**List of Experiments**

4. Single phase fully controlled rectifier with R, RL load

**UNIT- III: DC TO DC CHOPPERS** **9+6**

Types of Choppers, Class A to E, step-up and step-down choppers – Analysis of Voltage, Current and Load commutated choppers –Introduction to Resonant converters

**List of Experiments**

5. BUCK- BOOST converter using MOSFET

6. IGBT based choppers.

**UNIT – IV: INVERTERS** **9+6**

Single phase, Three phase voltage source inverters (Both $120^{o}$ and $180^{o}$ mode of conductions) – Bipolar sinusoidal modulation and unipolar sinusoidal modulation, Modulation Index - PWM Techniques- Current Source Inverters.

**List of Experiments**

7. Single phase IGBT PWM inverter.
8. Series Inverter/ Parallel Inverter.

| **UNIT -V: AC VOLTAGE CONTROLLERS** | **9+6** |
|---|---|

Single-phase and three phase AC voltage controllers -. Multi-stage sequence control – step-up and step-down cycloconverter – Single phase to single phase and Single phase to Three phase cycloconverters.

**List of Experiments**

9. Single phase AC voltage controller using SCR / TRIAC
10. Single phase cycloconverter
11. Mini project: Design of basic power converter circuits.

| | **LECTURE** | **TUTORIAL** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|---|
| | **45** | **0** | **30** | **75** |

**TEXTBOOKS**


1. Rashid, M.H., 'Power Electronics: Circuits, Devices and Applications', Pearson Education India, 2009.
2. Singh, M.D and Kanchandani, 'Power Electronics', Tata McGraw Hill & Hill publication Company Ltd New Delhi, 2009.
3. Bimbhra, P.S., 'Power Electronics', Khanna Publishers, 2007.
4. Ned Mohan, Tore M. Undeland and William P.Robbins, 'Power Electronics: Converters, Applications and Design', New Jersey, John Wiley and Sons, 2007.


**REFERENCES**


1. Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., 'Thyristorised Power Controllers', Wiley Eastern Limited, 1986.
2. Lander,W., 'Power Electronics', McGraw Hill and Company, Third Edition, 2009.
3. Sen.P.C., 'Power Electronics', Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2005.
4. Joseph Vithayathil, 'Power Electronics', McGraw-Hill New York, 1996.
5. Erickson, R.W and Maksimovic, D., 'Fundamentals of Power Electronics', Springer Science & Business Media, 2007.
6. Umanand, L., 'Power Electronics: Essentials and Applications', Wiley India, 2009.
7. Department Laboratory Manual.


**E REFERENCES**

1. **Lecture** Series on **Power Electronics** by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay.
2. http://www.nptel.ac.in/courses/108105066/PDF/L-1(SSG)(PE)%20((EE)NPTEL).pdf

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | 2 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 3 | 1 |
| **CO 2** | 2 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **CO 3** | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **CO 4** | 1 | 3 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| **CO 5** | 1 | 2 | 3 | 1 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 3 | 2 |
| **Total** | 10 | 9 | 9 | 2 | 3 | 2 | 5 | 1 | 0 | 0 | 0 | 1 | 11 | 8 |
| **Scaled** | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 3 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

**SEMESTER V**

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 501 | POWER SYSTEMS-I | 3 | 0 | 0 | 3 |
| C:P: A = 3:0:0 | (APPARATUS AND MODELING) | L | T | P | H |
| | | 3 | 0 | 0 | 3 |

| Course Outcomes (PEE 501): | | Domain | Level |
|---|---|---|---|
| CO1 | Understand the concepts of power systems. | Cognitive | Understand |
| CO2 | Understand the various power system components. | Cognitive | Understand |
| CO3 | Evaluate fault currents for different types of faults. | Cognitive | Evaluate |
| CO4 | Understand the generation of over voltages and insulation coordination basic protection schemes. | Cognitive | Understand |
| CO5 | Understand concepts of HVDC power transmission and renewable energy generation. | Cognitive | Understand |

**Learning Objectives**: Able to demonstrate the principles and practices of the electrical power industry regarding generation, transmission, distribution and electrical machines and their controls.

| UNIT - I: INTRODUCTION | 9 |
|---|---|

Need for system analysis in planning and operation of modern power system – per phase analysis - Single line diagram - Per unit representation and Per unit calculations – Change of base – introduction to Electricity Deregulation.

| UNIT – II: MODELLING OF POWER SYSTEM COMPONENTS | 9 |
|---|---|

Primitive network and its matrices – bus incidence matrix – bus admittance and bus impedance matrix formation – Z – Bus building algorithm - Modelling of generator, load, transformer, transmission line for different power system studies.

| UNIT – III: FAULT ANALYSIS-UNSYMMETRICAL FAULTS | 9 |
|---|---|

Need for short circuit study - basic assumptions in fault analysis of power systems. Symmetrical (or) balanced three phase faults – problem formulation – fault analysis using Z-bus matrix – algorithm and flow chart. Computations of short circuit capacity, post fault voltage and currents. Introduction to symmetrical components – sequence impedances – sequence networks Unsymmetrical fault analysis: L-G, L-L and L-L-G faults.

