# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

## Department of Electrical Engineering

### R-18 Curriculum Structure

| Sl. | Sem. | Category | Course Code | Course Name | L | T | P | Hr | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | I | BS | M101 | Mathematics - I | 3 | 1 | 0 | 4 | 4 |
| 2 | I | BS | CH101 | Chemistry | 3 | 0 | 0 | 3 | 3 |
| 3 | I | ES | EE101 | Basic Electrical Engineering | 3 | 0 | 0 | 3 | 3 |
| 4 | I | HS | HU101 | English | 2 | 0 | 0 | 2 | 2 |
| 5 | I | BS | CH191 | Chemistry Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 6 | I | ES | EE191 | Basic Electrical Engineering Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 7 | I | ES | ME191 | Engineering Graphics & Design | 0 | 0 | 3 | 3 | 1.5 |
| 8 | I | PW | PR191 | Project – IA | 0 | 0 | 1 | 1 | 0.5 |
| 9 | I | PW | PR192 | Project – IB | 0 | 0 | 1 | 1 | 0.5 |
| 10 | I | MC | MC181 | Induction Program | 0 | 0 | 0 | 0 | 0 |
| 11 | II | BS | M201 | Mathematics - II | 3 | 1 | 0 | 4 | 4 |
| 12 | II | BS | PH201 | Physics - I | 3 | 0 | 0 | 3 | 3 |
| 13 | II | ES | EC201 | Basic Electronics Engineering | 3 | 0 | 0 | 3 | 3 |
| 14 | II | ES | CS201 | Programming for Problem Solving | 3 | 0 | 0 | 3 | 3 |
| 15 | II | ES | ME201 | Engineering Mechanics | 3 | 0 | 0 | 3 | 3 |
| 16 | II | ES | CS291 | Programming for Problem Solving Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 17 | II | BS | PH291 | Physics - I Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 18 | II | ES | EC291 | Basic Electronics Engineering Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 19 | II | ES | ME292 | Workshop/Manufacturing Practices | 0 | 0 | 3 | 3 | 1.5 |
| 20 | II | HS | HU291 | Language Laboratory | 0 | 0 | 2 | 2 | 1 |
| 21 | II | PW | PR291 | Project – II | 0 | 0 | 1 | 1 | 0.5 |
| 22 | II | PW | PR292 | Innovative Activities – I | 0 | 0 | 0 | 0 | 0.5 |
| 23 | II | MC | MC281 | NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club | 0 | 0 | 0 | 3 | 0 |
| 24 | III | ES | EE301 | Electrical Circuit Analysis | 3 | 1 | 0 | 4 | 4 |
| 25 | III | PC | EE302 | Measurement and Instrumentation | 3 | 0 | 0 | 3 | 3 |
| 26 | III | PC | EE303 | Analog Electronics | 3 | 0 | 0 | 3 | 3 |
| 27 | III | BS | M(EE)301 | Mathematics – III | 3 | 1 | 0 | 4 | 4 |
| 28 | III | ES | EE391 | Electrical Circuit Analysis Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 29 | III | PC | EE392 | Measurement and Instrumentation Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 30 | III | PC | EE393 | Analog Electronics Laboratory | 0 | 0 | 2 | 2 | 1 |
| 31 | III | PW | PR391 | Project – III | 0 | 0 | 2 | 2 | 1 |
| 32 | III | PW | PR392 | Innovative Activities – II | 0 | 0 | 0 | 0 | 0.5 |
| 33 | III | MC | MC301 | Environmental Science | 3 | 0 | 0 | 3 | 0 |
| 34 | IV | BS | PH401 | Physics – II | 3 | 0 | 0 | 3 | 3 |
| 35 | IV | PC | EE401 | Electrical Machines – I | 3 | 0 | 0 | 3 | 3 |
| 36 | IV | PC | EE402 | Power Electronics | 3 | 0 | 0 | 3 | 3 |
| 37 | IV | PC | EE403 | Digital Electronics | 3 | 0 | 0 | 3 | 3 |
| 38 | IV | PC | EE404 | Electromagnetic Fields | 2 | 0 | 0 | 2 | 2 |
| 39 | IV | HS | HU401 | Values and Ethics in Profession | 2 | 0 | 0 | 2 | 2 |
| 40 | IV | BS | PH491 | Physics – II Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 41 | IV | PC | EE491 | Electrical Machines – I Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 42 | IV | PC | EE492 | Power Electronics Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 43 | IV | PC | EE493 | Digital Electronics Laboratory | 0 | 0 | 2 | 2 | 1 |
| 44 | IV | PW | PR491 | Project – IV | 0 | 0 | 2 | 2 | 1 |
| 45 | IV | PW | PR492 | Innovative Activities – III | 0 | 0 | 0 | 0 | 0.5 |
| 46 | IV | MC | MC481 | Behavioral & Interpersonal Skills | 0 | 0 | 3 | 3 | 0 |
| 47 | V | PC | EE501 | Electrical Machines – II | 3 | 0 | 0 | 3 | 3 |
| 48 | V | PC | EE502 | Power System – I | 3 | 0 | 0 | 3 | 3 |
| 49 | V | PC | EE503 | Control System – I | 3 | 0 | 0 | 3 | 3 |
| 50 | V | OE | EE504 | A. Data Structure | 3 | 0 | 0 | 3 | 3 |
| 51 | V | | | B. Computer Network | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 52 | V | | | C. Internet of Things | | | | | |
| 53 | V | PE | EE505 | A. Electrical Energy Conservation and Auditing | 3 | 0 | 0 | 3 | 3 |
| 54 | V | | | B. Electromagnetic Waves | | | | | |
| 55 | V | | | C. Illumination Engineering | | | | | |
| 56 | V | | | D. Power Plant Engineering | | | | | |
| 57 | V | PC | EE591 | Electrical Machines – II Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 58 | V | PC | EE592 | Power System – I Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 59 | V | PC | EE593 | Control System – I Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 60 | V | OE | EE594 | A. Data Structure Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 61 | V | | | B. Computer Network Laboratory | | | | | |
| 62 | V | | | C. Internet of Things Laboratory | | | | | |
| 63 | V | PW | PR591 | Project – V | 0 | 0 | 2 | 2 | 1 |
| 64 | V | PW | PR592 | Innovative Activities – IV | 0 | 0 | 0 | 0 | 0.5 |
| 65 | V | MC | MC501 | Constitution of India | 3 | 0 | 0 | 3 | 0 |
| 66 | VI | PC | EE601 | Microprocessor and Microcontroller | 3 | 0 | 0 | 3 | 3 |
| 67 | VI | PC | EE602 | Power System – II | 3 | 0 | 0 | 3 | 3 |
| 68 | VI | PC | EE603 | Control System – II | 3 | 0 | 0 | 3 | 3 |
| 69 | VI | OE | EE604 | A. Data Base Management System | 3 | 0 | 0 | 3 | 3 |
| 70 | VI | | | B. Embedded Systems | | | | | |
| 71 | VI | | | C. Software Engineering | | | | | |
| 72 | VI | PE | EE605 | A. Digital Signal Processing | 3 | 0 | 0 | 3 | 3 |
| 73 | VI | | | B. High Voltage Engineering | | | | | |
| 74 | VI | | | C. Computer Architecture | | | | | |
| 75 | VI | PC | EE691 | Microprocessor and Microcontroller Laboratory | 0 | 0 | 2 | 2 | 1 |
| 76 | VI | PC | EE692 | Power System – II Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 77 | VI | PC | EE693 | Control System – II Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 78 | VI | OE | EE694 | A. Data Base Management System Lab | 0 | 0 | 3 | 3 | 1.5 |
| 79 | VI | | | B. Embedded Systems Lab | | | | | |
| 80 | VI | | | C. Software Engineering Lab | | | | | |
| 81 | VI | PW | PR691 | Project – VI | 0 | 0 | 2 | 2 | 1 |
| 82 | VI | PW | PR692 | Innovative Activities – V | 0 | 0 | 0 | 0 | 0.5 |
| 83 | VI | MC | MC681 | Technical Lecture Presentation & Group Discussion – I | 0 | 0 | 3 | 3 | 0 |
| 84 | VII | PC | EE701 | Electrical Drives | 3 | 0 | 0 | 3 | 3 |
| 85 | VII | OE | EE702 | A. Object Oriented Programming using JAVA | 3 | 0 | 0 | 3 | 3 |
| 86 | VII | | | B. Big Data Analysis | | | | | |
| 87 | VII | | | C. Digital Image Processing | | | | | |
| 88 | VII | PE | EE703 | A. Power System – III | 3 | 0 | 0 | 3 | 3 |
| 89 | VII | | | B. Restructured Electrical Power System | | | | | |
| 90 | VII | | | C. Computer Applications in Power System | | | | | |
| 91 | VII | OE | EE704 | A. Power System Dynamics and Control | 3 | 0 | 0 | 3 | 3 |
| 92 | VII | | | B. Power Quality and FACTS | | | | | |
| 93 | VII | | | C. HVDC Transmission Systems | | | | | |
| 94 | VII | HS | HU703 | Industrial and Financial Management | 2 | 0 | 0 | 2 | 2 |
| 95 | VII | PC | EE791 | Electrical Drives Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 96 | VII | OE | EE792 | A. Object Oriented Programming Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 97 | VII | | | B. Big Data Analysis Laboratory | | | | | |
| 98 | VII | | | C. Digital Image Processing Laboratory | | | | | |
| 99 | VII | PW | PR791 | Project – VII | 0 | 0 | 0 | 6 | 3 |
| 100 | VII | PW | PR792 | Innovative Activities – VI | 0 | 0 | 0 | 0 | 0.5 |
| 101 | VII | MC | MC781 | Technical Lecture Presentation & Group Discussion – II | 0 | 0 | 3 | 3 | 0 |
| 102 | VIII | PE | EE801 | A. Wind and Solar Energy Systems | 2 | 0 | 0 | 2 | 2 |
| 103 | VIII | | | B. Utilization of Electric Power | | | | | |
| 104 | VIII | | | C. Line Commutated and Active Rectifiers | | | | | |
| 105 | VIII | PE | EE802 | A. Advanced Electric Drives | 3 | 0 | 0 | 3 | 3 |
| 106 | VIII | | | B. Control Systems Design | | | | | |
| 107 | VIII | | | C. Industrial Electrical System | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 108 | VIII | HS | HU801 | Principles of Management | 2 | 0 | 0 | 2 | 2 |
| 109 | VIII | PW | PR891 | Project – VIII | 0 | 0 | 8 | 8 | 4 |
| 110 | VIII | MC | MC804 | Essence of Indian Knowledge Tradition | 3 | 0 | 0 | 3 | 0 |
| | | | | Total | 114 | 4 | 99 | 226 | 160 |

R-18 courses under Humanities & Social Sciences including Management (HS) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | HU101 | English | 2:0:0 | 2 | I |
| 2. | HU291 | Language Laboratory | 0:0:2 | 1 | II |
| 3. | HU401 | Values and Ethics in Profession | 2:0:0 | 2 | IV |
| 3. | HU703 | Industrial and Financial Management | 2:0:0 | 2 | VII |
| 4. | HU802 | Principles of Management | 2:0:0 | 2 | VIII |
| Total | | | | 9 | |

R-18 courses under Basic Science Courses (BS) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | M101 | Mathematics – I | 3:1:0 | 4 | I |
| 2. | CH101 | Chemistry | 3:0:0 | 3 | I |
| 3. | CH191 | Chemistry Laboratory | 0:0:3 | 1.5 | I |
| 4. | M201 | Mathematics – II | 3:1:0 | 4 | II |
| 5. | PH201 | Physics – I | 3:0:0 | 3 | II |
| 6. | PH291 | Physics – I Laboratory | 0:0:3 | 1.5 | II |
| 7. | M(EE)301 | Mathematics – III | 3:1:0 | 4 | III |
| 8. | PH401 | Physics – II | 3:0:0 | 3 | IV |
| 9. | PH491 | Physics – II Laboratory | 0:0:3 | 1.5 | IV |
| Total | | | | 25.5 | |

R-18 courses under Engineering Science Courses (ES) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | EE101 | Basic Electrical Engineering | 3:0:0 | 3 | I |
| 2. | EE191 | Basic Electrical Engineering Laboratory | 0:0:3 | 1.5 | I |
| 3. | ME191 | Engineering Graphics & Design | 0:0:3 | 1.5 | I |
| 4. | EC201 | Basic Electronics Engineering | 3:0:0 | 3 | II |
| 5. | CS201 | Programming for Problem Solving | 3:0:0 | 3 | II |
| 6. | ME201 | Engineering Mechanics | 3:0:0 | 3 | II |
| 7. | EC291 | Basic Electronics Engineering Laboratory | 0:0:3 | 1.5 | II |
| 8. | CS291 | Programming for Problem Solving Laboratory | 0:0:3 | 1.5 | II |
| 9. | ME292 | Workshop / Manufacturing Practice | 0:0:3 | 1.5 | II |
| 10. | EE301 | Electrical Circuit Analysis | 3:1:0 | 4 | III |
| 11. | EE391 | Electrical Circuit Analysis Laboratory | 0:0:3 | 1.5 | III |
| Total | | | | 25 | |

R-18 courses under Professional Core Courses (PC) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | EE302 | Measurement and Instrumentation | 3:0:0 | 3 | III |
| 2. | EE303 | Analog Electronics | 3:0:0 | 3 | III |
| 3. | EE392 | Measurement and Instrumentation Laboratory | 0:0:3 | 1.5 | III |
| 4. | EE393 | Analog Electronics Laboratory | 0:0:2 | 1 | III |
| 5. | EE401 | Electrical Machines – I | 3:0:0 | 3 | III |
| 6. | EE402 | Power Electronics | 3:0:0 | 3 | IV |

| | | | | | |
|---|---|---|---|---|---|
| 7. | EE403 | Digital Electronics | 3:0:0 | 3 | IV |
| 8. | EE404 | Electromagnetic Fields | 2:0:0 | 2 | IV |
| 9. | EE491 | Electrical Machines – I Laboratory | 0:0:3 | 1.5 | IV |
| 10. | EE492 | Power Electronics Laboratory | 0:0:3 | 1.5 | IV |
| 11. | EE493 | Digital Electronics Laboratory | 0:0:2 | 1 | IV |
| 12. | EE501 | Electrical Machines – II | 3:0:0 | 3 | V |
| 13. | EE502 | Power System – I | 3:0:0 | 3 | V |
| 14. | EE503 | Control System – I | 3:0:0 | 3 | V |
| 15. | EE591 | Electrical Machines – II Laboratory | 0:0:3 | 1.5 | V |
| 16. | EE592 | Power System – I Laboratory | 0:0:3 | 1.5 | V |
| 17. | EE593 | Control System – I Laboratory | 0:0:3 | 1.5 | V |
| 18. | EE601 | Microprocessor and Microcontroller | 3:0:0 | 3 | VI |
| 19. | EE602 | Power System – II | 3:0:0 | 3 | VI |
| 20. | EE603 | Control System – II | 3:0:0 | 3 | VI |
| 21. | EE691 | Microprocessor and Microcontroller Laboratory | 0:0:2 | 1 | VI |
| 22. | EE692 | Power System – II Laboratory | 0:0:3 | 1.5 | VI |
| 23. | EE693 | Control System – II Laboratory | 0:0:3 | 1.5 | VI |
| 24. | EE701 | Electrical Drives | 3:0:0 | 3 | VII |
| 25. | EE791 | Electrical Drives Laboratory | 0:0:3 | 1.5 | VII |
| Total | | | | 54.5 | |

R-18 courses under Professional Elective Courses (PE) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | EE505 | A. Electrical Energy Conservation and Auditing<br>B. Electromagnetic Waves<br>C. Illumination Engineering | 3:0:0 | 3 | V |
| 2. | EE605 | A. Digital Signal Processing<br>B. High Voltage Engineering<br>C. Computer Architecture | 3:0:0 | 3 | VI |
| 3. | EE703 | A. Power System-III<br>B. Restructured Electrical Power System<br>C. Computer Applications in Power System<br>A. Power Quality and FACTS<br>B. HVDC Transmission Systems | 3:0:0 | 3 | VII |
| 4. | EE801 | A. Wind and Solar Energy Systems<br>B. Utilization of Electric Power<br>C. Line Commutated and Active Rectifiers | 2:0:0 | 2 | VIII |
| 5. | EE802 | A. Advanced Electric Drives<br>B. Control Systems Design<br>C. Industrial Electrical System | 3:0:0 | 3 | VIII |
| | | Total | | 14 | |

R-18 courses under Open Elective Courses (OE) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | EE504 | A. Data Structure<br>B. Computer Network<br>C. Internet of Things | 3:0:0 | 3 | V |
| 2. | EE594 | A. Data Structure Laboratory<br>B. Computer Network Laboratory<br>C. Internet of Things Laboratory | 0:0:3 | 1.5 | V |
| 3. | EE604 | A. Data Base Management System<br>B. Embedded Systems<br>C. Software Engineering | 3:0:0 | 3 | VI |

| | | | | | |
|---|---|---|---|---|---|
| 4. | EE694 | A. Data Base Management System Laboratory<br>B. Embedded Systems Laboratory<br>C. Software Engineering Laboratory | 0:0:3 | 1.5 | VI |
| 5. | EE702 | A. Object oriented programming using JAVA<br>B. Big Data Analysis<br>C. Digital Image Processing | 3:0:0 | 3 | VII |
| 6. | EE704 | A. Power System Dynamics and Control<br>B. Power Quality and FACTS<br>C. HVDC Transmission Systems | 3:0:0 | 3 | VII |
| 7. | EE792 | A. Object Oriented Programming Laboratory<br>B. Big Data Analysis Laboratory<br>C. Digital Image Processing Laboratory | 0:0:3 | 1.5 | VII |
| | | Total | | 16.5 | |