| UNIT – IV: POWER FLOW ANALYSIS | 9 |
|---|---|

Need for Power Flow Analysis – bus classification – derivation of power flow equation – solution by Gauss–Seidel, Newton–Raphson and Fast Decoupled Power Flow methods – comparison of three methods

| UNIT–V: STABILITY ANALYSIS | 9 |
|---|---|

Types of stability - Swing equation in state space form - equal area criterion - stability analysis of single machine connected to infinite bus by modified Euler's method using classical machine model– critical clearing angle and time. Causes of voltage instability – voltage stability proximity indices for two-bus system – methods of improving power system stability.

| | LECTURE | PRACTICAL | TOTAL |
|---|---|---|---|
| | 45 | 0 | 45 |

**TEXT BOOKS**

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw-Hill Education; 2nd edition (December 28, 2015)
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1st July 2017.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 2nd Edition, 2009.

**REFERENCES**

1. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 4th Edition (29 June 2011)
2. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 5 **edition** (December 26, 2012)

**E REFERENCES**

www.nptel.ac.in
https://nptel.ac.in/courses/108104051/
https://nptel.ac.in/courses/108102047/

## Mapping of COs with POs

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | | | | | | | | | 1 | | 1 | 3 | 2 |
| **CO 2** | 3 | | | | | | | | | 1 | | 1 | 3 | 2 |
| **CO 3** | 3 | 2 | | | | | | | | 1 | 1 | 2 | 3 | 2 |
| **CO 4** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 3 | 2 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 | 3 | 2 |
| **Total** | 15 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 3 | 6 | 3 | 2 |
| **Scaled** | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| | **INDUSTRIAL ECONOMIICS AND FOREIGN TRADE** | **3** | **0** | **0** | **3** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **3:0:0** | | **3** | **0** | **0** | **3** |

| **Course Outcomes:** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | States the international trade theory | Cognitive | Remember |
| **CO2** | List the international trade policy | Cognitive | Remember |
| **CO3** | Outline economic scales | Cognitive | Remember |
| **CO4** | Distinguish the Human Aspects and Social Issues in TIM | Cognitive | Understanding |
| **CO5** | List the sustainability of technology | Cognitive | Remember |

**Learning Objectives:**

Able to understand international trade theory
Able to know international trade policy
Able to understand the economics scales
Able to know economy macroeconomics
Able to know international monetary system

| **UNIT- I: INTRODUCTION TO INTERNATIONAL TRADE POLICY** | **10** |
|---|---|
| The Law of Comparative Advantage - The Standard Theory of International Trade - Demand and Supply, Offer Curves, and the Terms of Trade - Factor Endowments and the Heckscher–Ohlin Theory - Economies of Scale, Imperfect Competition, and International Trade - Economic Growth and International Trade | |
| **UNIT- II: INTERNATIONAL TRADE POLICY** | **9** |
| Trade Restrictions: Tariffs - Nontariff Trade Barriers and the New Protectionism - Economic Integration: Customs Unions and Free Trade Areas - International Trade and Economic Development - International Resource Movements and Multinational Corporations | |
| **UNIT- III: ECONOMIC SCALES** | **8** |
| Economies of Scale, Imperfect Competition, and International Trade - Economic Growth and International Trade | |
| **UNIT- IV: ECONOMY MACROECONOMICS** | **9** |
| The Price Adjustment Mechanism with Flexible and Fixed Exchange Rates - The Income Adjustment Mechanism and Synthesis of Automatic Adjustments - Open-Economy Macroeconomics: Adjustment Policies - Prices and Output in an Open Economy: Aggregate Demand and Aggregate Supply | |
| **UNIT- V: INTERNATIONAL MONETARY SYSTEM** | **9** |
| Flexible versus Fixed Exchange Rates, the European Monetary System, and Macroeconomic Policy Coordination 645 21 The International Monetary System: Past, Present, and Future | |

| | **LECTURE** | **TUTORIAL** | **TOTAL** |
|---|---|---|---|
| | **45** | **0** | **45** |

**TEXTBOOKS**

| |
|---|
| 1. Dominick Salvatore (2013), “International Economics” John Wiley & Sons, USA |
| **REFERENCES** |
| 2.Thomas A Pugel, “International Economics” McGraw Hill Education, 13th Edition, New Delhi |
| **E REFERENCES** |
| **-** |

**Mapping COs versus POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | | | | | |
| **CO 2** | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | | | | | |
| **CO 3** | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | | | | | |
| **CO 4** | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | | | | | |
| **CO 5** | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | | | | | |
| **Total** | 10 | 10 | 10 | 15 | 15 | 15 | 10 | 10 | 15 | | | | | |
| **Scaled** | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | | | | | |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 504 | CONTROL SYSTEMS | 3 | 0 | 1 | 4 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 0 | 2 | 5 |

| Course Outcomes (PEE 504): | | Domain | Level |
|---|---|---|---|
| CO1 | **Identify** the basic elements, derive the transfer function and **Compute** the overall gain of the control system **and Construct** the transfer function of DC motors and DC generators. | Cognitive Psychomotor | Understanding Complex or Overt Response |
| CO2 | **Explain** the performance of I and II system with static and dynamic error coefficients. | Cognitive Psychomotor | Understanding Set |
| CO3 | **Describe** the frequency domain specifications and show the response of frequency response. | Cognitive Psychomotor | Remembering Understanding Set |
| CO4 | **Determine** the stability of the systems and **Design** the suitable compensator and controller for the given performance criteria of the control system | Cognitive Psychomotor | Understanding Design Perception |
| CO5 | **Describe** State transition matrix. **Explain** State space model **and construct** and **verify** the canonical state model and Kalman's test for controllability and observability. | Cognitive | Remembering |

**Learning Objectives:** Control Systems is the engineering discipline that applies control theory to design systems with desired behaviors. To make students understand the concept of system representation for stability analysis and state –space analysis, to design the compensator in time and frequency domain, to design the PID compensator.

**UNIT - I: SYSTEMS AND THEIR REPRESENTATION** **15**

Basic elements in control systems – Open and closed loop systems – Principles of feedback, Transfer function Block diagram reduction techniques – Signal flow graphs. Mason gain formula, Modeling of electric systems translation and rotational mechanical systems.

**List of Experiments**

1. Transfer function and modeling of separately excited DC Generator.
2. Transfer function and modeling of Armature & field-controlled DC Motor.
3. 3. Transfer function of AC Servomotor

**UNIT – II: TIME RESPONSE ANALYSIS** **15**

Time response – Time domain specifications - Standard test signals. Time response of first and second order systems for standard test inputs. Error coefficients – Generalized error series – Steady state error

**List of Experiments**

4. Analysis of Synchro Transmitter and Receiver.
5. Performance of DC Stepper Motor
6. Digital simulation of I order and II order system by using Scilab.

| UNIT - III: FREQUENCY-RESPONSE ANALYSIS | 15 |
|---|---|

Frequency domain specification – Bode plot – Polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications

**List of Experiments**

7. Frequency response of Lag, Lead & Lag – Lead networks.
8. Determination of Phase margin and Gain margin of the Bode plot using Scilab.

| UNIT - IV: STABILITY ANALYSIS AND CONTROLLER DESIGN | 15 |
|---|---|

Characteristics equation – Location of roots in S plane for stability –Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition –Nyquist stability criterion. Introduction to design of Proportional, Integral and Derivative Controllers- Lead and Lag compensator- Analog and Digital implementation of controllers.

| UNIT – V: STATE VARIABLE ANALYSIS | 15 |
|---|---|

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Physical variable phase variable and canonical variable forms State Space representation of continuous time system. Transfer function from state variable representation –. Concept of controllability and observability.

**List of Experiments**

9. Transfer function and modeling of Ward – Leonard speed control system applied to DC motor.
10. DC Position using feedback Control system.

| | LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|---|
| | 45 | 0 | 30 | 75 |

**TEXTBOOKS**


1. I.J. Nagrath & M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003
2. Norman S. Nise, "Control System Engineering" Fifth edition, John Wiley &Sons, Inc, 2007.
3. M. Gopal, 'Control Systems, Principles & Design', Tata McGraw Hill, New Delhi, 2002.
4. Richard C. Dorf& Robert H. Bishop, "Modern Control Systems", Addison– Wesley, 2012.


**REFERENCES**


2. B.C. Kuo, 'Automatic Control Systems', Prentice Hall of India Ltd., New Delhi, 2014.
3. K. Ogata, 'Modern Control Engineering', 4th edition, Pearson Education, New Delhi, 2003 / PHI.
4. N. Bandyopadhyay, 'Control Engineering Theory and Practice', Prentice Hall of India, 2009
5. John J.D'azzo & Constantine H.Houpis, 'Linear control system analysis and design', Tata McGraw Hill, Inc., 2013


**E – REFERENCES**

NTPEL, Control Systems Engineering (Web Course), Prof. M. Gopal, IIT Kharagpur.

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO 12 | PS O1 | PS O2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 1 | | | 1 | 1 | 1 | | | 1 | | |
| **CO2** | 2 | 3 | 1 | | 2 | 1 | 1 | 1 | 1 | 1 | | 2 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | | | 1 | | 3 | | | | 2 | 2 |
| **CO4** | 1 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 2 |
| **CO5** | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | | 1 | 2 | 2 |
| **Total** | 10 | 10 | 9 | 7 | 4 | 4 | 5 | 4 | 9 | 3 | 1 | 6 | 7 | 7 |
| **Scaled** | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