R-18 courses under Project Work (PW) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | PR191 | Project – IA | 0:0:1 | 0.5 | I |
| 2. | PR192 | Project – IB | 0:0:1 | 0.5 | I |
| 3. | PR291 | Project – II | 0:0:1 | 0.5 | II |
| 4. | PR292 | Innovative Activities – I | 0:0:0 | 0.5 | II |
| 5. | PR391 | Project – III | 0:0:2 | 1 | III |
| 6. | PR392 | Innovative Activities – II | 0:0:0 | 0.5 | III |
| 7. | PR491 | Project - IV | 0:0:2 | 1 | IV |
| 8. | PR492 | Innovative Activities – III | 0:0:0 | 0.5 | IV |
| 9. | PR591 | Project – V | 0:0:2 | 1 | V |
| 10. | PR592 | Innovative Activities – IV | 0:0:0 | 0.5 | V |
| 11. | PR691 | Project – VI | 0:0:2 | 1 | VI |
| 12. | PR692 | Innovative Activities – V | 0:0:0 | 0.5 | VI |
| 13. | PR791 | Project – VII | 0:0:6 | 3 | VII |
| 14. | PR792 | Innovative Activities – VI | 0:0:0 | 0.5 | VII |
| 15. | PR891 | Major Project – II | 0:0:12 | 6 | VIII |
| 16. | PR892 | Grand Viva | 0:0:0 | 1 | VIII |
| | | Total | | 15.5 | |

R-18 courses under Mandatory Course (MC) category

| Sl. No. | Subject Code | Subject Name | Hrs. / Week L:T:P | Credit | Semester |
|---|---|---|---|---|---|
| 1. | MC181 | Induction Program | 0:0:0 | 0 | I |
| 2. | MC281 | NSS / Physical Activities / Meditation & Yoga / Photography / Nature Club | 0:0:3 | 0 | II |
| 3. | MC301 | Environmental Science | 3:0:0 | 0 | III |
| 4. | MC481 | Behavioral & Interpersonal Skills | 0:0:3 | 0 | IV |
| 5. | MC501 | Constitution of India | 3:0:0 | 0 | V |
| 6. | MC681 | Technical Lecture Presentation & Group Discussion – I | 0:0:3 | 0 | VI |
| 7. | MC781 | Technical Lecture Presentation & Group Discussion – II | 0:0:3 | 0 | VII |
| 8. | MC801 | Essence of Indian Knowledge Tradition | 3:0:0 | 0 | VIII |

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

## Department of Electrical Engineering

| Academic Factors | 1st Year | | 2nd Year | | 3rdYear | | 4th Year | | Factor Wise | | AICTE Guideline (Total Credit) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st sem. | 2nd sem. | 3rd sem. | 4th sem. | 5th sem. | 6th sem. | 7th sem. | 8th sem. | Total Credit | % | |
| Regulation R18 (effective from 2018-19 admission batches) | | | | | | | | | | | |
| Humanities and Social Sciences (HS) | 2 | 1 | | 2 | | | 2 | 2 | 9 | 5.63 | 12 |
| Basic Sciences (BS) | 8.5 | 8.5 | 4 | 4.5 | | | | | 25.5 | 15.94 | 25 |
| Engineering Sciences (ES) | 6 | 13.5 | 5.5 | | | | | | 25 | 15.63 | 24 |
| Professional Subjects – Core (PC) | | | 8.5 | 15 | 13.5 | 13 | 4.5 | | 54.5 | 34.06 | 48 |
| Professional Subjects – Electives (PE) | | | | | 3 | 3 | 3 | 5 | 14 | 8.75 | 18 |
| Open Subjects- Electives (OE) | | | | | 4.5 | 4.5 | 7.5 | | 16.5 | 10.31 | 18 |
| Project Work, Seminar etc. (PW) | 1 | 1 | 1.5 | 1.5 | 1.5 | 1.5 | 3.5 | 4 | 15.5 | 9.69 | 15 |
| Total | **17.5** | **24** | **19.5** | **23** | **22.5** | **22** | **20.5** | **11** | **160** | | **160** |

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | I |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| M101 | Mathematics - I | 3 | 1 | - | - | 4 | 30 | 70 | 100 |
| Pre-requisite | The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra and calculus. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| M101.1 | Remember | Recall the distinctive characteristics of matrix algebra and calculus. |
| M101.2 | Understand | Understand the theoretical working of matrix algebra and calculus. |
| M101.3 | Apply | Apply the principles of matrix algebra and calculus to address problems in their disciplines. |
| M101.4 | Apply | Examine the nature of system using the concept of matrix algebra and calculus. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | | | | | | | | | | | | 2 | | |
| 3 | CO3 | 3 | | | | | | | | | | | | 2 | | |
| 4 | CO4 | 3 | | | | | | | | | | | | 2 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Matrix Algebra<br>Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem. | 11L |
| Module II | Differential Calculus and Infinite Series<br>Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions. | 10L |
| Module III | Multivariable Calculus (Differentiation) - I<br>Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian. | 9L |
| Module IV | Multivariable Calculus (Differentiation) - II<br>Maxima and minima of functions of two variables, Method of Lagrange multipliers; Directional derivatives, Gradient, Divergence, Curl. | 7L |
| Module V | Integral Calculus<br>Evolutes and involutes; Evaluation of definite integrals and its applications to evaluate surface are a sand volumes of revolutions; Improper integrals; Beta and Gamma functions and their properties. | 11L |
| | Total | 48L |

**Text Books:**


1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2008.

**Reference Books:**


1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | I |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| CH101 | Chemistry | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | A basic knowledge in 10+2 science with chemistry. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| CH101.1 | Understand | Describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table. |
| CH101.2 | Apply | Apply fundamental concepts of thermodynamics in different engineering applications. |
| CH101.3 | Apply | Apply the knowledge of water quality parameters, corrosion control & polymers to different industries. |
| CH101.4 | Apply | Determine the structure of organic molecules using different spectroscopic techniques. |
| CH101.5 | Evaluate | Evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | | | |
| 2 | CO2 | 3 | | | | | 2 | | | | | | | | | |
| 3 | CO3 | 3 | | | | | 2 | | | | | | | | | |
| 4 | CO4 | 3 | | | | | 2 | | | | | | | | | |
| 5 | CO5 | 3 | | | | | 2 | 2 | | | | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Inorganic Chemistry<br>Atomic structure (5 Lectures)<br>Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction toSchrodinger equation.<br>Periodic properties (4 Lectures)<br>Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electrone gativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms. | 9L |
| Module II | Physical Chemistry<br>Use of free energy in chemical equilibria (6 Lectures)<br>Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.<br>Real Gases (2 Lectures)<br>Reason for deviation of real gases from ideal behaviour, Equations of state of real gases, Vander Waals' equation, pressure & volume correction, validity, critical state of gas. | 8L |
| Module III | Organic Chemistry<br>Stereochemistry (4 Lectures)<br>Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural<br>isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.<br>Organic reactions (4 Lectures)<br>Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensenreduction, Wolff-Kishner reduction) | 8L |

| | | |
|---|---|---|
| Module IV | Industrial Chemistry<br>Water (2 Lectures)<br>Hardness, alkalinity, numerical<br>Corrosion (2 Lectures)<br>Types of corrosion: wet & dry, preventive measures<br>Polymers (3 Lectures)<br>Classification of polymers, conducting polymers, biodegradable polymers<br>Synthesis of a commonly used drug molecule (1 Lecture)<br>Paracetamol, Aspirin | 8L |
| Module V | Spectroscopic techniques in Chemistry<br>Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, 1H Nuclear magnetic resonance spectroscopy, chemical shift. | 3L |
| | Total | 36L |

**Text Books:**

1 A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
2 General & Inorganic Chemistry, P.K. Dutt
3 General & Inorganic Chemistry, Vol I, R.P. Sarkar
4 Physical Chemistry, P.C. Rakshit

**Reference Books:**

1 Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
2 Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3 Physical Chemistry, by P. W. Atkins
4 Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5$^{th}$Edition
5 http://bcs.whfreeman.com/vollhardtschore5e/default.asp

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | I |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE101 | Basic Electrical Engineering | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Basic 12th standard Physics and Mathematics, Concept of components of electric circuit. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE101.1 | Apply | Illustrate basic terminology, laws and to describe, formulate the solution plan and methodology for solving and analysis of dc circuits using Network Theorem. |
| EE101.2 | Apply | Elucidate basics terms used in ac circuits, study RLC circuits with phasor diagrams, to determine impedance and admittance, power factor and power and to describe RLC resonance phenomena. |
| EE101.3 | Apply | Classify, illustrate the construction, explain the working principles, interpret the performance of single phase transformer, analyze the performance characteristics of dc machines and three phase induction motor |
| EE101.4 | Apply | Describe and illustrate power generation and sketch the general structure of electrical power system. |
| EE101.5 | Apply | Illustrate earthing of electrical equipment and categorize the components used in electrical wiring. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | 3 | 2 | 3 | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | 2 | | 3 | | | | | | | | | 2 | | |
| 3 | CO3 | 3 | 2 | 2 | | | | | | | | | | 2 | | |
| 4 | CO4 | 2 | | | | | | | | | | | | | | |
| 5 | CO5 | 2 | | | | | | | | | | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | DC Circuits<br>Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff ‘s laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin ‘s Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions. | 9L |
| Module II | AC Fundamentals<br>Sinusoidal quantities, Average and RMS values, peak factor, Form factor, Phase and Phase difference, concept of phasor diagram, V-I Relationship in R, L, C circuit, Combination R-L-C in series and parallel circuits with phasor diagrams, impedance and admittance, impedance triangle and power triangle, Power factor, concept of resonance, Power in AC circuit, simple problems(series and parallel circuit only), Three-phase balanced circuits, Concept of three-phase power measurement. | 9L |
| Module III | Single-Phase Transformer<br>Brief idea on constructional parts, classifications, working principle. Problems on EMF equation. Phasor diagram, Equivalent circuit. | 5L |
| Module IV | Electrical Rotating Machines<br>a) DC Machines (4L)<br>Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation.<br>b) Three-Phase Induction Motor (4L)<br>Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only). No numerical problem. | 8L |
| Module V | General Structure of Electrical Power System | 1L |

| | | |
|---|---|---|
| | Power generation to distribution through overhead lines and underground cables with single line | |
| Module VI | Electrical Installations<br>Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger. | 4L |
| | Total | 36L |

**Text Books:**


1 D. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
2 V. Mittle & Arvind Mittal, Basic Electrical Engineering, TMH.
3 Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
4 Chakrabarti, Nath & Chanda, Basic Electrical Engineering, TMH.
5 C.L. Wadhwa, Basic Electrical Engineering, Pearson Education.


**Reference Books:**


1 E. Hughes, —Electrical and Electronics Technology, Pearson, 2010.
2 V. D. Toro, —Electrical Engineering Fundamental, Printice Hall India, 1989.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | I |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| HU101 | English | L | T | P | S | C | IA | SEE | Total |
| | | 2 | - | - | - | 2 | 30 | 70 | 100 |
| Pre-requisite | The course presupposes a high school level knowledge of English grammar, punctuation, and elementary to intermediate reading and writing skills. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| HU101.1 | Apply | Comprehend importance of communication skill in engineering and communicate effectively with engineering community and with society in english through exposure to communication skills theory and practice. |
| HU101.2 | Apply | Practice to use the basic grammatical skills of the english language through intensive practice to write effective reports and make effective presentation. |
| HU101.3 | Apply | Develop listening and writing skill to communicate effectively with engineering community and with society. |
| HU101.4 | Apply | Write the official letters, technical report, memo, notice, minutes, agenda, resume, curriculum vitae to communicate effectively with engineering community and with society. |
| HU101.5 | Apply | Apply/illustrate all sets of english language and communication skills in creative and effective ways in the professional sphere of their life |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | | | 3 | | | | | |
| 2 | CO2 | | | | | | | | | | 3 | | | | | |
| 3 | CO3 | | | | | | | | | | 3 | | | | | |
| 4 | CO4 | | | | | | | | | | 3 | | | | | |
| 5 | CO5 | | | | | | | | | | 3 | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Communication in a Globalized World<br>1.1 Definition, Process, Types of Communication<br>1.2 Verbal and Non-Verbal Communication<br>1.3 Barriers to Communication<br>1.4 Workplace Communication | 4L |
| Module II | Functional Grammar<br>2.1. Articles, Prepositions and Verbs<br>2.2. Verb-Subject Agreement<br>2.3. Voice, Modality and Modifiers<br>2.4. Direct and Indirect Speech<br>2.5. Common Errors in English | 4L |
| Module III | Vocabulary and Reading<br>3.1. Word Roots, Prefixes and Suffixes<br>3.2. Antonyms, Synonyms and one word Substitution<br>3.3. Reading—Purposes and Skills (Skimming, Scanning & Intensive Reading)<br>3.4. Reading Comprehension (Fictional and Non-fictional prose) | 6L |
| Module IV | Professional Writing<br>4.1. Writing Functions: Describing, Defining, Classifying Structuring—coherence and clarity<br>4.2. Business Writing—Letters (Enquiry, Order, Sales, Complaint, Adjustment, Job Application letters), Memos, Notices, Circulars, Agendas and Minutes of Meetings).<br>4.3. E-mails—types, conventions, jargons and modalities.<br>4.4. Reports and Proposals<br>4.5. Précis writing<br>4.6. Essay writing | 10L |

4.7. Punctuation and its importance in writing
4.8. Writing for an Audience

Total 24L

**Text Books:**

1 Ruskin Bond: The Night Train at Deoli
2 Khushwant Singh: The Portrait of a Lady
3 Roald Dahl: Lamb to the Slaughter
4 Somerset Maugham: The Man with the Scar
5 Anne Frank: The Diary of a Young Girl (Letters of 3rd February 1944, 12th February 1944and 13th February 1944)
6 Jawaharlal Nehru: —How Britain Ruled India‖ (Glimpses of World History, Chap 112)

**Reference Books:**

1 Raymond Murphy. English Grammar in Use. 3rd Edn. CUP, 2001.
2 A. J Thomson and A. V. Martinet. A Practical English Grammar Oxford: OUP, 1980.
3 Michael Swan. Practical English Usage. Oxford: OUP, 1980.
4 Simeon Potter. Our Language. Oxford: OUP, 1950.
5 Pickett, Laster and Staples. Technical English: Writing, Reading & Speaking. 8th ed.London: Longman, 2001.
6 Ben Heasley and Liz Hamp-Lyons. Study Writing. Cambridge: CUP, 2006.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | I |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| CH191 | Chemistry Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | 10+2 science with chemistry | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| CH191.1 | Apply | Work as an individual also as a team member to perform experiments and make the report. |
| CH191.2 | Apply | Conducting experiments in group and operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields. |
| CH191.3 | Analyze | Perform test in group to analyze different parameters of water considering environmental issues. |
| CH191.4 | Analyze | Perform test in group to synthesize nano and polymer materials. |
| CH191.5 | Create | Design innovative experiments applying the fundamentals of chemistry |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | | 3 | 3 | | | | | |
| 2 | CO2 | | | | 3 | | | | | | | | | | | |
| 3 | CO3 | | | | 3 | | | 3 | | | | | | | | |
| 4 | CO4 | | | | | | | | | | | | | | | |
| 5 | CO5 | 3 | 2 | 2 | 3 | | | | | | | | | | | |

| Experiment No | List of Experiment |
|---|---|
| Experiment - 1 | To determine the alkalinity in given water sample. |
| Experiment – 2 | Redox titration (estimation of iron using permanganometry) |
| Experiment – 3 | To determine calcium and magnesium hardness of a given water sample separately. |
| Experiment – 4 | Preparation of phenol-formaldehyde resin (Bakelite). |
| Experiment – 5 | Heterogeneous equilibrium (determination of partition coefficient of acetic acid between nbutanol and water). |
| Experiment – 6 | Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution. |
| Experiment – 7 | pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution. |
| Experiment – 8 | Determination of dissolved oxygen present in a given water sample. |
| Experiment – 9 | To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution). |
| Experiment – 10 | Innovative experiment: Preparation of silver nano-particles. |

**Text Books:**

1. A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
2. General & Inorganic Chemistry, P.K. Dutt
3. General & Inorganic Chemistry, Vol I, R.P. Sarkar
4. Physical Chemistry, P.C. Rakshit

**Reference Books:**

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
2. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
3. Physical Chemistry, by P. W. Atkins
4. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5thEdition
5. http://bcs.whfreeman.com/vollhardtschore5e/default.asp

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | I |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE191 | Basic Electrical Engineering Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Basic Physics and applied physics, Basic Mathematics, Basic concept of Electric Circuit. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE191.1 | Apply | Make electrical connection from circuit diagram for conducting experiments, operate common electrical measuring instruments, identify common electrical components and select their ratings. |
| EE191.2 | Apply | Conduct experiment to verify the network theorems in DC circuit and study of AC R-L-C series circuit. |
| EE191.3 | Apply | Conduct experiment to understand operation dc machine and perform the starting, reversing and speed control of DC shunt motor and torque-speed characteristics of DC machine and Three-phase Induction motor. |
| EE191.4 | Apply | Conduct experiment to understand operation of transformer and determine losses of transformers by open circuit and short circuit test. |
| EE191.5 | Apply | Conduct experiment to determine the 3 ph power by 2-wattmeter method and 1 ph energy by energy meter. |
| EE191.6 | Apply | Perform experiments in a group, note the observation with ethics, interpret the observed test result, hence calculate unknown parameters individually, and write an effective reports to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | | | | | | | | | | 3 | |
| 2 | CO2 | 2 | | | 3 | | | | | | | | | | 3 | |
| 3 | CO3 | 2 | | | 3 | | | | | | | | | | 3 | |
| 4 | CO4 | 2 | | | 3 | | | | | | | | | | 3 | |
| 5 | CO5 | 2 | | | 3 | | | | | | | | | | 3 | |
| 6 | CO6 | | | | | | | | | 3 | 3 | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment – 1 | Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor. |
| Experiment – 2 | Verification of Thevenin's and Norton's Theorem. |
| Experiment – 3 | Verification of Superposition and Maximum Power Transfer Theorem. |
| Experiment - 4 | Characteristics of Fluorescent, Tungsten and Carbon filament lamps. |
| Experiment – 5 | Study of R-L-C series circuit. |
| Experiment – 6 | Three-phase Power measurement with two wattmeter method. |
| Experiment - 7 | Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor). |
| Experiment - 8 | Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test. |
| Experiment - 9 | Starting, Reversing and speed control of DC shunt motor. |
| Experiment - 10 | Torque-Speed characteristics of DC Machine. |
| Experiment - 11 | Torque-Speed characteristics of Three-phase Induction Motor. |
| Experiment - 12 | Test on single-phase Energy Meter. |
| Experiment - 13 | Innovative experiments |

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | I |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| ME191 | Engineering Graphics & Design | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Basic knowledge of geometry | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| ME191.1 | Understand | Become familiar and learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings. |
| ME191.2 | Understand | Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements. |
| ME191.3 | Understand | Describe projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts. |
| ME191.4 | Understand | Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | | | | | | | | |
| 2 | CO2 | | | | 2 | | | | | | | | | | | |
| 3 | CO3 | | | | 2 | 2 | | | | | | | | | | |
| 4 | CO4 | | | | 2 | 3 | | | | | | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Experiment - 2 Introduction to Engineering Drawing:
Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Experiment - 3 Orthographic & Isometric Projections:
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Experiment - 4 Sections and Sectional Views of Right Angular Solids:
Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only)

Experiment - 5 Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Experiment - 6 Overview of Computer Graphics:
Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modifyand Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Experiment - 7 CAD Drawing, Customization, Annotations, layering:
Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and

| | |
|---|---|
| | tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, Changing line lengths (extend/lengthen);<br>Printing documents; Drawing sectional views of solids and project the true shape of the sectioned surface; Drawing annotation, CAD modeling of parts and assemblies with animation, Parametric and non parametric solid, surface and wireframe modeling, Part editing and two dimensional documentation of models. |
| Experiment - 8 | Demonstration of a simple team design project:<br>Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, Use of solid-modeling software for creating associative models at the component and assembly levels. |

**Text Books:**

1 Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2 (Corresponding set of) CAD Software Theory and User Manuals

**Reference Books:**

1 K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers
2 Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3 Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4 Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| M201 | Mathematics - II | 3 | 1 | - | - | 4 | 30 | 70 | 100 |
| Pre-requisite | The students to whom this course will be offered must have the concept of (10+2)standard calculus. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| M201.1 | Understand | Use mathematical tools to solve multiple integrals and vector integrals equation in engineering problems. |
| M201.2 | Apply | Apply effective mathematical tools for the solutions of ordinary differential equations that model physical processes of in engineering problems. |
| M201.3 | Apply | Recall the properties of Laplace transform to evaluate multiple integrals and their usage in engineering problems. |
| M201.4 | Apply | Understand the concept of Laplace transform to formulate and solve ordinary differential equations in engineering problems. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | | | | | | | | | | | | 2 | | |
| 3 | CO3 | 3 | | | | | | | | | | | | 2 | | |
| 4 | CO4 | 3 | | | | | | | | | | | | 2 | | |
| 5 | CO5 | 3 | | | | | | | | | | | | 2 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Multivariable Calculus (Integration)<br>Double integration, Change of order of integration in double integrals, Triple integrals, vector lineintegrals, scalar surface integrals, vector surface integrals, Green ‘s theorem, Gauss divergence theorem and Stokes ‘ theorem. | 12L |
| Module II | First Order Ordinary Differential Equations (ODE)<br>Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli ‘s equation, Solution of first order and higher degree ODE: solvable for ,solvable for solvable for and Clairaut ‘s equation. | 10L |
| Module III | Second Order Ordinary Differential Equations (ODE)<br>Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Reduction of 2nd order ODE to a pair of first order ODEs, Solution of simultaneous linear ODEs. | 12L |
| Module IV | Laplace Transform (LT)<br>Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of , LT of , LT of derivatives of f (t), LT ∫ of ,<br>Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem)using LT. | 14L |
| | Total | 48L |

**Text Books:**


1 Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2 Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
3 Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
4 Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5 Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

**Reference Books:**


1 Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2 Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3 Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4 Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5 Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| PH201 | Physics - I | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Knowledge of Physics up to 12th standard. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| PH201.1 | Understand | Describe various types mechanical resonance and its electrical equivalence. |
| PH201.2 | Understand | Explain basic principles of laser, optical fibers and various types of semiconductors. |
| PH201.3 | Apply | Apply superposition theorem to explain behaviors of waves, including diffraction and interference and describe applications based on these behaviors using Heisenberg's uncertainty principle. |
| PH201.4 | Analyze | Analyze importance of light as a carrier of information and examine different crystallographic structures according to their co-ordination number and packing factors. |
| PH201.5 | Evaluate | Justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | | | | | | | | | | | | 2 | | |
| 3 | CO3 | 3 | 2 | | | | | | | | | | | | | |
| 4 | CO4 | 2 | 3 | | | | | | | | | | | | | |
| 5 | CO5 | | 3 | | | | | | | | | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Waves & Oscillations<br>Simple Harmonic Motion (only preliminary idea), damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems. | 6L |
| Module II | Classical Optics<br>Interference of light: Huygens ‘s principle, superposition of waves, conditions of sustained interference, Newton ‘s ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, Numerical Problems.<br>Diffraction of light: Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, multipleslits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems. | 8L |
| Module III | Quantum Mechanics-I<br>Quantum Theory: Inadequacy of classical physics and its modifications by Planck ‘s quantum hypothesis-qualitative (no deductions), particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines),wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment.<br>Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems. | 8L |
| Module IV | Solid State Physics-I<br>Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples),lattice, basis, unit cell, Fundamental types of lattices −Bravais lattice, simple cubic, fcc and bcclattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg ‘sequation, applications, numerical problems. 4L<br>Semiconductor: Physics of semiconductors, electrons and holes, metal, insulator and | 7L |

| | | |
|---|---|---|
| | semiconductor, intrinsic and extrinsic semiconductor, p-n junction. | |
| Module V | Modern Optics-I<br>Laser: Concepts of various emission and absorption process, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser.<br>Fibre optics: Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle, Numerical problems. | 7L |
| | Total | 36L |

**Text Books:**

Waves & Oscillations

1 Sound-N. K. Bajaj (TMH)
2 Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3 Principles of Acoustics-B. Ghosh (Sridhar Publisher)
4 A text book of sound-M. Ghosh ( S. Chand publishers
5 A text book of Light- K.G. Mazumder & B. Ghoshs, (Book & Allied Publisher)
6 Physics of Oscillations and Waves- R.P. Singh
7 College Physics Vol. II - A.B. Gupta
8 Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics

1 A text book of Light- K.G. Mazumder & B. Ghoshs (Book & Allied Publisher)
2 A text book of Light-Brijlal & Subhramanium, ( S. Chand publishers)
3 Modern Optics-A. B. Gupta ( Book & Allied Publisher)
4 Optics-Ajay Ghatak (TMH)
5 Optics-Hecht
6 Optics-R. Kar, Books Applied Publishers
7 Physical Optics Möler
8 Optics -F.A. Jenkins and H.E White

Quantum Mechanics-I

1 Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2 Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3 Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4 Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5 Quantum Mechanics-Bransden (Pearson Education Ltd.)
6 Perspective of Modern Physics-A. Beiser (TMH)
7 Quantum mechanics -A.K. Ghatak and S Lokenathan
8 Modern Physics -E.E. Anderson
9 Physics Volume 2 -Haliday, Resnick &Krane Published by Wiley India

Solid State Physics-I

1 Solid state physics-Puri & Babbar ( S. Chand publishers)
2 Materials Science & Engineering-KakaniKakani
3 Solid state physics- S. O. Pillai
4 Introduction to solid state physics-Kittel (TMH)
5 Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6 Problem in Solid state physics -S.O. Pillai (a. b.)

**Reference Books:**

1 Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2 Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3 Perspective & Concept of Modern Physics -Arthur Baiser
4 Principles of engineering physics − Md. N Khan and S Panigrahi.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EC201 | Basic Electronics Engineering | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | A basic course in Electronics and Communication Engineering Progresses from the fundamentals of electricity, direct current (DC) devices and circuits, series and parallel circuits to the study of active and passive components, Ohm's Law, Kirchhoff ‘s Law i.e. KVL, KCL, Ampere ‘s Law etc. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EC201.1 | Apply | Illustrate the basics of semiconductor physics and its operation. |
| EC201.2 | Apply | Elucidate and describe the basics of PN junction diode, analyze its characteristics and categorize applications and solve numerical problems. |
| EC201.3 | Apply | Classify and explain the working principles of bipolar junction transistors, interpret and analyze its characteristics and categorize the applications and solve numerical problems. |
| EC201.4 | Apply | Classify, explain the working principles of field effect transistors interpret and analyze its characteristics and applications and solve numerical problems. |
| EC201.5 | Apply | Explain concepts of feedback in electronic circuits and demonstrate basics of operational amplifiers and categorize its application in electronic signals. |
| EC201.6 | Apply | Demonstrate the operating principle of CRO and categorize its use to measure different parameter - voltage, frequency and phase. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | | | 2 | | | | | | | | | 2 | | |
| 3 | CO3 | 3 | 2 | | 2 | | | | | | | | | 2 | | |
| 4 | CO4 | 3 | 2 | | 2 | | | | | | | | | 2 | | |
| 5 | CO5 | 3 | | | | | | | | | | | | 2 | | |
| 6 | CO6 | 2 | | | | | | | | | | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Basics of semiconductor<br>Conductors, Insulators, and Semiconductors- crystal structure, Fermi Dirac function, Fermi level, E-kand Energy band diagrams, valence band, conduction band, and band gap; intrinsic, and extrinsic(p-type and n-type) semiconductors, position of Fermi level in intrinsic and extrinsic semiconductor, drift and diffusion current − expression only ( no derivation) , mass action law ,charge neutrality in semiconductor, Einstein relationship in semiconductor , Numerical problems on- Fermi level, conductivity, mass action law, drift and diffusion current . | 5L |
| Module II | P-N Junction Diode and its applications<br>P-N junction formation and depletion region , energy band diagram of p-n junction at equilibrium and barrier energy , built in potential at p-n junction , energy band diagram and current through p-njunction at forward and reverse bias, V-I characteristics and current expression of diode ,temperature dependencies of V-I characteristics of diode , p-n junction breakdown − conditions ,avalanche and Zener breakdown , Concept of Junction capacitance, Zener diode and characteristics. Diode half wave and full wave rectifiers circuits and operation ( IDC , Irms , VDC , Vrms, ripple factor without filter, efficiency ,PIV,TUF; Reduction of ac ripples using filter circuit (Qualitative analysis); Design of diode clipper and clamper circuit - explanation with example, application of Zener diode in regulator circuit. Numerical problems | 7L |

| | | |
|---|---|---|
| Module III | Bipolar Junction Transistor<br>Formation of PNP/NPN Transistors, energy band diagram, current conduction mechanism, CE, CB,CC configurations, transistor static characteristics in CE, CB and CC mode, junction biasing condition for active, saturation and cut-off modes, current gain $\alpha$, $\beta$ and $\gamma$, early effect. Biasing and bias stability; biasing circuits - fixed bias; voltage divider bias; collector to base bias, D.C. load line and Quiescent point, calculation of stability factors for different biasing circuits.BJT as an amplifier and as a switch − Graphical analysis; Numerical Problems. | 8L |
| Module IV | Field Effect Transistors<br>Concept of field effect, channel width modulation Classification of FETs-JFET, MOSFET, operating principle of JFET. drain and transfer characteristics of JFET (n-channel and p-channel),CS,CG,CD configurations, Relation between JFET parameters. FET as an amplifier and as a switch− graphical analysis. E-MOSFET (n-channel and p-channel), D-MOSFET (n-channel and p channel),Numerical Problems | 6L |
| Module V | Feedback and Operational Amplifier<br>Concept of feedback with block diagram, positive and negative feedback, gain with feedback. Feedback topologies, effect of feedback on input and output impedance, distortion, concept of oscillation and Barkhausen criterion.<br>Operational amplifier − electrical equivalent circuit ,ideal characteristics , Non ideal characteristics of op- amp − offset voltages ;bias current ;offset current; Slew rate ; CMRR and bandwidth, Configuration of inverting and non-inverting amplifier using Op-amp, closed loop voltage gain of inverting and non- inverting amplifier , Concept of virtual ground, Applications op-amp − summing amplifier; differential amplifier; voltage follower ; basic differentiator and integrator .Problems on Characteristics of Op-amp, CMRR, slew rate, amplifier and application of Op-amp tobe discussed. Any other relevant problems related to topic may be discussed or assigned. | 8L |
| Module VI | Cathode Ray Oscilloscope (CRO)<br>Operating principle of CRO with block diagram, measurement of voltage, frequency and phase. | 2L |
| | Total | 36L |

**Text Books:**

1 D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2 Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3 Sedra & Smith, Microelectronics Engineering

**Reference Books:**

1 John D. Ryder, Electronic Fundamentals and Applications, PHI
2 J.B.Gupta, Basic Electronics, S.K. Kataria.
3 Malvino: Electronic Principle.
4 Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| CS201 | Programming for Problem Solving | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Number system, Boolean Algebra | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| CS201.1 | Understand | Know the fundamentals of computer and associated temrs, describe and differentiate different programming languages for solving engineering problem. |
| CS201.2 | Understand | Execution and debug programs in C language. |
| CS201.3 | Remember | Define various variables, data types, declarations and statements used in C. |
| CS201.4 | Remember | Define and know the uses of various operators, expressions, input and output, branching and loop statement, functions in C to solve mathematical problems. |
| CS201.5 | Apply | Demonstrate the basics of array, string, pointer and dynamic memory allocation. |
| CS201.6 | Apply | Handling files with C and construct and develop programs using files. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | 2 | | | | | | | | | | |
| 2 | CO2 | | | | | 3 | | | | | | | | | | |
| 3 | CO3 | | | | | 3 | | | | | | | | | | |
| 4 | CO4 | | | | | 3 | | | | | | | | | | |
| 5 | CO5 | | | | | 3 | | | | | | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Fundamentals of Computer<br>History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. (3L)<br>Binary and Allied number systems representation of signed & unsigned numbers, BCD, ASCII, Binary number Arithmetic − Addition and Subtraction (using 1 ‘s complement and 2 ‘s complement). (2L)<br>Overview of Procedural vs Structural language, compiler and assembler (basic concepts). (1L)<br>Problem solving-Algorithm & flow chart. (2L) | 8L |
| Module II | C Fundamentals<br>Variable and Data Types: The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements. (2L)<br>C Operators & Expressions: Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, special operators - type conversion, C expressions, precedence and associativity. (3L)<br>Input and Output: Standard input and output, formatted output - printf, formatted input scanf, bitfields. (1L)<br>Branching and Loop Statements: Statement and blocks, if - else, switch, goto and labels, Loops -while, for, do while, break and continue. (4L)<br>Fundamentals and Program Structures: auto, external, static and register variables Functions, function types, function prototypes, functions returning values, functions not returning values, scope rules, recursion, C preprocess or and macro. (5L)<br>Arrays, Strings and Pointers: One dimensional arrays, Two-dimensional arrays, Multidimensional arrays. Passing an array to a function Character array and string, array of strings, Passing a string toa function, String related functions, Pointers, Pointer and Array, Pointer and String, Pointer and functions, Dynamic memory allocation. (7L)<br>Structures and Unions: Basic of structures, arrays of structures, structures and pointers, | 28L |

structures and functions. (3L)
Files handling with C: Formatted and unformatted files, Command line arguments, fopen, fclose, fgetc, fputc, fprintf, fscanf function. (3L)

Total 36L

**Text Books:**

1 Kerninghan B.W. & Ritchie D.M. - The C Programming Language ,PHI, 2nd Edition
2 Kanetkar Y. - Let us C, BPB Publication, 15th Edition

**Reference Books:**

1 E Balagurusamy– Programming in ANSI C, TMH, 3rd Edition
2 K R Venugopal& S R Prasad – MASTERING C, TMH, 2nd Edition
3 ReemaThareja– INTRODUCTION TO C PROGRAMMING, OXFORD UNIVERSITYPRESS, 2nd Edition

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| ME201 | Engineering Mechanics | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Basic Concept of Physics | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| ME201.1 | Remember | Know about thermodynamic equilibrium, heat & work transfer, First law and its application. |
| ME201.2 | Remember | Know the thermodynamic characteristics of a pure substance and its application in power cycles (Simple Rankine cycles, Air Standard cycles) |
| ME201.3 | Remember | Knowledge of basic principles of fluid mechanics, and ability to analyze fluid flow problems with the application of the momentum and energy equations |
| ME201.4 | Understand | Understand the basic concepts of Heat Engine, Entropy from Second law of thermodynamics. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | | | |
| 2 | CO2 | 3 | | | | | | | | | | | | | | |
| 3 | CO3 | 3 | | | | | | | | | | | | | | |
| 4 | CO4 | 3 | | | | | | | | | | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction to Engineering Mechanics<br>Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space − Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy. | 6L |
| Module II | Friction<br>Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack. | 2L |
| Module III | Basic Structural Analysis<br>Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zeroforce members; Beams & types of beams; Frames & Machines. | 3L |
| Module IV | Centroid and Centre of Gravity<br>Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment ofinertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. | 5L |
| Module V | Virtual Work and Energy Method<br>Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium. | 5L |
| Module VI | Review of particle dynamics<br>Rectilinear motion; Plane curvilinear motion(rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton ‘s 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). | 5L |

| | | |
|---|---|---|
| Module VII | Introduction to Kinetics of Rigid Bodies<br>Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D ʻAlembert ʻs principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. | 5L |
| Module VIII | Mechanical Vibrations<br>Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums. | 5L |
| | Total | 36L |