**SEMESTER VI**

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 601 | POWER SYSTEMS-II (OPERATION AND CONTROL) | 3 | 0 | 0 | 3 |
| C:P: A = 3:0:0 | | L | T | P | H |
| | | 3 | 0 | 0 | 3 |

| Course Outcomes (PEE 601): | | Domain | Level |
|---|---|---|---|
| CO1 | Use numerical methods to analyze a power system in steady state. | Cognitive | Analyze |
| CO2 | Understand stability constraints in a synchronous grid. | Cognitive | Understand |
| CO3 | Understand methods to control the voltage, frequency and power flow | Cognitive | Understand |
| CO4 | Understand the monitoring and control of a power system. | Cognitive | Understand |
| CO5 | Understand the basics of power system economics. | Cognitive | Understand |

**Learning objectives:** To provide the knowledge of optimization techniques used in the power system and Load Frequency Control (LFC). To provide a solid foundation in mathematical and engineering fundamentals required to control the governing system in Turbine models. To provide the knowledge of Hydrothermal scheduling, reactive power control.

| **UNIT - I: INTRODUCTION** | **9** |
|---|---|
| An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves - Importance of load forecasting - quadratic and exponential curve fitting techniques for forecasting – plant level and system level controls. | |
| **UNIT – II: REAL POWER - FREQUENCY CONTROL** | **9** |
| Basics of speed governing mechanism and modelling - speed-load characteristics – load sharing between two synchronous machines in parallel - concept of control area - LFC control of a single-area system: static and dynamic analysis of uncontrolled and controlled cases - two-area system: modelling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model. | |
| **UNIT – III: REACTIVE POWER–VOLTAGE CONTROL** | **9** |
| Generation and absorption of reactive power - basics of reactive power control - excitation systems– modelling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, injection reactive power - SVC (TCR + TSC) and STATCOM – secondary voltage control. | |
| **UNIT – IV: UNIT COMMITMENT AND ECONOMIC DISPATCH** | **9** |
| Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve - coordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-list method - forward dynamic programming. | |
| **UNIT – V: COMPUTER CONTROL OF POWER SYSTEMS** | **9** |
| Need for computer control of power systems - concept of energy control centre – functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS | |

| |
|---|
| functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies. |

| LECTURE | PRACTICAL | TOTAL |
|---|---|---|
| 45 | 0 | 45 |

**TEXTBOOKS**


1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 3rd Edition ,2013.
3. Kundur P., 'Power System Stability and Control, Tata McGraw Hill, New Delhi, 5th reprint, 2014.


**REFERENCES**


1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition,2011.
2. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
3. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.


**E REFERENCES**

www.nptel.ac.in

https://nptel.ac.in/courses/108102047/29

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | 2 | 1 | 1 | 1 | 1 | - | - | - | 1 | - | 1 | 2 | 2 |
| **CO 2** | 3 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | - | 1 | 1 | 1 |
| **CO 3** | 2 | 1 | 1 | 2 | 1 | 0 | - | - | - | 1 | - | 2 | 1 | 1 |
| **CO 4** | 1 | 1 | 1 | 1 | 1 | 0 | 1 | - | - | 1 | - | 1 | 2 | 2 |
| **CO 5** | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - | 1 | - | 1 | 1 | 1 |
| **Total** | 10 | 8 | 6 | 5 | 5 | 3 | 2 | 0 | 0 | 5 | 0 | 6 | 7 | 7 |
| **Scaling** | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| | **E-WASTE MANAGEMENT** | **3** | **0** | **0** | **3** |
| **C:P: A** | | **L** | **T** | **P** | **H** |
| **3:0:0** | | **3** | **0** | **0** | **3** |

| **Course Outcomes:** | | **Domain** | **Level** |
|---|---|---|---|
| **CO1** | Able to **find** the technologies for waste electrical and electronic equipment | Cognitive | Remember |
| **CO2** | Able to **explain** the methods of Mechanical Processing of waste disposal | Cognitive | Remember |
| **CO3** | Able to **classify** the sources of Hydrometallurgical Processing | Cognitive | Remember Understand |
| **CO4** | Able to **summarize** the Electronic Waste Recycling | Cognitive | Remember Understand |
| **CO5** | Able to **demonstrate** the methods for Batteries disposal | Cognitive | Remember Understand |

**Learning Objectives:**

- To classify waste sources
- To identify methods of waste disposal
- To study various energy generation methods
- To analyse recycling of e-waste

| **UNIT- I: INTRODUCTION** | **9** |
|---|---|
| Introduction, Electronic Waste, Generation and Management, Electronic Waste in the World, The Problem of WEEE, WEEE Management Leaching Processes, Acid and Alkaline Leaching, Leaching Using Supercritical Fluids, Bioleaching. | |
| **UNIT- II: MECHANICAL PROCESSING** | **9** |
| Mechanical Processing, Comminution, Size Separation, Density Separation, Separation by Dense Medium, Separation via Suspensions, Jigs, Flowing Film Concentrators, Air Separation, Magnetic Separation, Dry Separators, Wet Separators, Electrostatic Separation, Electrification by Contact or Friction, Electrification by Ion Bombardment, Eddy Current (Foucault Current) | |
| **UNIT- III: HYDRO METALLURGICAL PROCESSING** | **9** |
| Hydrometallurgical Processing: Liquid-Liquid Extraction, Supercritical Extraction, Cementation, Electrometallurgical Processing: Pyrometallurgical Processing | |
| **UNIT- IV: ELECTRONIC WASTE RECYCLING** | **9** |
| Electronic Waste Recycling: Materials Recycling Considerations, Polymers, Ceramics, Printed Circuit Boards, Mechanical Processing, Hydrometallurgical Processing, Bio hydro metallurgical Processing, Pyro metallurgical Processing, Monitors, Cathode Ray Tube, Liquid Crystal Displays/Light Emitting Diodes | |
| **UNIT- V: BATTERIES** | **9** |