**Text Books:**


1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, VolII, − Dynamics, 9th Ed, Tata McGraw Hill
3. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and RudraPratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education


**Reference Books:**


1. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer ʻs Engineering Mechanics
2. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
3. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
4. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| CS291 | Programming for Problem Solving Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Number system, Boolean Algebra | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| CS291.1 | Understand | Write program to summarize DOS system commands and editor. |
| CS291.2 | Understand | Write program to learn the concept of programs with Arrays, Pointers, Structures, Union and Files. |
| CS291.3 | Apply | Write program to formulate the algorithms for simple problems and to translate given algorithms to a working and correct program. |
| CS291.4 | Apply | Write iterative as well as recursive programs |
| CS291.5 | Apply | Identify and correct syntax errors / logical errors as reported during compilation time and run time. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | 2 | | | | | | | | | | |
| 2 | CO2 | | | | 2 | 2 | | | | | | | | | | |
| 3 | CO3 | | | | 2 | 2 | | | | | | | | | | |
| 4 | CO4 | | | | 2 | 2 | | | | | | | | | | |
| 5 | CO5 | | | | 2 | 2 | | | | | | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Some basic commands of DOS, Windows and Linux Operating System, File handling and Directory structures, file permissions, creating and editing simple C program, compilation and execution of C program. |
| Experiment - 2 | Writing C Programs on variable, expression, operator and type-casting. |
| Experiment - 3 | Writing C Programs using different structures of if-else statement and switch-case statement. |
| Experiment - 4 | Writing C Programs demonstrating use of loop (for loop, while loop and do-while loop) concept and use of break and continue statement. |
| Experiment - 5 | Writing C Programs demonstrating concept of Single & Multidimensional arrays. |
| Experiment - 6 | Writing C Programs demonstrating concept of Function and Recursion. |
| Experiment – 7 | Writing C Programs demonstrating concept of Pointers, address of operator, declaring pointers and operations on pointers. |
| Experiment – 8 | Writing C Programs demonstrating concept of structures, union and pointer to structure. |
| Experiment - 9 | Writing C Programs demonstrating concept of String and command line arguments. |
| Experiment - 10 | Writing C Programs demonstrating concept of dynamic memory allocation. |
| Experiment - 11 | Writing C Programs demonstrating concept of File Programming. |
| Experiment - 12 | Innovative Experiment |

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| PH291 | Physics-I Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Basic knowledge of 10+2 | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| PH291.1 | Understand | Demonstrate experiments allied to their theoretical concepts. |
| PH291.2 | Analyze | Conduct experiments in group using laser, optical fibers, Torsional pendulum, spctrometer. |
| PH291.3 | Apply | Participate as an individual and as a member or leader in groups in laboratory sessions actively. |
| PH291.4 | Analyze | Analyze and interpret experimental data using graphical representations, and to make effective laboratory reports including innovative experiments. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | 2 | | | | | | | | 2 | | | | | |
| 2 | CO2 | | 2 | | 3 | | | | | | | | | | | |
| 3 | CO3 | | 2 | | | | | | | 3 | | | | | | |
| 4 | CO4 | 2 | 2 | | | | | | | | 3 | | | | | |

**Experiment No** **List of Experiments**

General idea about Measurements and Errors (One Mandatory):
Experiment – 1 Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
Experiment – 2 Proportional error calculation using Carrey Foster Bridge.
Experiments on Oscillations& Elasticity:
Experiment – 3 Study of Torsional oscillation of Torsional pendulum & determination of time period using various load of the oscillator.
Experiment – 4 Experiments on Lissajous figure (using CRO).
Experiment – 5 Experiments on LCR circuit.
Experiment – 6 Determination of elastic modulii of different materials (Young‘s modulus and Rigidity modulus)

Experiments on Optics:

Experiment – 7 Determination of wavelength of light by Newton‘s ring method.
Experiment – 8 Determination of wavelength of light by Laser diffraction method.
Experiment- 9 Determination of numerical aperture and the energy losses related to optical fiber experiment
Experiment - 10 Measurement of specific rotation of an optically active solution by polarimeter.
Experiments on Quantum Physics:
Experiment - 11 Determination of Planck‘s constant using photoelectric cell.
Experiment - 12 Verification of Bohr‘s atomic orbital theory through Frank-Hertz experiment.
Innovative experiments:
Experiment - 13 Determination of wavelength of light by Fresnel‘s bi-prism method (beyond the syllabus).
Experiment - 14 Study of half-wave, quarter-wave plate (beyond the syllabus)
Experiment – 15 Study of dispersive power of material of a prism.
Experiment – 16 Study of viscosity using Poyseullie‘s caplillary flow method/using Stoke‘s law.
Experiment – 17 Measurement of nodal and antinodal points along transmission wire and measurement of wave length.
Experiment - 18 Any other experiment related to the theory

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EC291 | Basic Electronics Engineering Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | A basic course in electronics and Communication engineering Progresses from the fundamentals of electricity, active and passive components, basic electronics laws like Ohms law, Amperes law. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EC291.1 | Understand | Conduct experiment to gain the knowledge of electronic components such as resistors, capacitors, diodes, transistors, measuring equipment like DC power supply, nultimeter, CRO, signal generator. |
| EC291.2 | Analyze | Conduct experiment to study the characteristics of Junction Diode, Zener Diode, BJT & FET and different types of rectifier circuits. |
| EC291.3 | Analyze | Conduct experiment to determination of input-offset voltage, input bias current and Slew rate, Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs. |
| EC291.4 | Analyze | Conduct experiment to study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators. |
| EC291.5 | Analyze | Conduct experiment to study of Logic Gates and realization of Boolean functions using Logic Gates |
| EC291.6 | Analyze | Perform experiments in a group, note the observation with ethics, interpret the observed test result, hence calculate unknown parameters individually, and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | 2 | | | | | | | | | | | |
| 2 | CO2 | 2 | | | 3 | | | | | | | | | | | |
| 3 | CO3 | 2 | | | 3 | | | | | | | | | | | |
| 4 | CO4 | 2 | | | 3 | | | | | | | | | | | |
| 5 | CO5 | 2 | | | 3 | | | | | | | | | | | |
| 6 | CO6 | | | | | | | | | 3 | 3 | | | | 3 | |

**Experiment No** **List of Experiments**

| | |
|---|---|
| Experiment – 1 | Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimeters etc. |
| Experiment – 2 | Familiarization with measuring and testing equipment like CRO, Signal generators etc. |
| Experiment – 3 | Study of I-V characteristics of Junction diodes. |
| Experiment – 4 | Study of I-V characteristics of Zener diodes. |
| Experiment - 5 | Study of Half and Full wave rectifiers with Regulation and Ripple factors. |
| Experiment - 6 | Study of I-V characteristics of BJTs. |
| Experiment – 7 | Study of I-V characteristics of Field Effect Transistors. |
| Experiment - 8 | Determination of input-offset voltage, input bias current and Slew rate of OPAMPs. |
| Experiment - 9 | Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs. |
| Experiment - 10 | Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators. |
| Experiment – 11 | Study of Logic Gates and realization of Boolean functions using Logic Gates. |
| Experiment – 12 | Study of Characteristic curves for CB, CE and CC mode transistors. |
| Experiment - 13 | Innovative Experiments |

**Text Books:**

1 D. Chattopadhyay, P. C. Rakshit, Electronics Fundamentals and Applications, New Age International
2 Millman & Halkias, Integrated Electronics, Tata McGraw Hill.
3 Sedra & Smith, Microelectronics Engineering

**Reference Books:**

1 John D. Ryder, Electronic Fundamentals and Applications, PHI
2 J.B. Gupta, Basic Electronics, S.K. Kataria.
3 Malvino: Electronic Principle.
4 Boyelstad & Nashelsky: Electronic Devices & Circuit Theory, McGraw Hill, 1976.

# JIS COLLEGE OF ENGINEERING

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|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| ME292 | Workshop/Manufacturing Practices | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Higher Secondary with Mathematics, Physics and Chemistry | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| ME292.1 | Understand | Gain basic knowledge of Workshop Practice and Safety useful for our daily living. |
| ME292.2 | Understand | Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and performing operations like such as Marking, Cutting etc used in manufacturing processes. |
| ME292.3 | Understand | Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc to understand the concept of tolerances applicable in all kind of manufacturing. |
| ME292.4 | Understand | Get hands on practice of in Welding and various machining processes which give a lot of confidence to manufacture physical prototypes in project works. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | | | |
| 2 | CO2 | | | | 2 | | | | | | | | | | | |
| 3 | CO3 | | | | 3 | | | | | | | | | | | |
| 4 | CO4 | | | | 3 | | | | | | | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Theoretical discussion & videos: (6P):-
1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting.

Experiment – 2 Machine shop (6P):- Typical jobs that may be made in this practice module:
i. To make a pin from a mild steel rod in a lathe.
ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Experiment – 3 Fitting shop (6P):- Typical jobs that may be made in this practice module:
i. To make a Gauge from MS plate.

Experiment – 4 Carpentry (6P):- Typical jobs that may be made in this practice module:
i. To make wooden joints and/or a pattern or like.

Experiment - 5 Welding shop (Arc welding 3P + gas welding 3P) (6P):- Typical jobs that may be made in this practice module:
i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arcwelding.
ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Experiment - 6 Electrical & Electronics (3P):- House wiring, soft Soldering

Experiment - 7 Smithy (3P):- Typical jobs that may be made in this practice module:
i. A simple job of making a square rod from a round bar or like.

Experiment - 8 Casting:- Typical jobs that may be made in this practice module:
i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Experiment - 9 Plastic moulding & Glass Cutting:- Typical jobs that may be made in this practice module:
i. For plastic moulding, making at least one simple plastic component should be made.
ii. At least one sample shape on glass should be made using laser cutting machine.

**Text Books:**

1 Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., —Elements of Workshop Technology, Vol. I 2008 and Vol. II 2010, Media Promoters and Publishers Private Limited, Mumbai.
2 Rao P.N., —Manufacturing Technology, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

**Reference Books:**

1 Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2 Roy A. Lindberg, —Processes and Materials of Manufacture, 4th edition, Prentice Hall India, 1998.
3 Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4 Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern.
5 Principles of Metal Cutting/Principles of Machine Tools by G.C.Sen and A.Bhattacharya, New Central Book Agency, Kolkata.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | II |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| HU291 | Language Laboratory | - | - | 2 | - | 1 | 40 | 60 | 100 |
| Pre-requisite | Basic knowledge of LSRW skills | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| HU291.1 | Understand | Make sense of advanced skills of Technical Communication in English through Language Laboratory. |
| HU291.2 | Apply | Develop listening, speaking, reading and writing skills in societal and professional life. |
| HU291.3 | Apply | Demonstrate the skills necessary to be a competent interpersonal communicator. |
| HU291.4 | Apply | Explore and analyze communication behaviours |
| HU291.5 | Apply | Adjust and adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | | | 3 | | | | | |
| 2 | CO2 | | | | | | | | | | 3 | | | | | |
| 3 | CO3 | | | | | | | | | | 3 | | | | | |
| 4 | CO4 | | | | | | | | | | 3 | | | | | |
| 5 | CO5 | | | | | | | | | | 3 | | | | | |

| Module | Content |
|---|---|
| Module I | Introduction to the Language Lab<br>a. The Need for a Language Laboratory<br>b. Tasks in the Lab<br>c. Writing a Laboratory Note Book |
| Module II | Active Listening<br>a. What is Active Listening?<br>b. Listening Sub-Skills–Predicting, Clarifying, Inferencing, Evaluating, Note-taking<br>c. Academic Listening vs Business Listening<br>d. Listening in Business Telephony<br>e. Study of Contextualized Examples based on Lab Recordings |
| Module III | Speaking<br>a. Speaking–Accuracy and Fluency Parameters<br>b. Pronunciation Guide–Basics of Sound Scripting, Stress and Intonation<br>c. Fluency-focussed activities–JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs<br>d. Accuracy-focussed activities–Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)<br>e. Group Discussion: Principles and Practice |
| Module IV | Lab Project Work<br>a. Making a brief Animation film with voice over (5 minutes) OR<br>b. Making a brief Documentary film (10 minutes) |

**Reference Books:**

1 IIT Mumbai, Preparatory Course in English syllabus
2 IIT Mumbai, Introduction to Linguistics syllabus
3 Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4 Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE301 | Electrical Circuit Analysis | 3 | 1 | - | - | 4 | 30 | 70 | 100 |
| **Pre-requisite** | The students to whom this course will be offered must have the concept of Basic electrical engineering, Laplace transform, First order ordinary differential equation and Second order ordinary differential equation. | | | | | | | | |

| **Course Outcomes** | | |
|---|---|---|
| EE301.1 | Apply | Illustrate the basic terminologies associated with circuit theories, solve numerical using fundamental laws of electric circuit, explain fundamentals of coupled circuit and solve related numerical. |
| EE301.2 | Analyze | Interpret and analyze different electrical circuit response by using the concept of Laplace transformation and solve related numerical. |
| EE301.3 | Analyze | Interpret and analyze different electrical circuit response by using network theorems and solve related numerical. |
| EE301.4 | Analyze | Interpret and analyze different electrical circuit response using the concept of graph theory and two port network and solve related numerical. |
| EE301.5 | Analyze | Interpret, analyze, illustrate and synthesis of low pass, high pass, band pass, band reject, all pass filters (first and second order only) using operational amplifier. |
| EE301.6 | Analyze | Interpret and analyze different electrical circuit response by using the concept of Fourier series analysis and solve related numerical. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No.** | **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| 1 | CO1 | 3 | 2 | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 3 | 2 |
| 4 | CO4 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 3 | 2 |
| 5 | CO5 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 3 | 2 |
| 6 | CO6 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 3 | 2 |

| **Module** | **Content** | **Hour** |
|---|---|---|
| Module I | Introduction<br>Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks , Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals, Source transformation, KVL & KCL. | 3L |
| Module II | Coupled Circuits<br>Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits, Ideal Transformer, Solution of problems. | 5L |
| Module III | Laplace Transform in Circuit Analysis<br>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. | 8L |
| Module IV | Network Theorems<br>Loop variable analysis, Node variable analysis, Superposition Theorem, Thevenin ‘s Theorem, Norton ‘s Theorem, Maximum Power Transfer Theorem, Millman ‘s Theorem Solution of Problems with DC & AC sources. | 8L |
| Module V | Graph Theory<br>Concept of Tree, Branch, Tree link, Incidence Matrix, Cut Set Matrix, Tie Set Matrix, Formation of incidence, tie set, cut set matrices of electric circuits. | 4L |

| | | |
|---|---|---|
| Module VI | Two Port Network<br>Open circuit Impedance & Short circuit Admittance parameter, Transmission parameter, Hybrid Parameter, Conditions Of Reciprocity And Symmetry, Interrelation between different parameters, Driving point impedance & Admittance. Interconnection Of Two Port Networks. Solution of problems. | 8L |
| Module VII | Filter<br>Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier | 6L |
| Module VIII | Fourier Series Analysis<br>Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. Euler's Formulae for Fourier Series, Fourier Series for functions of period $2\pi$, Dirichlet's conditions, Sum of Fourier series. Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its Periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval 's identity (statement only). | 6L |
| | Total | 48L |

**Text Books:**


1 Sudhakar: Circuits & Networks: Analysis & Synthesis 2/e TMH
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.
4 C. K. Alexander and M. N. O. Sadiku, —Electric Circuits, McGraw Hill Education, 2004.
5 D. Chattopadhyay and P.C. Rakshit: Electrical Circuits


**Reference Books:**


1 M. E. Van Valkenburg, —Network Analysis, Prentice Hall, 2006.
2 K. V. V. Murthy and M. S. Kamath, —Basic Circuit Analysis, Jai co Publishers, 1999.
3 Sivanandam: Electric Circuits Analysis
4 V.K. Chandna, A Text Book of Network Theory & Circuit Analysis, Cyber Tech References.
5 Kuo F. F., —Network Analysis & Synthesis, John Wiley & Sons.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE302 | Measurement and Instrumentation | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concepts of Basic Electrical Engineering. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE302.1 | Apply | Illustrate the basic terminology associated with measurement, explain the operating principles of different analog meters and instrument transformer and categorize their uses. |
| EE302.2 | Apply | Explain the operating principles of instrument transformer for measurement of electrical power and energy. |
| EE302.3 | Apply | Explain the theories and apply the understanding to measure unknown values of resistance, inductance, capacitance and frequency. |
| EE302.4 | Apply | Elucidate the concept of operating principles of CRO and electronic instruments. |
| EE302.5 | Apply | Illustrate the working of sensors & transducers and explain its application in flow measurement. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | | | | | | | | | | | | 2 | 2 | 2 |
| 3 | CO3 | 3 | | | | | | | | | | | | 2 | 2 | 2 |
| 4 | CO4 | 3 | | | | | | | | | | | | 2 | 2 | 2 |
| 5 | CO5 | 3 | | | | | | | | | | | | 2 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | | 12L |
| | Measurements: (4L)<br>Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Errors in measurement. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, Cp, Cpk.<br>Analog meters: (6L)<br>General features, Construction, Principle of operation and torque equation of Moving coil and Moving iron, Electrodynamometer, Induction instruments, Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers. Disadvantage of shunt and multipliers<br>Galvanometer: (2L)<br>Basic concept: Principle of operation, Advantage, Disadvantage, Error and Application. | |
| Module II | | 7L |
| | Instrument transformer: (2L)<br>Advantage of Instrument transformers, Principle of operation of Current &Potential transformer, errors.<br>Measurement of Power: (3L)<br>Principle of operation of Electrodynamic & Induction type wattmeter. Wattmeter errors.<br>Measurement of Energy: (2L)<br>Construction, theory and application of AC energy meter. Testing of energy meters. | |
| Module III | | 7L |
| | Measurement of resistance: (3L)<br>Measurement of medium, low and high resistances, Megger. Basic concept of Crompton ‘s DC potentiometer Polar and Co-ordinate type AC potentiometer. Application.<br>AC Bridges: (4L)<br>Measurement of Inductance, Capacitance frequency | |

Module IV 10L

Cathode ray oscilloscope (CRO): (3L)
Basic concept of Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. Digital Storage Oscilloscope
Electronic Instruments: (3L)
Basic concept of Digital voltmeter (Electronic), Resolution and sensitivity of digital meters, Digital Multi meter Digital frequency meter, True RMS meters, Clamp-on meters
Sensors & Transducers: (4L)
Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.