Batteries: Nickel–Cadmium (NiCd) Batteries, Manual Sorting, Component Separation by Unity Operations of Mineral Treatment, Pyro metallurgical Route, Hydrometallurgical Route, Nickel Metal Hydride (NiMH) Batteries, Characteristics of Nickel Metal Hydride Batteries—NiMH, Recycling NiMH Batteries, Lithium Ion Batteries, Constituents of Rechargeable Lithium-Ion Batteries (LIBs), Cathode Materials, Anode Materials, Electrolytes, Separator, Recycling LIBs Batteries, Zinc-Manganese Dioxide Systems

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 0 | 45 |

**TEXTBOOKS**


1. Hugo Marcelo Veit Andréa Moura Bernardes, Electronic Waste Recycling Techniques, Springer International Publishing Switzerland 2015.
2. "E-waste in India: Research unit, Rajya Sabha Secretariat, New Delhi, June 2011"


**REFERENCES**

**GOOGLE BOOKS**


1. e-waste Management: From waste to Resource Klaus Hieronymi, Ramzy Kahnat, Eric williams Tech. & Engg.-2013(Publisher: Earthscan 2013).
2. What is the impact of E-waste: Tamara Thompson
3. E-waste poses a Health Hazard: Sairudeen Pattazhy


**E REFERENCES**

**WEBLINKS:**

- www.unep.org
- www.routledge.com
- www.amazon.com
- www.bookdepository.com
- www.ecoactiv.com

## Mapping of COs with POs

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 1 | | | | | 2 | 3 | 2 | | | 1 | 1 | 2 | 1 |
| **CO 2** | | | 2 | 1 | | 2 | 3 | 2 | | | 1 | 1 | 1 | 1 |
| **CO 3** | | 1 | 1 | 1 | 2 | 2 | 2 | 2 | | | 1 | 1 | 2 | 2 |
| **CO 4** | 1 | 1 | 1 | 1 | | | 2 | 2 | | 2 | 2 | 2 | 2 | 2 |
| **CO 5** | 2 | | 3 | 2 | 2 | 2 | 2 | 2 | | | 2 | 2 | 3 | 3 |
| **Total** | 4 | 2 | 7 | 5 | 4 | 8 | 12 | 10 | | 2 | 7 | 7 | 10 | 9 |
| **Scaled** | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | | 1 | 2 | 2 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| | DISASTER MANAGEMENT | 3 | 0 | 0 | 3 |
| C:P: A | | L | T | P | H |
| 3:0:0 | | 3 | 0 | 0 | 3 |

| Course Outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | Understanding the concepts of application of types of disaster preparedness | Cognitive | Application |
| CO2 | On completion of this course the students will be able to understand planning essentials of disaster. | Cognitive | Analyze |
| CO3 | Have a good understanding of importance of seismic waves occurring globally | Cognitive | Analyze |
| CO4 | On completion of this course, the students will be able to perform drill essential for disaster mitigation | Cognitive | Application |
| CO5 | Have a keen knowledge on essentials of risk reduction | Cognitive | Application |

| | |
|---|---|
| **UNIT- I: INTRODUCTION** | **9** |
| Introduction – Disaster preparedness – Goals and objectives of ISDR Programme- Risk identification – Risk sharing – Disaster and development: Development plans and disaster management –Alternative to dominant approach– disaster-development linkages -Principle of risk partnership | |
| **UNIT- II: APPLICATION OF TECHNOLOGY IN DISASTER RISK REDUCTION** | **9** |
| Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems – Intranets and extranets – video teleconferencing. Trigger mechanism – Remote sensing-an insight – contribution of remote sensing and GIS - Case study | |
| **UNIT- III: AWARENESS OF RISK REDUCTION** | **9** |
| Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness | |
| **UNIT- IV: DEVELOPMENT PLANNING ON DISASTER** | **9** |
| Implication of development planning – Financial arrangements – Areas of improvement – Disaster preparedness – Community based disaster management– Emergency response. | |
| **UNIT- V: SEISMICITY** | **9** |
| Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes | |

| | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 0 | 45 |

**TEXTBOOKS**

1. Siddhartha Gautam and K Leelakrishna Rao, “Disaster Management Programmes and Policies”, Vista International Pub House, 2012,
2. Arun Kumar, “Global Disaster Management”, SBS Publishers, 2008