Total 36L

**Text Books:**

1 A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2 Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3 Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.

**Reference Books:**

1 Sensors & Transducers, D. Patranabis, PHI, 2nd edition.
2 Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3 Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C.Copper, Wheeler Publication.
4 Instrument transducers, H.K.P. Neubert, Oxford University press

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|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE303 | Analog Electronics | 3 | - | - | - | 3 | 30 | 70 | 100 |
| **Pre-requisite** | Basic knowledge about electronic components (R, L, C). Network Theorems (Kirchoffs law, Thevenin's theorem, Norton's theorem, Miller theorem etc.). Basic knowledge about the operation of semiconductor devices (Diode, Transistor, JFET, MOSFET, etc.), Basic idea of integrated circuit, Voltage current equations. Basic knowledge of Differentiation, Integration, Differential equation, matrix etc. | | | | | | | | |

| **Course Outcomes** | | |
|---|---|---|
| EE303.1 | Apply | Classify and explain working of various filter and regulator circuits. |
| EE303.2 | Apply | Analyze the different amplifier configurations for transistors biasing, illustrate transistor stability, elucidate the term voltage gain, current gain, input and output impedance, power gain and emitter follower circuit |
| EE303.3 | Apply | Explain the different coupling techniques using transistor as amplifier, illustrate high frequency model of transistors (hybrid-π model), elucidate frequency response characteristics, derive expression for lower and upper half frequencies, bandwidth, and explain the concept of wide band amplifier |
| EE303.4 | Apply | Illustrate the amplifier feedback concept, explain the Barkhausen criterion, working of RC oscillators - phase shift, Wein bridge oscillators, LC oscillator - Colpitts, Hartley's and crystal oscillators |
| EE303.5 | Apply | Elusive the fundamentals of op-amp, explain the importance of feedback loop (positive & negative), inverting & non-inverting mode of amplifiers, design circuits such as adder &subtractor, differentiator and integrator, log & anti-log amplifiers, multipliers, precision rectifier, voltage to current & current to voltage converter, comparator & Schmitt trigger, infer the significance of op-amp in multivibrators and oscillators. |
| EE303.6 | Apply | Explain the working of class A, B, AB, C power amplifier, tuned amplifier, define and determine conversion efficiency. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | | | | | | | | | 2 | | |
| 2 | CO2 | | 2 | | | | | | | | | | | 3 | 2 | 2 |
| 3 | CO3 | | 2 | | | | | | | | | | | 3 | 2 | 2 |
| 4 | CO4 | | 2 | | | | | | | | | | | 3 | 2 | 2 |
| 5 | CO5 | | 2 | | | | | | | | | | | 3 | 2 | 2 |
| 6 | CO6 | | 2 | | | | | | | | | | | 3 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Filters and Regulators<br>Capacitor filter, $\pi$-section filter, ripple factor, series and shunt voltage regulator, line and load regulation, 78xx and 79xx series, concept of SMPS. | 4L |
| Module II | Transistor Biasing and Stability<br>Biasing technique, Q-point & its Stability, Self Bias-CE configuration, Bias Compensation techniques, h-parameter model of transistors, Expression for voltage gain, current gain, input and output impedance, power gain, Emitter follower circuit. | 4L |
| Module III | Transistor Amplifier<br>Different coupling techniques, RC coupled amplifier, functions of all components, derivation of voltage gain, current gain, input impedance and output impedance, High frequency model of transistors (hybrid-$\pi$ model), frequency response characteristics, Expression for lower and upper half frequencies, bandwidth, and concept of wide band amplifier. | 5L |

| | | |
|---|---|---|
| Module IV | Feedback Amplifiers& Oscillators<br>Feedback concept, negative & positive feedback, Voltage/Current & Series/Shunt Feedback Barkhausen criterion, RC Oscillators-Phase shift and Wein bridge oscillators, LC Oscillator-Colpitts, Hartley ‘s and crystal oscillators. | 5L |
| Module V | Operational Amplifier<br>Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting& non-inverting amplifiers, Voltage follower/Buffer circuits. | 4L |
| Module VI | Application of Operational amplifiers<br>Adder & subtractor circuit, practical integrator & differentiator circuit, Instrumentation Amplifier, Log & Anti-log amplifiers, multipliers, Precision Rectifier, Comparator & Schmitt Trigger, Voltage to current & Current to voltage converter. | 5L |
| Module VII | Power amplifiers<br>Class A, B, AB, C, Conversion efficiency, Tuned amplifier. | 3L |
| Module VIII | Multivibrators<br>Astable, Monostable, Bistablemultivibrators; Astable and Monostable operation using 555 timer. | 2L |
| Module IX | Special Function Circuits<br>VCO, PLL. | 2L |
| | Total | 34L |

**Text Books:**


1 Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI.
2 Gayakwad R.A -OpAmps and Linear IC ‘s, PHI.
3 Sedra& Smith-Microelectronic Circuits- Oxford UP.
4 D. Roy Choudhury & B. Jain-Linear Integrated circuits, New Age Science Limited.
5 Franco-Design with Operational Amplifiers & Analog Integrated Circuits, 3/e, McGrawHill.
6 J.B.Gupta- Electronic Devices and circuits, S.K. KATARIA & SONS.


**Reference Books:**


1 Millman & Halkias- Integrated Electronics, McGraw Hill.
2 Rashid-Microelectronic Circuits-Analysis and Design- Thomson (Cenage Learning)
3 Schilling &Belove-Electronic Circuit: Discrete& Integrated , 3/e , McGraw Hill
4 Razavi- Fundamentals of Microelectronic s- Wiley
5 Malvino-Electronic Principles , 6/e , McGraw Hill
6 Horowitz & Hill- The Art of Electronics; Cambridge University Press.
7 Bell- Operational Amplifiers and Linear ICs- Oxford UP
8 Tobey & Grame-Operational Amplifier: Design and Applications, Mc GrawHill.
9 Coughlin and Driscol-Operational Amplifier and Linear Integrated Circuits − Pearson Education

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| M(EE) 301 | Mathematics – III | L | T | P | S | C | IA | SEE | Total |
| | | 3 | 1 | - | - | 4 | 30 | 70 | 100 |
| Pre-requisite | The students to whom this course will be offered must have the concept of (10+2)standard calculus, basic probability and differential equations. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| M(EE)301.1 | Remember | Recall the underlying principle and properties numerical analysis, statistics, partial differential equation and ordinary differential equation for engineering problems. |
| M(EE)301.2 | Understand | Exemplify the variables, functions and differential equations and find their distinctive measures using the underlying concept partial differential equation and ordinary differential equation, numerical methods and statistics for engineering problems. |
| M(EE)301.3 | Apply | Apply numerical methods used to obtain approximate solutions to intractable for engineering mathematical problems. |
| M(EE)301.4 | Apply | Solve partial differential equation using method of separation of variables and ordinary differential equation using techniques of series solution and special function (Legendre's and Bessel's) for engineering problems. |
| M(EE)301.5 | Analyze | Interpret complex statistical findings using the understanding of inferential statistics for engineering problems. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | 3 | | | | | | | | | | | 2 | | |
| 3 | CO3 | 3 | 3 | | | | | | | | | | | 2 | | |
| 4 | CO4 | 3 | 3 | | | | | | | | | | | 2 | | |
| 5 | CO5 | 3 | 3 | | | | | | | | | | | 2 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Interpolation<br>Difference Operators (Only Definition): Forward and Backward, Shift Operator, Newton forward interpolation, Newton backward interpolation, Lagrange 's Interpolation. | 8L |
| Module II | Numerical Solution of Linear and Non-linear Equations<br>Numerical Solution of a System of Linear Equations: Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method.<br>Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Newton-Raphson method. | 6L |
| Module III | Numerical Integration and Numerical Solution of Differential Equation<br>Numerical Integration: Trapezoidal rule, Simpson 's 1/3 rule, Expression for corresponding errorterms.<br>Numerical Solution of Ordinary Differential Equation: Taylor series method, Euler 's method, Euler's modified method, fourth order Runge-Kutta method and Milne 's Predictor-Corrector methods.<br>Numerical solution of partial differential equation: Finite Difference method, Crank Nicolson method. | 10L |
| Module IV | Statistics<br>Basic Statistics: Basic statistics, measure of central tendency, mean, median, mode, dispersion, correlation coefficient and regression.<br>Sampling theory: Random sampling. Statistic and its Sampling distribution. Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems.<br>Estimation of parameters: Unbiased and consistent estimators. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson).Confidence intervals and | 12L |

| | | |
|---|---|---|
| | related problems. | |
| Module V | Partial Differential Equation (PDE) and Series Solution of Ordinary Differential Equation (ODE)<br>Solution of PDE: Method of Separation of Variables.<br>Solution of Initial Value & Boundary Value Problem: One Dimensional Wave Equation, One Dimensional Heat Equation, Two Dimensional Laplace Equation.<br>Series solution of ODE: General method to solve and related problems to Powerseries method, Bessel ‘s Function, Legendre Polynomial. | 12L |
| | Total | 48L |

**Text Books:**


1. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. Numerical Methods (Problems and Solution).New age International Publisher.
2. Das, N.G. Probability and Statistics; The McGraw Hill Companies.
3. Gupta, S. C. and Kapoor, V. K. Fundamentals of Mathematical Statistics, Sultan Chand &Sons.
4. Raisinghania, M .D. Advanced Ordinary & Partial Differential. Equation; S. Chand Publication.
5. Ross, S. L. Differential Equations, John Willey & Sons.
6. Grewal, B. S. Higher Engineering Mathematics, Khanna Pub.
7. Kreyszig, E. Advanced Engineering Mathematics, John Wiley & Sons, 2006.


**Reference Books:**


1. Lipschutz & Lipson, Schaum’s Outline in Probability (2ndEd), McGraw Hill Education.
2. Shastri, S. S. Numerical Analysis, PHI.
3. Mollah, S. A. Numerical Analysis, New Central Book Agency Spiegel,
4. M. R. Theory and Problems of Probability and Statistics (Schaum's Outline Series),McGraw Hill Book Co.
5. Goon, A.M., Gupta M .K. and Dasgupta, B. Fundamental of Statistics, The World PressPvt. Ltd.
6. Soong, T. T. Fundamentals of Probability and Statistics for Engineers, John Wiley &Sons Inc, 2004.
7. Delampady, M. Probability & Statistics, Universities Press.
8. Sneddon, I. N. Elements of Partial Differential Equations, McGraw Hill Book Co.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE391 | Electrical Circuit Analysis Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concepts of Basic Electrical Engineering | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE391.1 | Apply | Use MATLAB to conduct experiment to study transient response of R-L, R-C, R-L-C series and parallel circuit and to study frequency response of LP, HP, BP and BR filters |
| EE391.2 | Apply | Use MATLAB to conduct experiment to determination of impedance (Z) and admittance (Y) parameter of two port network |
| EE391.3 | Apply | Use MATLAB to conduct experiment to generate periodic, exponential, sinusoidal, damped sinusoidal, step, impulse, ramp signal both discrete and analog form to study amplitude and phase spectrum analysis of different signals. |
| EE391.4 | Apply | Conduct experiment to verify the network theorems using hardware components |
| EE391.5 | Apply | Perform experiments on electrical circuit theory in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE391.6 | Apply | Perform experiments on electrical circuit theory, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 2 | | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 2 | CO2 | 2 | 2 | | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | 2 | | | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 4 | CO4 | 2 | | | 3 | | | | | 2 | | | | 3 | 3 | 2 |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Familiarization with various MATLAB commands used in Electrical Engineering |
| Experiment - 2 | Transient response of R-L and R-C network: simulation with PSPICE / MATLAB / Hardware |
| Experiment - 3 | Transient response of R-L-C series and parallel circuit: Simulation with PSPICE / MATLAB / Hardware |
| Experiment - 4 | Study the effect of inductance on step response of series RL circuit in MATLAB / HARDWARE. |
| Experiment - 5 | Determination of Impedance (Z) and Admittance (Y) parameter of two port network: Simulation / Hardware. |
| Experiment - 6 | Frequency response of LP and HP filters: Simulation / Hardware. |
| Experiment - 7 | Frequency response of BP and BR filters: Simulation / Hardware. |
| Experiment - 8 | Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form. |
| Experiment - 9 | Amplitude and Phase spectrum analysis of different signals using MATLAB. |
| Experiment - 10 | Verification of Network theorems using hardware components. |
| Experiment - 11 | Innovative Experiments. |

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE392 | Measurement and Instrumentation Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concepts of different measuring system. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE392.1 | Apply | Conduct experiment to measure of resistance, inductance, capacitance, frequency using bridge circuit and measure power using instrument transformer. |
| EE392.2 | Apply | Conduct experiments to calibrate digital energy meter and to perform testing of energy meter |
| EE392.3 | Apply | Conduct experiments to measurement current using shunt, CT and hall sensor |
| EE392.4 | Apply | Usage of DSO to capture transient like step change in R-L-C circuit |
| EE392.5 | Apply | Perform experiments on electrical measurement in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE392.6 | Apply | Perform experiments on electrical measurement, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | 3 | | | | | | | | | 3 | 3 | |
| 2 | CO2 | 2 | | | 3 | | | | | | | | | 3 | 3 | |
| 3 | CO3 | 2 | | | 3 | | | | | | | | | 3 | 3 | |
| 4 | CO4 | | | | 3 | | | | | | | | | 2 | 3 | |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiment**

Experiment - 1 Measurement of power in polyphase circuit.
Experiment - 2 Measurement of power using instrument transformer.
Experiment - 3 Measurement of capacitance using Schering Bridge technique as well as LCR meter.
Experiment - 4 Calibration of Digital Energy Meter.
Experiment - 5 Testing of energy Meter
Experiment - 6 Measurement of capacitance using Anderson Bridge technique as well as LCR meter.
Experiment - 7 Measurement of low resistance using Kelvin Double bridge.
Experiment - 8 Measurement of high resistance and insulation resistance using Megger.
Experiment - 9 Usage of DSO to capture transient like step change in R-L-C circuit.
Experiment - 10 Current measurement using shunt, CT and Hall Sensor
Experiment - 11 Measurement of capacitance by De sauty bridge
Experiment - 12 Measurement of frequency by Wien Bridge.
Experiment - 13 Innovative Experiments.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE393 | Analog Electronics Laboratory | - | - | 2 | - | 1 | 40 | 60 | 100 |
| Pre-requisite | Knowledge in electrical circuits and electronic devices. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE393.1 | Analyze | Conduct experiment to understand and analyze the analog circuits pertaining to applications like amplifier, oscillators and timer. |
| EE393.2 | Analyze | Conduct experiment to know how to interface digital circuits with ADC & DAC. |
| EE393.3 | Analyze | Conduct experiment to understand the fundamental concepts and techniques used in digital electronics. |
| EE393.4 | Analyze | Conduct experiment to understand and examine the structure of various number systems, de-morgan's law, boolean algebra and its application in digital design. |
| EE393.5 | Analyze | Conduct experiment to understand and analyze the analog circuits pertaining to applications like amplifier, oscillators and timer. |
| EE393.6 | Apply | Function effectively as as a member in a group and comprehend and write reports on conducted experiments to provide conclusions. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 3 | | | | | | | | | 2 | 3 | 2 |
| 2 | CO2 | | | | 3 | | | | | | | | | 2 | 3 | 2 |
| 3 | CO3 | | | | 3 | | | | | | | | | 2 | 3 | 2 |
| 4 | CO4 | | | | 3 | | | | | | | | | 2 | 3 | 2 |
| 5 | CO5 | | | | 3 | | | | | | | | | 2 | 3 | 2 |
| 6 | CO6 | | | | | | | | | 3 | 3 | | | | | |

## Syllabus

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Design of voltage regulator circuit using zener diode. |
| Experiment - 2 | Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip. |
| Experiment – 3 | Design of RC coupled amplifier & study of it's gain & Bandwidth using BJT. |
| Experiment – 4 | Design of RC Phase shift oscillator using BJT. |
| Experiment – 5 | Design of wien bridge oscillator using BJT. |
| Experiment – 6 | Study of class A & class B power amplifiers. |
| Experiment – 7 | Design of Integrator using OPAMP IC 741 |
| Experiment – 8 | Design of Differentiator using OPAMP IC 741 |
| Experiment - 9 | Study of V to I and I-V converter using OPAMP IC 741 |
| Experiment - 10 | Design of Instrumentation Amplifier using OPAMP IC 741 |
| Experiment – 11 | Study of timer circuit using NE555 & configuration for monostable & astable multivibrator. |
| Experiment – 12 | Study of voltage controlled oscillator. |
| Experiment - 13 | Innovative Experiments. |