**REFERENCES**

1. Encyclopaedia of Disaster Management, Neha Publishers & Distributors, 2008
2. Pradeep Sahni, Madhavi Malalgoda and Ariyabandu, “Disaster risk reduction in South Asia”, PHI, 2002
3. Amita Sinvhal, “Understanding earthquake disasters” TMH, 2010.
4. Pardeep Sahni, Alka Dhameja and Uma Medury, “Disaster mitigation: Experiences and reflections”, PHI, 2000

**E REFERENCES**

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | | 1 | 1 | | | | | 1 | | | 1 | 1 | 2 | 2 |
| **CO 2** | | | 2 | | 3 | | | | | | 2 | 2 | 2 | 2 |
| **CO 3** | | | | | | 2 | 2 | | | | 1 | 1 | | 1 |
| **CO 4** | | 2 | 2 | | 1 | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 1 | |
| **CO 5** | | | | | | 2 | 3 | 3 | | 2 | 1 | 1 | 2 | 2 |
| **Total** | 0 | 3 | 5 | 0 | 4 | 5 | 6 | 6 | 1 | 3 | 8 | 6 | 7 | 7 |
| **Scaled** | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| COURSE CODE | COURSE NAME | L | T | P | C |
|---|---|---|---|---|---|
| PEE 604 | MICROPROCESSORS AND MICROCONTROLLERS | 3 | 0 | 1 | 4 |
| C:P: A = 3:1:0 | | L | T | P | H |
| | | 3 | 0 | 2 | 5 |

| Course Outcomes (PEE 604): | | Domain | Level |
|---|---|---|---|
| CO1 | To understand the fundamentals of microprocessors, microcontrollers and embedded systems | Cognitive | Understanding |
| CO2 | To understand the architecture, Timing diagrams and Execution cycles of 8051 | Cognitive | Understanding |
| CO3 | To understand the types of addressing modes, Instruction types and to understand the basic concepts of programming | Cognitive Psychomotor Affective | Understanding Set Responding |
| CO4 | To understand interfacing design of peripherals like I/O, A/D, D/A, timer etc. | Cognitive Psychomotor Affective | Understanding Set Responding |
| CO5 | To understand communication protocols and interfacing with external devices | Cognitive Psychomotor Affective | Understanding Set Responding |

**Learning Outcomes:** Able to do assembly language programming, do interfacing design of peripherals like I/O, A/D, D/A, timer etc. and to develop systems using different microcontrollers.

| UNIT - I: FUNDAMENTALS OF MICROPROCESSORS | 9 |
|---|---|
| Fundamentals of Microprocessor Architecture, 8-bit Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers,16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051family. | |
| **UNIT – II: THE 8051 ARCHITECTURE** | **9** |
| Internal Block Diagram, CPU, ALU, address, data and control bus, working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles. | |
| **UNIT- III: INSTRUCTION SET AND PROGRAMMING** | **9+12** |

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compiler Programming and Debugging tools.

**List of Experiments**

1. Simple arithmetic operations with 8085 Microprocessors: Multi precision addition / subtraction / multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions.
3. Demonstration of basic instructions with 8051 Micro controller execution, including: a. Conditional jumps, looping b. Calling subroutines. c. Stack parameter testing
4. Design program for code conversions.

| **UNIT – IV: MEMORY AND I/O INTERFACING** | **9+3** |
|---|---|

Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, memory devices.

**List of Experiments**

5. Interfacing Converters of 8-bit D/A and A/D.

| **UNIT–V: EXTERNAL COMMUNICATION INTERFACE AND APPLICATIONS** | **9+15** |
|---|---|

Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee. LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, sensor interfacing.

**List of Experiments**

6. Interfacing of Keyboard with 8085
7. Interfacing of seven segment display with 8085.
8. Serial communication, I/O Port operations.
9. Design and implementation of Traffic Light control.
10. Design and implementation of Stepper motor control

| | **LECTURE** | **PRACTICAL** | **TOTAL** |
|---|---|---|---|
| | **45** | **30** | **75** |

**TEXTBOOKS**


1. M.A.Mazidi, J.G.Mazidi and R.D.McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Pearson Education, 2007.
2. K.J. Ayala, “8051 Microcontroller”, Delmar Cengage Learning, 2004.
3. R. Kamal, “Embedded System”, McGraw Hill Education, Third Edition, 2017.
4. R.S. Gaonkar, “Microprocessor Architecture: Programming and Applications with the 8085”, Penram International Publishing, 6th Edition, 2013


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1. D.A.Patterson and J.H.Hennessy, “Computer Organization and Design: The Hardware /Software interface”, Morgan Kaufman Publishers, 5th Edition, 2013.