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | III |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| MC301 | Environmental Science | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | - | 100 | - | 100 |
| Pre-requisite | Basic knowledge of Chemistry | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| MC301.1 | Apply | Acquire skills for scientific problem-solving related to air, water and noise & land pollution. |
| MC301.2 | Apply | Understand the natural environment and its relationships with human activities in society |
| MC301.3 | Apply | Develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations for society |
| MC301.4 | Apply | Assess environmental and health risk. |
| MC301.5 | Apply | Apply critical thinking skills ethically to provide sustainable solutions socio-ecological system for the society need |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | 3 | | | | | | | | |
| 2 | CO2 | | | | | | 3 | 3 | | | | | | | | |
| 3 | CO3 | | | | | | 3 | 3 | | | | | | | | |
| 4 | CO4 | | | | | | 3 | 3 | | | | | | | | |
| 5 | CO5 | | | | | | 3 | 3 | 2 | | | | 3 | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | General<br>Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy.<br>Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, Demography.<br>Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control).<br>Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function,Food chain & Food web, Structure and function of the followingecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.<br>Environmental Management: Environmental impact assessment, Environmental laws and protection act of India( The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules. | 6L |
| Module II | Air pollution and control<br>Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant.<br>Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog).<br>Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion.<br>Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion.<br>control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury). | 6L |
| Module III | Water Pollution<br>Classification of water (Ground & surface water)<br>Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, | 6L |

| | | |
|---|---|---|
| | Salts, heavy metals, pesticides, volatile organic compounds.<br>Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants,COD.<br>Numerical related to BOD<br>Lake: Eutrophication [Definition, source and effect].<br>Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)<br>Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride<br>Layout of waste water treatment plant (scheme only). | |
| Module IV | Land Pollution<br>Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste<br>Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).<br>Waste management: waste classification, waste segregation, treatment & disposal | 2L |
| Module V | Noise Pollution<br>Definition of noise, effect of noise pollution on human health,<br>Average Noise level of some common noise sources<br>Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18 hr Index) .<br>Noise pollution control. | 2L |
| | Total | 22L |

**Reference Books:**

1 A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill EducationPrivate Limited
2 Environmental Studies, Dr. J P Sharma, University Science Press
3 Environmental Engineering, J K Das Mohapatra, Vikas Publication

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| PH401 | Physics – II | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Knowledge of Physics up B.Tech 1st year Physics-I course | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| PH401.1 | Understand | Explain electron transport in metal-insulators and semiconductors using energy Band theory. |
| PH401.2 | Apply | Apply Schrödinger equation in variety of atomic scale problems including nano-materials. |
| PH401.3 | Analyze | Analyze the physics of various kinds of electric and magnetic materials. |
| PH401.4 | Evaluate | Justify the importance of Fermi energy level in turning electronic properties of various semiconductors. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | | | |
| 2 | CO2 | 3 | | | | | | | | | | | | | | |
| 3 | CO3 | 3 | 3 | | | | | | | | | | | | | |
| 4 | CO4 | 3 | 3 | | | | | | | | | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Electric and Magnetic properties of materials<br>Module 1.01: Insulating materials<br>Dielectric Material: Concept of Polarization, the relation between D, E and P, Polarizability, Electronic (derivation of polarizability), Ionic, Orientation & Space charge polarization (no derivation), behavior of Dielectric under alternating field (qualitative discussion only), Dielectric losses, Local electric field at an atom: Lorentz field, Lorentz relation; Dielectric constant and polarizability –Clausius-Mossotti equation (with derivation); ferroelctric and piezoelectrics(Qualitative study). (5L)<br><br>Module 1.02: Magnetic materials and storage devices<br>Magnetic Field & Magnetization M, relation between B, H, M. Bohr magneton, susceptibility, Diamagnetism- & Paramagnetism - Curie law (qualitative discussion), Ferromagnetism– Curie Temperature, Weiss molecular field theory (qualitative) & Curie-Weiss law, concept of $\theta$ p, Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storagedevices) and Soft ferromagnets (Permalloys, Ferrites etc.) (5L) | 10L |
| Module II | Quantum Mechanics – II<br>Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics-Eigen value, Eigen function, Schrödinger ‘s equation as energy eigen valueequation. (4L)<br>Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-Dpotential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantumtunnelling (solve only E<V0). (4L) | 8L |
| Module III | Statistical Mechanics<br>Concept of energy levels and energy states, phasespace, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero &non-zero temperature, Concept of Fermi level. | 4L |
| Module IV | Elements of solid state physics<br>Module 4.01: Free electron theory (qualitative) – Electronic conduction in solids Drude ‘s theory, B Wiedemann Frantz Law, Idea of quantization of energy-Sommerfeld theory. (3L) | 6L |

| | | |
|---|---|---|
| | Module 4.02: Band theory of solids Bloch Theorem-statement only, Kronig-Penny model (qualitative treatment)- Energy-band (E-k)diagram, allowed and forbidden energy bands. (3L) | |
| Module V | Physicsof Nanomaterials<br>Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional),Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect andQuantum confinement. Carbon allotropes. Application of nanomaterials (CNT, grapheme,electronic, environment, medical). | 4L |
| Module VI | Nuclear energy as future energy<br>Nuclear Binding Energy, Liquid drop model, Concept of Nuclear Fission, Nuclear Fusion & Energyoutput , Nuclear Reactor. | 4L |
| | Total | 36L |

**Text Books:**


1. Insulating Materials: Principles, Materials, Applications, Margit Pfundstein , Roland Gellert , Martin Spitzner& Alexander Rudolphi: BirkhauserVerlag AG; 1
2. High Voltage and Electrical Insulation Engineering, Ravindra Arora, Wolfgang Mosch: Online ISBN: 9780470947906 DOI: 10.1002/9780470947906 Series Editor(s): Mohamed E. El-Hawary
3. Physics-II, Sujay Kumar Bhattacharya and Soumen Pal, McGraw Hill Education Private Limited
4. Advanced Engineering Physics, S. P. Kuila, New Central Book Agency (P) Ltd.
5. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
6. Quantum Mechanics- Bagde Singh (S. Chand Publishers)
7. Principles of Engineering Physics Vol 1 and Vol 2; by Md. N. Khan and S. Panigrahi, Pub:Cambridge Univ. press
8. Advanced Quantum Mechanics-J. J. Sakurai (TMH)
9. Quantum Computation and Quantum Information(10th Anniversary Edition)- Nielsen &Chuang (Cambridge University Press)
10. Fundamental of Statistical Mechanics: B Laud
11. Introduction to statistical mechanics : .Pathria
12. Fundamental of Statistical and Thermal Physics: F. Reif Advanced Engineering Physics-S.P. Kuila New Central Book Agency (P)Ltd.
13. Electricity and Magnetism (In Si Units): Berkeley Physics Course - Vol.2, Edward MPurcell
14. Introduction to Electrodynamics-Griffiths David J.
15. The Feynman Lectures on Physics. 2 (2nd ed.)., Feynman, Richard P Addison-Wesley.ISBN 978-0-8053-9065-0
16. Solid State Physics, A. J. Dekker, McMillan
17. Nanostructure and Nanomaterials, B.K. Parthasarathy
18. Introduction to Nanotechnology, B.K. Parthasarathy
19. Essentials of Nanotechnology, RishabhAnand
20. Nanomaterials Handbook (Advanced Materials and Technologies)-YuryGogotsi (Editor) 1.Nuclear Physics, Irvin Keplan
21. Nuclear Physics, J. Pearson, University of Manchester, 2008
22. Nuclear and Particle Physics, Jenny Thomas - University College London , 2000.R18 B. Tech EE
23. Solid State Physics, S.O. Pillai.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE401 | Electrical Machines - I | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Knowledge of Physics up to B. Tech. 1st year Physics-I course. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE401.1 | Apply | Apply the knowledge electromechanical energy conversion principle and understand the concept of faraday's laws of electromagnetic induction, Fleming's rule and Lenz's law to describe principle of electrical machine. |
| EE401.2 | Apply | Illustrate the construction, classify, explain the working principles, interpret the performance characteristics of dc machines, determine losses and efficiency and solve numerical problems on dc machines. |
| EE401.3 | Apply | Illustrate the construction, classify, explain the working principles, interpret the performance of single phase transformer, determine equivalent circuit parameters and solve numerical problems on regulation, calculate efficiency and all day efficiency, explain working of auto-transformer comparing with 2-winding transformer. |
| EE401.4 | Apply | Explain the polarity of transformer, illustrate vector groups, sketch various connections, explain working principles, analyze the performance of three phase transformer, infer the effect of unbalanced loading, demonstrate the concept of tertiary winding and neutral shifting, explain parallel operation and solve numerical problems on load sharing. |
| EE401.5 | Apply | Illustrate working principles of Scott-connected transformer and open-delta connection, sketch connections, explain the working grounding transformer and elucidate concept of tap changing. |
| EE401.6 | Apply | Elucidate the concept of rotating magnetic field, illustrate the construction, explain the working principles, analyze the performance, develop the relation of different power, determine losses and efficiency, explain the concept of deep bar and double cage rotor, crawling and cogging, describe starting, speed control and braking of three phase induction motor |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 2 | 3 |
| 3 | CO3 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 2 | 3 |
| 4 | CO4 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 2 | 3 |
| 5 | CO5 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 2 | 3 |
| 6 | CO6 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 2 | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | General Introduction to Electrical Machines<br>Faraday's laws of electromagnetic induction, Fleming's rule and Lenz's Law. (1L)<br>Concept of Electrical and Mechanical degree. (2L) | 3L |
| Module II | D.C. Machine<br>EMF generation in armature, Characteristics of D.C. Machines. (1L)<br>Methods of building up of e.m.f., Significance of Critical resistance and Critical speed. (1L)<br>Armature reaction and its effect, Function of Interpole and Compensating winding. (2L)<br>Commutation method, Concept of reactance voltage. (1L)<br>Power flow diagram, Losses and efficiency, Solution of problems. (1L)<br>Testing of D.C. machines –Hopkinson's, Swinburne's test, Brake test (Tests specified as perstandards). (1L)<br>Starting and Speed Control of D.C. Motors. (2L) | 9L |

| | | |
|---|---|---|
| Module III | Single-Phase Transformers<br>Core construction and different parts of transformer and their function, Materials used for core, winding and insulation, Transformer oil, Different types of cooling methods (in brief), Name plate rating. (1L)<br>Equivalent circuit and per unit representation and its importance, Regulation, Efficiency and Al lday efficiency, Solution of problems. (2L)<br>Single-phase Auto transformer − Comparison of weight, copper loss with 2-winding transformer. (1L)<br>Sumpner Test, Applications of 2-winding transformer and Auto transformer. (1L) | 5L |
| Module IV | Three-Phase Transformers<br>Types of three-phase transformer. Construction and Different types of windings. (1L)<br>Polarity of transformer, Vector groups for various connections. (1L)<br>Parallel operation and load sharing, Solution of problems. (2L)<br>Effect of unbalanced loading and neutral shifting, Tertiary windings. (1L)<br>Scott-connected transformer and open-delta connection − working principle, connection diagram, practical application. (1L)<br>Tap-changing methods, Tap changers − Off load and On-load type. (1L)<br>Special Transformer: Pulse transformer, Grounding transformer. (1L)<br>Testing of Three-phase Transformers. (1L) | 9L |
| Module V | Three-Phase Induction Motor<br>Induction motor as a transformer, Concept of rotating magnetic field, Power stages in 3-phaseinduction motor and their relation, power-slip characteristics. (3L)<br>Determination of equivalent circuit parameters, Separation of losses, Efficiency, Solution of problems. (2L)<br>Concept of Deep bar and Double cage rotor. (1L)<br>Starting and speed control of three phase induction motor. (1L)<br>Space harmonics: Crawling and Cogging, Brief idea of braking of induction motor. (2L)<br>Testing and Industrial applications of 3-phase induction motor. (1L) | 10L |
| | Total | 36L |

**Text Books:**


1. Electrical Machinery, P.S. Bhimra, 6th Edition, Khanna Publishers.
2. Electric machines, D.P. Kothari & I.J Nagrath, 3rd Edition, Tata Mc Graw-Hill Publishing Company Limited.
3. Electrical Machines, P.K. Mukherjee & S. Chakrabarty, Dhanpat Rai Publication.


**Reference Books:**


1. Electric Machinery & Transformers, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electrical Machines, R.K. Srivastava, Cengage Learning
3. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition.
4. The performance and Design of Alternating Current Machines, M. G. Say, CBS Publishers& Distributors.
5. Electric Machinery & transformer, Irving L Koskow, 2nd Edition, Prentice Hall India.

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE402 | Power Electronics | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Basic Electronics, Electrical Circuit Analysis, Analog Electronics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE402.1 | Apply | Explain and describe operation of power electronics switches - rectifier diodes, fast recovery diodes, Schottky barrier diode, BJT, power MOSFET, SCR, TRIAC, IGBT, IGCT, GTO, triggering circuits, SCR commutation circuits, and Snubber circuit. |
| EE402.2 | Apply | Illustrate operating principles of uncontrolled and controlled rectifiers (single-phase and three-phase) with R, R-L and RLC loads, power converter, dual converter and solve related numerical. |
| EE402.3 | Apply | Explain the working principles of dc-dc converter, buck, boost, buck-boost and Cuk converters, step up and step down choppers and illustrate the concept of resonant switching and categories their uses in electronics circuits. |
| EE402.4 | Apply | Explain the operating principles of inverter; elucidate the concept of PWM techniques and current sources inverter. |
| EE402.5 | Apply | Illustrate the operating principles of cycloconverters and ac voltage regulators. |
| EE402.6 | Apply | Explain the working of ups (online and offline), SMPS and battery chargers used in electronics circuits. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | 3 | | | 2 | | | | | | | | 2 | 2 | |
| 2 | CO2 | 3 | 3 | | 3 | 2 | | | | | | | | 3 | 2 | 3 |
| 3 | CO3 | 3 | 3 | | 3 | 2 | | | | | | | | 3 | 2 | 3 |
| 4 | CO4 | 3 | 3 | | 2 | 2 | | | | | | | | 3 | 2 | 3 |
| 5 | CO5 | 3 | 3 | | | 2 | | | | | | | | 3 | 2 | 2 |
| 6 | C06 | 3 | 3 | | | 2 | | | | | | | | 3 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Power Electronic Switching Devices<br>Advances in Power Electronics Power Semiconductor Switches: Rectifier diodes, fast recovery diodes, Schottky barrier diode, BJT, Power MOSFET, SCR, TRIAC, IGBT, IGCT and GTO. Ratings, Static and Dynamic Characteristics, triggering and switching characteristics and cooling.SCR turn–on and turn-off methods, Triggering circuits, SCR Commutation circuits, SCR Series and Parallel operation, Snubber Circuit. | 8L |
| Module II | Uncontrolled and Controlled Rectifiers<br>Single-Phase and Three-Phase Uncontrolled rectifiers. Phase controlled Rectifiers: Principle of operation of single phase and three phase semi-controlled, full controlled converters with R, R-L and RLE loads. Effects of source inductance on the performance of converters. Performance parameters of converters, Dual converters, Solution of problems. | 6L |
| Module III | DC-DC Converters<br>Principle of operation, control strategies, Step up and Step down choppers, Buck, Boost, Buck -Boost and Cuk Converters, Concept of Resonant Switching. | 5L |
| Module IV | Inverters<br>Inverters: Principle of operation of single phase inverter, $120^{\circ}$ and $180^{\circ}$ conduction mode of operation of three phase inverter, performance parameters of inverters, PWM techniques, Sinusoidal PWM, modified Sinusoidal PWM - multiple PWM Voltage and harmonic Control, introduction toSpace vector modulation method, Series resonant inverter-Current Sources Inverter. | 10L |

| | | |
|---|---|---|
| Module V | Cycloconverters and AC Voltage Regulators<br>AC Voltage Controllers, Single phase and three phase Cycloconveters, Concept of Matrix Converter. | 5L |
| Module VI | Applications<br>UPS (Online and Offline), SMPS, Battery Chargers. | 2L |
| | Total | 36L |

**Text Books:**

1 L. Umanand, Power Electronics: Essentials and Applications.
2 M. H. Rashid, Power Electronics, PHI/ Pearson Education.
3 P. S. Bhimra, Power Electronics, Khanna Publications.
4 K. Hari Babu: Power Electronics

**Reference Books:**

1 C.W. Lander, Power Electronics, McGraw Hill.
2 B. K. Bose, Modern Power Electronics, JAICO.
3 Mohan, N Undeland, TM & Robbins, WP- Power Electronics, John Wiley & Sons.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE403 | Digital Electronics | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Knowledge of Basic Electronics and Mathematics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE403.1 | Apply | Perform mathematical and logical operation to solve the number systems conversions problems, design logic circuits using logic gates to their simplest forms using De Morgan's theorems and K-maps for circuit minimization. |
| EE403.2 | Analyze | Design and analyze various combinational circuits to perform mathematical and logical operation and also to identify the limitations of the same circuit. |
| EE403.3 | Analyze | Design and analyze various sequential circuits to perform logical operation using state diagrams & tables. |
| EE403.4 | Analyze | Analyze different complex circuit like DAC, ADC and illustrate the operation of different logics. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | 3 | 3 | | | | | | | | | 3 | 3 | 2 |
| 2 | CO2 | 2 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | 2 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 4 | CO4 | 2 | | | 3 | | | | | | | | | 3 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Binary, Octal and Hexadecimal number system representation and their conversions; BCD, Graycodes and their conversions. Signed binary number representation with 1's, 2's, 9's and 10's complement methods, Binary arithmetic. Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP andPOS forms; Minimization of logic expressions by algebraic method, K-map method. | 11L |
| Module II | Combinational circuits- Half Adder, Full Adder, Serial & Parallel Adder, BCD Adder, Half Subtractor, Full Subtractor circuits, Adder-Subtractor Circuit. Encoder, Decoder, Multiplexer, DeMultiplexer, Adder & Subtractor Design using decoder & multiplexer, Comparator and Parity Generator-Checker. | 10L |
| Module III | Sequential Circuits- latch & Flip Flops-S-R, J-K, D and T, Conversion of Flip Flops, Various typesof Shift Registers-SISO, SIPO, PISO, PIPO, Bidirectional & Universal Shift. Counters-Synchronous, Asynchronous, Ring & Johnson Counter. | 10L |
| Module IV | Parameters of D/A & A/D Converters. Different types of A/D -Flash Type, Successive Approximation and Dual Slope and D/A -R-2R Ladder. Logic families- TTL, ECL, MOS and CMOS, their operation and specifications. TTL Equivalent Circuit. | 5L |
| | Total | 36L |

**Text Books:**


1 A. Anand Kumar, Fundamentals of Digital Circuits-PHI
2 Morries Mano- Digital Logic Design- PHI
3 S. Salivahanan & S. Arivazhagan, Digital Circuit & Design- Bikas Publishing
4 A.K. Maini- Digital Electronics- Wiley-India


**Reference Books:**


1 Floyed& Jain- Digital Fundamentals-Pearson.
2 R.P.Jain–Modern Digital Electronics, 2/e , Mc Graw Hill
3 H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
4 D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
5 Kharate- Digital Electronics- Oxford
6 Tocci, Widmer, Moss- Digital Systems, 9/e- Pearson

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE404 | Electromagnetic Fields | 2 | - | - | - | 2 | 30 | 70 | 100 |
| Pre-requisite | Concept of mathematics, physics and basic electrical engineering. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE404.1 | Apply | Apply knowledge of mathematics to demonstrate orthogonal co-ordinates & their transformation to solve and analyze problems on vector calculus. |
| EE404.2 | Apply | Illustrate the coulomb's law and gauss's law, explain electrical potential and potential gradient, electric dipole, energy density, deduce the relation between E and V, apply Poisson's and Laplace's equation to solve numerical on electrostatic field |
| EE404.3 | Apply | Explain the Biot-Savart's law, ampere's circuit law, illustrate the terms associate with magneto-static field - magnetic flux density, magnetic static and vector potential, magnetic torque and moments, magnetization in material, magnetic boundary condition, concept of magnetic energy, magnetostriction, and solve related numerical problems. |
| EE404.4 | Apply | Explain the faraday's law, define transformer and motional EMF, determine displacement current, illustrate Maxwell's equations to solve numerical problems on electromagnetic fields. |
| EE404.5 | Apply | Apply the knowledge of electromagnetic theory to explain the propagation of EM waves in conducting medium, in lossy dielectric, in loss less dielectric, in free space, in good and dielectric conductor, define skin effect, skin depth, power and pointing vector and solve related numerical problems. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | 3 | | | | | | | | | | | 3 | | |
| 2 | CO2 | 3 | 3 | | | | | | | | | | | 3 | | |
| 3 | CO3 | 3 | 3 | | | | | | | | | | | 3 | | |
| 4 | CO4 | 3 | 3 | | | | | | | | | | | 3 | | |
| 5 | CO5 | 3 | 3 | | | | | | | | | | | 3 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Co-ordinate systems<br>Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates and their transformation. Differential length, area and volume in different coordinate systems. Solution of problems. | 3L |
| Module II | Introduction to Vector calculus<br>DEL operator, Gradient of a scalar, Divergence of a vector and Divergence theorem, Curl of a Vector and Strokes theorem, Solution of problems. | 3L |
| Module III | Electrostatic field<br>Coulomb ‘s law, field intensity, Gauss ‘s law, Electric potential and potential gradient, Relation between E and V, Concept of Electric dipole, flux lines and Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor−dielectric, Conductor-free space. Poisson ‘sand Laplace ‘s equation, Solution of problems. | 5L |
| Module IV | Magneto static fields<br>Biot-savart ‘s law, Ampere ‘s circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetization in material, Magnetic boundary condition, Concept of Magnetic energy, Magnetostriction, Solution of problems. | 5L |
| Module V | Electromagnetic fields<br>Faraday ‘s law, Transformer and motional emf, Displacement current, Maxwell ‘s equations, Solution of problems. | 3L |

| | | |
|---|---|---|
| Module VI | Electromagnetic wave propagation<br>Wave equation, Wave equation in conducting medium, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good and dielectric conductor, Skin effect, Skin depth, Power and Poynting vector. Solution of problems. | 5L |
| | Total | 24L |

**Text Books:**


1 Quantum Field Theory, Lewis H. Ryder, 2nd Edition, Cambridge University Press.
2 Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford University press.
3 Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
4 Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH
5 Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press.
6 Elements of Electromagnetic Fields, S.P. Seth, Dhanpat Rai & Sons.


**Reference Books:**


1 Electromagnetic with application, Krause, 5th Edition, TMH.
2 Elements of Engineering Electromagnetic, N.N. Rao, 6th Edition, Pearson Education.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| HU401 | Values and Ethics in Profession | 2 | - | - | - | 2 | 30 | 70 | 100 |
| Pre-requisite | Basic knowledge of engineering and management. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| HU401.1 | Understand | Make sense of the core values that shape the ethical behavior of an engineer and exposed awareness on professional ethics and human values. |
| HU401.2 | Understand | Infer and conclude the basic perception of profession, professional ethics, various moral issues & uses of ethical theories. |
| HU401.3 | Understand | Identify and interpret various social issues, industrial standards, code of ethics and role of professional ethics in engineering field. |
| HU401.4 | Understand | Aware of social responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer. |
| HU401.5 | Understand | Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives. |
| HU401.6 | Understand | Distinguish between ethical and non ethical situations and develop cognitive skills in solving social problems. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | 3 | | 3 | | 2 | | 3 | | | 3 |
| 2 | CO2 | | | | | | 3 | | 3 | | 2 | | 3 | | | 3 |
| 3 | CO3 | | | | | | 3 | | 3 | | 2 | | 3 | | | 3 |
| 4 | CO4 | | | | | | 3 | | 3 | | 2 | | 3 | | | 3 |
| 5 | CO5 | | | | | | 3 | | 3 | | 2 | | 3 | | | 3 |
| 6 | CO6 | | | | | | 3 | | 3 | | 2 | | 3 | | | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction<br>Definition, Relevance, Types of values, changing concepts of values, Concept of Morals and Ethics, Work ethic − Service learning − Civic virtue, Stress Management -Concept of stress, causes and consequences, managing stress. | 4L |
| Module II | Theories of Self Development<br>Emotional Intelligence (EI): Concept, Importance and Measurement, Concept of Motivation, Maslow ‘s theory, Kohlberg ‘s theory. | 4L |
| Module III | Moral and Ethical Concerns<br>Variety of Moral Issues, Moral Dilemmas, Nature of values, Value Crisis in contemporary society, Value Spectrum of a good life, Steven Covey ‘s Pursuit of Excellence. | 4L |
| Module IV | Engineering Ethics<br>Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals, Social and ethical responsibilities of Technologists, Codes of professional ethics, Ethical and Unethical practices − case studies, Whistle blowing and beyond, Case studies. | 4L |
| Module V | Technology and Sustainable Development<br>Rapid Technological growth and depletion of resources, Reports of the Club of Rome, Limits of growth, Sustainable Development, Energy Crisis, Renewable Energy Resources, Environmental degradation and pollution, Environmental Regulations, Environmental | 8L |

Ethics and appropriate Technology, Movement of Schumacher, Problems of Technology transfer, Technology assessment impact analysis, Human Operator in Engineering projects and industries, Problems of man, machine, interaction, Impact of assembly line and automation.

Total 24L

**Text/Reference Books:**


1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, JohnWiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson: Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, NewJersey 1991.
3. A N Tripathi: Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.
4. S. K. Chakraborty: Values and Ethics in Organization, OUP
5. Caroline Whitbeck: Ethics in Engineering Practice and Research, Cambridge University Press.
6. Jaysree Suresh and B.S Raghavan: Human values and Professional Ethics, S. Chand Publication

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|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| PH491 | Physics – II Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Knowledge of Physics up B. Tech. 1st year Physics-I course. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| PH491.1 | Understand | Demonstrate experiments allied to their theoretical concepts. |
| PH491.2 | Analyze | Conduct experiments using semiconductors, dielectric and ferroelectrics. |
| PH491.3 | Analyze | Perform test to classify various types of magnetic materials. |
| PH491.4 | Analyze | Participate as an individual, and as a member or leader in groups in laboratory sessions actively. |
| PH491.5 | Analyze | Analyze and interpret experimental data using graphical representations, and to make effective laboratory reports including innovative experiments. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | | | | | | 2 | | | | | |
| 2 | CO2 | 2 | | | 3 | | | | | 3 | | | | | | |
| 3 | CO3 | 2 | | | 3 | | | | | 3 | | | | | | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | 2 | | | | | | | | 3 | | | | | |

| Module | List of Experiments | Hour |
|---|---|---|
| Module I | Electric and Magnetic properties of materials<br>1. Study of dipolar magnetic field behavior using deflection magnetometer.<br>2. Study of hysteresis curve of a ferromagnetic material using CRO.<br>3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.<br>4. Measurement of Curie temperature of the given sample.<br>5. Determination of dielectric constant of given sample (frequency dependent) / Measurement of losses in a dielectric using LCR circuits. | 8L |
| Module II | Quantum Mechanics-II<br>6. Determination of Stefan ‘s radiation constant.<br>7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.<br>8. Measurement of specific charge of electron using CRT. | 6L |
| Module IV | Solid state physics<br>9. Determination of band gap of a semiconductor using four probe method.<br>10. Determination of Hall co-efficient of a semiconductor and measurement of magneto resistance of a given semiconductor<br>11. Study of I-V characteristics of a LED.<br>12. Study of Intensity-Resistance characteristics of a LDR. | 9L |
| | Total | |

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE491 | Electrical Machines – I Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concept of Basic Electrical Engineering Laboratory, Electrical Measurement Laboratory. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE491.1 | Analyze | Conduct experiments to determine losses & efficiency of dc machine by swinburne test, by brake test, to perform experiment of voltage build-up of a d.c. Shunt generator and determine critical resistance and critical speed |
| EE491.2 | Analyze | Conduct experiments to determine the polarity of transformer, verify the vector grouping of 3 ph transformer and determine losses & efficiency of single phase transformer by back-to-back test and direct loading method. |
| EE491.3 | Analyze | Conduct experiments to determine efficiency, separation of losses, load test and speed control of induction motor. |
| EE491.4 | Apply | Perform experiments on electrical machine in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE491.5 | Apply | Perform experiments on electrical machines, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 3 | | 3 | | | | | | | | | 3 | 3 | 2 |
| 2 | CO2 | 2 | 3 | | 3 | | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | 2 | 2 | | 3 | | | | | | | | | 3 | 3 | 2 |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Heat-run test of a single-phase transformer.
Experiment - 2 Regulation and Efficiency of single-phase transformer by direct loading method.
Experiment - 3 Parallel operation of two single-phase transformer and find out the load sharing between them.
Experiment - 4 Efficiency of a single-phase transformer by Back-to-Back test.
Experiment - 5 Polarity test and vector grouping of a three-phase transformer.
Experiment - 6 Swinburne test of a D.C. shunt motor.
Experiment - 7 Brake test of D.C. series motor.
Experiment - 8 Voltage build-up of a D.C. shunt generator and find out critical resistance and critical speed.
Experiment - 9 Circle diagram of a three-phase Induction Motor.
Experiment - 10 Speed control of three-phase Induction Motor by V/f constant.
Experiment - 11 Separation of losses in three-phase Induction Motor.
Experiment - 12 Load test of a three-phase wound rotor Induction Motor.
Experiment - 13 Innovative Experiments

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE492 | Power Electronics Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concept of Basic Electronics, Electrical Circuit Analysis, Analog Electronics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE492.1 | Apply | Conduct experiment in a group to understand how to control and convert output signal as per requirements. |
| EE492.2 | Analyze | Conduct experiment in a group to construct any power electronics circuits as needed in operation. |
| EE492.3 | Analyze | Conduct experiment in a group to analyze the response of any power electronics devices. |
| EE492.4 | Analyze | Able to select suitable power electronics devices for a given application. |
| EE492.5 | Apply | Prepare professional quality textual and graphical presentations of laboratory data and computational results, incorporating accepted data analysis and synthesis methods, mathematical software, and word-processing tools. |
| EE492.6 | Apply | Function as individual and in team to complete a given task with professional attitude. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 3 | | | | | | | | | | | 2 | 3 | 2 |
| 2 | CO2 | | | | 3 | 2 | | | | | | | | 2 | 3 | 2 |
| 3 | CO3 | | | | 3 | 2 | | | | | | | | 2 | 3 | 2 |
| 4 | CO4 | | | | 3 | 2 | | | | | | | | | 2 | |
| 5 | CO5 | | | | | 2 | | | | | 3 | | | | | |
| 6 | CO6 | | | | | | | | | 3 | | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Study of the characteristics of an SCR. |
| Experiment - 2 | Study of the characteristics of a TRIAC |
| Experiment - 3 | Study of different triggering circuits of an SCR. |
| Experiment - 4 | Study of the operation of a single phase full controlled bridge converter with R and R-L load. |
| Experiment - 5 | Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters. |
| Experiment - 6 | Study the performance of step down chopper. |
| Experiment - 7 | Study the performance of step up chopper. |
| Experiment - 8 | Study the performance of single-phase inverter with 180° conduction mode of operation. |
| Experiment - 9 | Study the performance of SPWM controlled single-phase inverter. |
| Experiment - 10 | Study of performance of single phase controlled converter with and without source inductance (Simulation). |
| Experiment - 11 | Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation). |
| Experiment - 12 | Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter (Simulation). |
| Experiment - 13 | Study of performance of three phase controlled converter with R & R-L load (simulation). |
| Experiment - 14 | Innovative Experiments. |

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE493 | Digital Electronics Laboratory | - | - | 2 | - | 1 | 40 | 60 | 100 |
| Pre-requisite | Knowledge of Basic Electronics and Mathematics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE493.1 | Apply | Conduct experiment to understand the operation of basic gates using universal logic gates and logic gates using TTL. |
| EE493.2 | Design | Conduct experiment to design the circuit of grey to binary and vice versa, BCD to 7-segment display, four-bit parity generator and comparator circuits. |
| EE493.3 | Design | Conduct experiment to design and construction of simple encoder, decoder, multiplexer & de multiplexer, half adder, full adder, half subtractor & full subtractor circuits, RS, D, JK and T flip-flops, register using logic gates. |
| EE493.4 | Apply | Perform experiments on digital electronics in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE493.5 | Apply | Perform experiments on digital electronics, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 3 | | | | | | | | | | 3 | |
| 2 | CO2 | | | 3 | 3 | | | | | | | | | | 3 | |
| 3 | CO3 | | | 3 | 3 | | | | | | | | | | 3 | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Realization of basic gates using Universal logic gates.
Experiment - 2 Realization of logic gates using TTL.
Experiment - 3 Design the circuit of Grey to Binary and vice versa.
Experiment - 4 Design a circuit for BCD to 7-segment display.
Experiment - 5 Four-bit parity generator and comparator circuits.
Experiment - 6 Construction of simple Encoder & Decoder circuits using logic gates.
Experiment - 7 Construction of simple Multiplexer & De Multiplexer circuits using logic gates.
Experiment - 8 Design of Half Adder & Full Adder Circuit using Logic Gates.
Experiment - 9 Design Half Subtractor & Full Subtractor Circuit using Logic Gates.
Experiment - 10 Realization of RS, D, JK and T flip-flops using logic gates.
Experiment - 11 Realization of Register using flip-flops and logic gates.
Experiment - 12 Realization of Up/Down counters.
Experiment - 13 One Innovative design of Digital Circuits.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | IV |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| MC481 | Behavioral & Interpersonal Skills | - | - | - | 3 | 0 | 100 | - | 100 |
| Pre-requisite | The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra and calculus. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| MC481.1 | Understand | Equip the student to handle workplace interpersonal communication in an effective manner. |
| MC481.2 | Apply | Enable students with strong oral and written interpersonal communication skills. |
| MC481.3 | Apply | Critically analyze workplace situations and take appropriate decisions. |
| MC481.4 | Apply | Campus ready through proper behavioral and interpersonal grooming. |
| MC481.5 | Apply | Enhanced skill set to design and frame team based project report and presentation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | | | 3 | | 2 | | | |
| 2 | CO2 | | | | | | | | | | 3 | | 2 | | | |
| 3 | CO3 | | | | | | | | 3 | | 3 | | 2 | | | |
| 4 | CO4 | | | | | | | | 3 | | 3 | | 2 | | | |
| 5 | CO5 | | | | | | | | | | 3 | | 2 | | | |

| Module | Content | Hour |
|---|---|---|

Module I INTERPERSONAL COMMUNICATON
1. The skills of Interpersonal Communication.
2. Gender/Culture Neutrality.
3. Rate of Speech, Pausing, Pitch Variation and Tone.
4. Corporate Communication.
5. Branding and Identity.

Module II INTERPERSONAL COMMUNICATION BASED ON WORKPLACECOMMUNICATION
6. Workplace Communication.
7. Modes of Communication (Telephone, Conference Call, Team Huddle, Public Relationetc.)
8. Communication with Clients, Customers, Suppliers etc.
9. Organizing/Participating in Business Meeting.
10. Note Taking.
11. Agenda.
12. Minutes.

Module III BUSINESS ETIQUETTE AND CORPORATE LIFE
13. Presenting oneself in the Business Environment.
14. Corporate Dressing and Mannerism.
15. Table Etiquette (Corporate Acculturation, Office parties, Client/Customer invitations etc.)
16. E-mail Etiquette.
17. Activity based Case Study.