2. D.V.Hall, “Microprocessors & Interfacing”, McGraw Hill Higher Education,2005.

**E REFERENCES**

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https://onlinecourses.nptel.ac.in/noc19_ee11

https://nptel.ac.in/courses/Webcourse-contents/IISc BANG/notused/Microprocessors%20and%20Microcontrollers-/Learning%20Material%20-%20Microprocessors%20and%20microcontrollers.pdf

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| **CO 2** | 1 | 2 | 1 | 3 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 1 | 1 |
| **CO 3** | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 2 | 0 | 0 | 1 | 1 |
| **CO 4** | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | 2 | 1 | 2 | 1 | 0 | 1 |
| **CO 5** | 1 | 2 | 2 | 1 | 0 | 0 | 3 | 0 | 3 | 2 | 1 | 0 | 0 | 1 |
| **Total** | 4 | 5 | 7 | 6 | 2 | 1 | 5 | 0 | 8 | 7 | 6 | 2 | 3 | 5 |
| **Scaled** | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 0 | 2 | 2 | 1 | 1 | 1 | 1 |

0 –No Relation 1 – Low Relation 2 – Medium Relation 3 – High Relation

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Department** | Electrical & Electronics Engineering | **Course Code** | 603 | **Sub. Code** | PEE 701 | **Sub. Name** | **Electric Vehicles and Power Management** | |
| **Year** | IV | **Semester** | VII | **Regulation** | 2015 | **Max Mark** | 100 | |

| **MODE OF EVALUATION & WEIGHTAGE ( %)** | | | | | **Credit** | | | **Hours/ Week** |
|---|---|---|---|---|---|---|---|---|
| **CA 1** | **CA 2** | **CA 3** | **CA 4** | **Total** | **L** | **T** | **P** | **3** |
| | | | | | 3 | 0 | 0 | |
| 15% | 15% | 20% | 50% | 100% | **L = 45; T = 0; P = 0;** | | | **Total = 45 hrs** |

| | | |
|---|---|---|
| **Objective (s)** | This course introduces the fundamental concepts, principles, analysis and design of hybrid and electric vehicles. | |
| **Unit- 1** | **ELECTRIC VEHICLES AND VEHICLE MECHANICS** | **09 hours** |
| | Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with internal combustion Engine vehicles, Fundamentals of vehicle mechanics | |
| **Unit- 2** | **ARCHITECTURE OF EV's AND POWER TRAIN COMPONENTS** | **09 hours** |
| | Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes | |
| **Unit- 3** | **CONTROL OF DC AND AC DRIVES** | **09 hours** |
| | DC/DC chopper based four quadrant operations of DC drives – Inverter based V/f Operation (motoring and braking) of induction motor drive system – Induction motor and permanent motor based vector control operation – Switched reluctance motor (SRM) drives. | |
| **Unit- 4** | **BATTERY ENERGY STORAGE SYSTEM** | **09 hours** |
| | Battery Basics, Different types, Battery Parameters, Battery modeling, Traction Batteries | |
| **Unit- 5** | **ALTERNATIVE ENERGY STORAGE SYSTEMS** | **09 hours** |
| | Fuel cell – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors | |
| **Text Books:** | | |
| 1. | Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003 | |
| 2. | MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004 | |
| 3. | Chris Mi, M. AbulMasrur and David WenzhongGao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley and Sons, 2011 | |

| Reference Books: | |
|---|---|
| 1. | Ali Emadi, MehrdadEhsani, John M.Miller Vehicular Electric Power Systems, Marceldekker, 2004 |
| 2. | James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003 |
| 3. | L. E. Carmichael, Hybrid and Electric Vehicles, ABDO Publishing Company, 2013 |

| **PEE 701 –Electric Vehicles and Power Management**<br>**Course Outcomes (COs)** |
|---|
| **At the end of the course, the students will be able to** |
| 1. **Specify** the key components of a vehicle propulsion system and their functions<br>2. **Select** appropriate hybrid electric power-train architecture<br>3. **Determine** appropriate type and size of hybrid electric power-train components and ESS<br>4. **Design** hybrid electric power-train system by combining appropriate power-train architecture,key power-train components, and energy storage system<br>5. Perform vehicle operation performance and energy efficiency **evaluation** for given drivingcycle, power-train design, and vehicle data through computer simulation<br>6. **Apply** the learnt modeling, simulation and analysis methods to similar transportation applications. |

<table>
<tr><td>Department</td><td>Electrical & Electronics Engineering</td><td>Course Code</td><td>603</td><td>Sub. Code</td><td>PEE 702</td><td>Sub. Name</td><td>Power System Operation and Control</td></tr>
<tr><td>Year</td><td>IV</td><td>Semester</td><td>VII</td><td>Regulation</td><td>2015</td><td>Max Mark</td><td>100</td></tr>
<tr><td colspan="4">MODE OF EVALUATION & WEIGHTAGE ( %)</td><td colspan="3">Credit</td><td>Hours/ Week</td></tr>
<tr><td>CA 1</td><td>CA 2</td><td>CA 3</td><td>CA 4</td><td>Total</td><td>L</td><td>T</td><td>P</td><td rowspan="2">3</td></tr>
<tr><td rowspan="2">15%</td><td rowspan="2">15%</td><td rowspan="2">20%</td><td rowspan="2">50%</td><td rowspan="2">100%</td><td>3</td><td>0</td><td>0</td></tr>
<tr><td colspan="4">L = 45; T = 0; P = 0;</td><td colspan="2">Total = 45 hrs</td></tr>
<tr><td>Objective (s)</td><td colspan="7">The objectives of this course are to have an overview of power system operation and control. To model load-frequency dynamics and to design load-frequency controller; To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load; To study the economic operation of power system; To teach about SCADA and its application for real time operation and control of power systems.</td></tr>
<tr><td>Unit- 1</td><td colspan="6">INTRODUCTION</td><td>09 hours</td></tr>
<tr><td></td><td colspan="7">An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves - Importance of load forecasting - quadratic and exponential curve fitting techniques for forecasting – plant level and system level controls.</td></tr>
<tr><td>Unit- 2</td><td colspan="6">REAL POWER - FREQUENCY CONTROL</td><td>09 hours</td></tr>
<tr><td></td><td colspan="7">Basics of speed governing mechanism and modeling - speed-load characteristics – load sharingbetween two synchronous machines in parallel - concept of control area - LFC control of a single-area system: static and dynamic analysis of uncontrolled and controlled cases - two-areasystem: modeling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model</td></tr>
<tr><td>Unit- 3</td><td colspan="6">REACTIVE POWER–VOLTAGE CONTROL</td><td>09 hours</td></tr>
<tr><td></td><td colspan="7">Generation and absorption of reactive power - basics of reactive power control - excitation systems – modeling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, injection reactive power - SVC (TCR + TSC) and STATCOM – secondary voltage control.</td></tr>
<tr><td>Unit- 4</td><td colspan="6">UNIT COMMITMENT AND ECONOMIC DISPATCH</td><td>09 hours</td></tr>
<tr><td></td><td colspan="7">Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve - coordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-listmethod - forward dynamic programming.</td></tr>
</table>

| Unit –5 | COMPUTER CONTROL OF POWER SYSTEMS | 09 hours |
|---|---|---|
| | Need for computer control of power systems - concept of energy control centre – functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMSfunctions - network topology - state estimation – WLSE - Contingency Analysis - state transitiondiagram showing various state transitions and control strategies. | |
| **Text Books:** | | |
| 1. | Olle.I.Elgerd, _Electric Energy Systems theory - An introduction‘, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010. | |
| 2. | Allen. J. Wood and Bruce F. Wollenberg, _Power Generation, Operation and Control‘, John Wiley & Sons, Inc., 2003. | |
| 3. | Kundur P., _Power System Stability and Control, Tata McGraw Hill, New Delhi, 5th reprint, 2008. | |
| **Reference Books:** | | |
| 1. | Nagrath I.J. and Kothari D.P., _Modern Power System Analysis‘, Tata McGraw-Hill, Fourth Edition,2011. | |
| 2. | HadiSaadat, _Power System Analysis‘, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010. | |
| 3. | AbhijitChakrabarti, SunitaHalder, _Power System Analysis Operation and Control‘, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010. | |

**PEE 702 – Power System Operation and Control**
**Course Outcomes (COs)**

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

1. **Know** power system load characteristics and generation reserve requirements.
2. **Understand** AGC and tie-line control for constant frequency operation.
3. **Apply** the mathematical knowledge to model and analysis of power system for frequency control.
4. **Indentify** fundamental aspects of reactive power and its effect on system voltage.
5. **Select** the suitable voltage control method for the system operating condition.
6. **Formulate** economic dispatch problem and its solution.
7. **State** unit commitment problem and its effect on economic dispatch problem.
8. **Apply** computer control methods for power system operation and control.

**Mapping of Course Outcomes (COs) with Programme Outcomes (POs)**

## PEE 701 – Electric Vehicles and Power Management

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 2 | - | 2 | - | 3 | - | 2 | 1 | - | - |
| **CO2** | - | - | - | 1 | - | - | - | - | 2 | 1 | 2 | - |
| **CO3** | 2 | - | - | - | 1 | - | - | - | - | - | - | - |
| **CO4** | - | - | 2 | 1 | - | - | - | - | 2 | 1 | 2 | - |
| **CO5** | - | - | - | - | - | - | 3 | - | 3 | 2 | 1 | - |
| **CO6** | 1 | 1 | 2 | - | 2 | - | 3 | - | 2 | 1 | - | - |

1- Slightly 2 – Supportive 3 – Highly related

## PEE 702– Power System Operation and Control

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | 2 | - | - | - | - | 1 | - | - |
| **CO2** | 2 | 3 | 2 | 2 | 2 | - | - | - | 1 | 2 | 1 | - |
| **CO3** | 2 | 3 | 3 | 2 | 2 | - | - | - | 1 | 1 | 1 | - |
| **CO4** | 2 | 3 | 2 | 2 | 3 | - | - | - | - | 1 | - | - |
| **CO5** | 2 | 2 | 2 | 3 | 3 | - | - | - | 1 | 1 | 1 | - |
| **CO6** | 2 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | - |
| **CO7** | 2 | 2 | 3 | 3 | 2 | - | - | - | - | 1 | - | - |
| **CO8** | 1 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 1 |

1- Slightly 2 – Supportive 3 – Highly related