Module IV MOVIE MAKING: CORPORATE BUSINESS MEETING
18. Team based Brainstorming.
19. Process Planning and Developing Plot.
20. People management.
21. Documentation and Scripting.
22. Shooting the Movie: Location and Camera.
23. Post Production and Editing.
24. Movie Review: Feedback and Analysis

**References:**


1. Interpersonal Communication, Peter Hartley, Routledge, 1993.
2. Workplace Vagabonds: Career and Community in Changing Worlds of Work, Christina Garsten, Palgrave Macmillan, 2008.
3. Transnational Business Cultures Life and Work in a Multinational Corporation, FionaMoore, Ashgate, 2005.
4. Global Business Etiquette: A Guide to International Communication and Customs, JeanetteS. Martin and Lillian H. Chaney, Praeger Publishers, 2006.
5. Making Teams Work: 24 Lessons for Working Together Successfully, Michael Maginn, McGraw-Hill, 2004.
6. Corporate Communications: Convention, Complexity, and Critique, Lars Thøger Christensen, Mette Morsing and George Cheney, SAGE Publications Ltd., 2008.
7. The Business Meetings Sourcebook: A Practical Guide to Better Meetings and Shared Decision Making, Eli Mina, AMACOM, 2002.
8. Moving Images: Making Movies, Understanding Media, Carl Casinghino, Delmar, 2011.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE501 | Electrical Machines - II | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Knowledge of Physics up to B. Tech. 1st year Physics-I course and Electrical Machines − I. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE501.1 | Apply | Illustrate and interpret behavior of magnetic field, explain the MMF distribution in rotating electrical machine. |
| EE501.2 | Apply | Illustrate the construction, classify, explain the working principles, analyze the performance of the synchronous machine, describe armature reaction, sketch phasor diagram, define voltage regulation, SCR, elucidate load shearing, parallel operation, method of control of active & reactive power, perform testing of synchronous generator and solve numerical on alternator. |
| EE501.3 | Apply | Illustrate construction, explain the working principles, elucidate two reaction theory, sketch the phasor diagram at different loads, analysis the performance of the synchronous motor, explain the effect of variation of excitation, V curves, hunting and solve numerical on synchronous motor. |
| EE501.4 | Apply | Explain the concept of pulsating torque, double-revolving field theory, illustrate the construction, explain the working principles, classify different starting methods, develop the equivalent circuit, sketch the speed-torque characteristics, phasor diagram, derive condition of maximum torque and determine loss, efficiency and solve numerical problems of single phase induction motor. |
| EE501.5 | Apply | Elucidate the construction, explain the working principles of switched reluctance motor, permanent magnet machines, brushless dc machines, hysteresis motor, stepper motor and induction generator and linear induction motor and categorize their applications. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 3 | | |
| 2 | CO2 | 3 | 3 | | 3 | | | | | | | | | 3 | 2 | 2 |
| 3 | CO3 | 3 | 3 | | 3 | | | | | | | | | 3 | 2 | 2 |
| 4 | CO4 | 3 | 3 | | 3 | | | | | | | | | 3 | 2 | 2 |
| 5 | CO5 | 3 | 3 | | | | | | | | | | | 3 | | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Synchronous Machines<br>Construction of 3-phase Synchronous Machines, Description of salient & non-salient rotor, Advantages of Stationary armature and Rotating field system, Name plate rating. (1L)<br>Methods of excitation systems: Static excitation, Brushless excitation, DC generator. (1L)<br>Armature reaction at various p.f, concept of Synchronous reactance. (2L)<br>Phasor diagrams of alternator at lagging, leading and unity p.f. loads. (1L)<br>Voltage regulation of alternator by synchronous impedance method, Solution of problems. (2L)<br>Open circuit characteristics, Short circuit characteristics of alternator and determination of synchronous reactance. (1L)<br>Theory for salient pole machine, Two reaction theory, phasor diagram at different loads. (2L)<br>Power angle characteristics of Synchronous machines, Solution of problems. (1L)<br>Short circuit ratio (SCR) − concept and significance. (1L)<br>Method of control of Active & Reactive Power of an alternator. (1L)<br>Reasons and advantages of Parallel operation. (1L)<br>Synchronization of two or more alternators: Three lamps method, Synchroscope. (1L) | 21L |

| | | |
|---|---|---|
| | Parallel operation of (i) an alternator and infinite bus and (ii) Between two alternators and Load sharing between them. Solution of problems. (2L)<br>Methods of starting of Three-Phase Synchronous Motor: by auxiliary motor and Damper winding. (1L)<br>Effect of variation of excitation at infinite bus (over and under excitation) − V curves and inverted V curves. (1L)<br>Hunting and its prevention. (1L)<br>Applications of synchronous motor, Synchronous condenser. (1L) | |
| Module II | Single-Phase Induction Motor<br>Construction, Concept of Pulsating Torque, Double-revolving field theory. (2L)<br>Development of equivalent circuit, Determination of equivalent circuit parameters, Solution of problems. (2L)<br>Methods of starting using auxiliary winding, Selection of capacitor value during starting and running, Solution of problems. (2L)<br>Speed-Torque characteristics, Phasor diagram, Condition of Maximum torque. (2L)<br>Constructional features and performance characteristics of Universal Series Motors, Compensated and uncompensated motors. (2L)<br>Testing of Single phase motors and Applications. (1L) | 11L |
| Module III | Special Machines<br>Principle and construction of switched Reluctance motor, Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper Motor. (2L)<br>Construction and Operational characteristics of Induction generator and Linear Induction motor. (2L) | 4L |
| | Total | 36L |

**Text Books:**


1 Electrical Machines, Nagrath & Kothary, TMH
2 The performance and design of Alternating Current machines, M. G. Say, C.B.S Publishers& Distributors
3 Electrical Machinery, P.S. Bhimra, Khanna Publishers.
4 Electrical Machines, Ashfaq Husain, Dhanpat Rai & Co.
5 Electrical Machines, S.K.Bhattacharya, T.M.H Publishing Co. Ltd.


**Reference Books:**


1 Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI
2 Electrical Technology, H.Cotton, C.B.S. Publisher New Delhi
3 Electric Machinery & Transformes, Irving L. Kosow, PHI
4 Electric Machinery, A.E.Fitzgerald, Charles Kingsley, Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.
5 Problems in Electrical Engineering, Parker smith, 9th Edition, CBS publishers &distributors.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE502 | Power System - I | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concepts of basic electrical engineering, circuit theory and electrical machine. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE502.1 | Apply | Illustrate the basic structure of a power system and explain the workings of typical coal-fired power stations, hydroelectric power stations, nuclear power stations, and solar and wind energy systems. |
| EE502.2 | Apply | Explain, define, and describe different terms related to the mechanical design of overhead transmission lines, determine string efficiency, and illustrate the terms sag tension and clearance. |
| EE502.3 | Apply | Explain, define, and describe different terms related to the electrical design of overhead transmission lines; determine the value of inductance and capacitance of single-phase and three-phase symmetrical and unsymmetrical configurations; and explain the term transposition, concept of GMD and GMR. |
| EE502.4 | Apply | Illustrate the principle of corona formation, define critical disruptive voltage, visual critical corona discharge potential, and corona loss, describe different types of cables used in power systems, and define associated terms dielectric stress, optimum cable thickness, grading, dielectric loss, and loss angle. |
| EE502.5 | Apply | Classify transmission lines with their representation, determine ABCD constants and voltage regulation, explain the Ferranti effect and line compensation, and draw power circle diagrams. |
| EE502.6 | Apply | Illustrate and determine different tariff types and elucidate the guiding principle of tariff described in the Indian electricity rule. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | | 2 | | | | | | | 3 | 2 | 2 |
| 2 | CO2 | | 2 | | | | | | | | | | | 3 | 2 | 2 |
| 3 | CO3 | | 2 | 2 | | | | | | | | | | 3 | 2 | 2 |
| 4 | CO4 | | 2 | | | | | | | | | | | 3 | 2 | 2 |
| 5 | CO5 | | 2 | | 2 | | | | | | | | | 3 | 2 | 2 |
| 6 | CO6 | | 2 | | 2 | | 2 | | | | | | | 3 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Basic Concept of Electrical Supply System<br>Structure of Power system, basic idea of transmission, distribution, tie lines, Grid networks etc. | 1L |
| Module II | Generation of Electric Power<br>General layout of a typical coal fired power station, Hydroelectric power station, and Nuclear power station, their components and working principles, comparison of different methods of power generation, Introduction to Solar and Wind energy system. | 3L |
| Module III | Mechanical Design of Overhead Transmission Line<br>Design of Conductors, Line supports: Towers, Poles, Insulators: Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield and rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators Sag, Tension and Clearance, Effect of Wind and Ice on Sag, Stringing Chart Dampers. | 6L |
| Module IV | Electrical Design of Overhead Transmission Line<br>Choice of frequency, Choice of voltage, Types of conductors, Inductance and Capacitance of a single phase and three phases symmetrical and unsymmetrical configurations. Bundle conductors. | 8L |

| | | |
|---|---|---|
| | Transposition. Concept of GMD and GMR. Influence of Earth on conductor capacitance. | |
| Module V | Corona<br>Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona. | 3L |
| Module VI | Cables<br>Types of cables, cable components, capacitance of single core and 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle. | 5L |
| Module VII | Performance of Lines<br>Short, medium (nominal π, T) and long lines and their representation. ABCD constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams. | 8L |
| Module VIII | Tariff<br>Introduction of Economics of power. Guiding principle of Tariff, different types of tariff. Indian<br>Electricity Rule-1956 and 2003: General Introduction. | 2L |
| | | Total 36L |

**Text Books:**


1 Electrical Power System, Subir Roy, Prentice Hall
2 Power System Engineering, Nagrath & Kothery, TMH
3 Elements of Power System Analysis, C.L. Wadhwa, New Age International.
4 Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors
5 Principles of Power System, V.K.Mehta and Rohit Mehta, S.Chand.


**Reference Books:**


1 Electric Power Transmission & Distribution, S.Sivanagaraju, S.Satyanarayana, Pearson Education.
2 A Text book on Power system Engineering, Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat Rai & Co.
3 Power System Protection and Switchgear, Badri Ram, TMH
4 Electric Power Distribution System Engineering, 2nd Edition, T. Gonen, CRC Press.
5 www.powermin.nic.in/acts_notification/pdf/ier1956.pdf

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE503 | Control System-I | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Basic Electrical Engineering, Circuit Theory and Engineering Mathematics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE503.1 | Apply | Apply the concept of Laplace transform and basic laws of electrical engineering to obtain transfer functions of electrical and mechanical systems. |
| EE503.2 | Apply | Use block diagram reduction rules and Mason's gain formula to estimate the interconnected system transfer function. |
| EE503.3 | Apply | Sketch time domain behavior of 1st and 2nd order systems for common input signals and predict different time domain specification parameters applying different mathematical techniques. |
| EE503.4 | Apply | Examine system stability using Root Locus Plot and R - H Stability Criterion. |
| EE503.5 | Apply | Judge control system stability using Bode Plot, and Nyquist Plot |
| EE503.6 | Apply | Use different controllers and compensators for the performance improvement of systems |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 3 | 3 | 3 |
| 2 | CO2 | 3 | 2 | 2 | 3 | | | | | | | | | 3 | 3 | 3 |
| 3 | CO3 | 3 | 3 | | 3 | | | | | | | | | 3 | 3 | 3 |
| 4 | CO4 | 3 | 3 | 2 | 3 | 3 | | | | | | | | 2 | 3 | 3 |
| 5 | CO5 | 3 | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | 3 |
| 6 | CO6 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction to Control System<br>Concept of feedback and Automatic control, Types and examples of feedback control systems, Definition of transfer function .Poles and Zeroes of a transfer function. | 2L |
| Module II | Mathematical Modelling of Dynamic Systems<br>Writing differential equations and determining transfer function of model of various physical systems including - Translational & Rotational mechanical systems, Basic Electrical systems and<br>transfer function, Liquid level systems, Electrical analogy of Spring – Mass Dashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason's gain formula. | 6L |
| Module III | Control System Components<br>Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tachogenerators, Actuators. | 2L |
| Module IV | Time Domain Analysis<br>Time domain analysis of a standard second order closed loop system. Determination of timedomain specifications of systems. Step and Impulse response of first and second order systems. Stability by pole location. Routh-Hurwitz criteria and applications. Control Actions: Basic concepts of PI, PD and PID control, Steady-state error and error constants. | 8L |
| Module V | Stability Analysis by Root Locus Method<br>Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. | 4L |
| Module VI | Frequency Domain Analysis of Linear System<br>Bode plots, Polar plots, Nichols chart, Concept of resonance frequency of peak magnification. Nyquist criteria and Nyquist plots, measure of relative stability, phase and gain margin. Determination of margins in Bode plot. | 8L |

| | | |
|---|---|---|
| Module VII | Control System Performance<br>Improvement of system performance through compensation, Lead, Lag and Lead-Lag compensation. | 4L |
| Module VIII | Case-studies<br>Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control, voltage control of an Alternator. Numerical problems to be solved in the tutorial classes. | 4L |
| | Total | 38L |

**Text Books:**

1 Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education.
2 Control System Engineering, I. J. Nagrath & M. Gopal. New Age International Publication.
3 Control System Engineering, D. Roy Choudhury, PHI
4 Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI

**Reference Books:**

1 Control Engineering Theory & Practice, Bandyopadhyaya, PHI
2 Control systems, K.R. Varmah, Mc Graw Hill
3 Control System Engineering, Norman Nise, 5th Edition, John Wiley & Sons
4 Modern Control System, R.C. Dorf & R.H. Bishop, 11th Edition, Pearson Education.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE504A | Data Structure | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Familiarity with the fundamentals of C or other programming language.<br>2. A solid background in mathematics, including probability, set theory. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE504A.1 | Understand | Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing |
| EE504A.2 | Apply | Differentiate how the choice of data structure and algorithm methods based on impact the performance of program |
| EE504A.3 | Apply | Compare and contrast the benefits of dynamic and static data structures implementations. |
| EE504A.4 | Apply | Identify appropriate data structure & algorithmic methods in solving problem. |
| EE504A.5 | Apply | Solve problems based upon different data structure & also write programs. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | 2 | | | | | 2 | | 2 | 2 | | |
| 2 | CO2 | | 2 | | | 2 | | | | 2 | | | 2 | 2 | | |
| 3 | CO3 | | 2 | | | 2 | | | | 2 | | | 2 | 2 | | |
| 4 | CO4 | | 3 | | 3 | 2 | | | | 3 | | 3 | 2 | 2 | 2 | 3 |
| 5 | CO5 | | 3 | 3 | 3 | 3 | | | | 3 | | 3 | 3 | 2 | 3 | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Linear Data Structure<br>Introduction (2L): Concepts of data structures:<br>a) Data and data structure b) Abstract Data Type and Data Type.<br>Algorithms and programs, basic idea of pseudo-code. (1L)<br>Algorithm efficiency and analysis, time and space analysis of algorithms – order notations. (1L)<br>Array (2L): Different representations – row major, column major. (1L)<br>Sparse matrix - its implementation and usage, Array representation of polynomials. (1L)<br>Linked List (6L):<br>Singly linked list – operations, Doubly linked list – operations. (4L)<br>Circular linked list – operations, Linked list representation of polynomial and applications. (2L) | 10L |
| Module II | Linear Data Structure<br>Stack and Queue (4L)<br>Stack and its implementations (using array and linked list) (1L)<br>Applications (infix to Postfix, Postfix Evaluation) (1L)<br>Queue, circular queue, de-queue (1L)<br>Implementation of queue- linear and circular (using array and linked list) (1L)<br>Recursion (2L)<br>Principles of recursion - use of stack, tail recursion. (1L)<br>Applications - The Tower of Hanoi (1L) | 6L |
| Module III | Nonlinear Data structures<br>Trees (8L):<br>Basic terminologies, forest, tree representation (using array and linked list) (1L)<br>Binary trees - binary tree traversal (pre-, in-, post- order) (1L)<br>Threaded binary tree (1L)<br>Binary search tree- operations (creation, insertion, deletion, searching) (1L)<br>Concept of Max-Heap and Min-Heap (creation, deletion) (1L)<br>Height balanced binary tree – AVL tree (insertion with examples only) (1L) | 12L |

| | | |
|---|---|---|
| | Height balanced binary tree – AVL tree (deletion with examples only) (1L)<br>m –Way Search Tree, B Tree – operations (insertion, deletion with examples only) (1L)<br>Graphs (4L):<br>Graph theory review (1L)<br>Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts<br>of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) (2L)<br>Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) (1L) | |
| Module IV | Searching, Sorting<br>Sorting Algorithms (4L):<br>Bubble sort, Insertion sort, Selection sort – with notion of complexity (1L)<br>Quick sort, Merge sort – with complexity (2L)<br>Radix sort – with complexity (1L)<br>Searching (2L):<br>Sequential search – with complexity (1L)<br>Binary search, Interpolation Search– with complexity (1L)<br>Hashing (2L)<br>Introduction to Hashing and Hashing functions (1L)<br>Collision resolution techniques (1L) | 8L |
| | Total | 36L |

**Text Books:**


1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications.
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Andersonfreed 2nd Edition, Universities Press.


**Reference Books:**


1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1st Edition, Pearson.
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited.
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson.
4. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE504B | Computer Network | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Familiarity and knowledge of Operating Systems and Computer Architecture<br>2. Also require little bit programming languages concepts like C, Java | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE504B.1 | Understand | Understand OSI and TCP/IP models. |
| EE504B.2 | Apply | Analyze MAC layer protocols and LAN technologies. |
| EE504B.3 | Analyze | Design applications using internet protocols. |
| EE504B.4 | Create | Implement routing and congestion control algorithms. |
| EE504B.5 | Create | Develop application layer protocols and understand socket programming. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | 2 | | | | | | | 2 | 2 | | |
| 2 | CO2 | | 2 | 3 | | 2 | | | | | | | 2 | 2 | | |
| 3 | CO3 | | | | 3 | 2 | | | | | | | 2 | 2 | 3 | 2 |
| 4 | CO4 | | | | 3 | 2 | | | | | | | 2 | 2 | 3 | 2 |
| 5 | CO5 | | | | 3 | 2 | | | | | | | 2 | 2 | 3 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction<br>Introduction: Computer Network, data communication, topology, OSI and TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network. (3L)<br>Physical Layer: Overview of data (analog and digital), signal (analog and digital), transmission (analog and digital) and transmission media (guided and unguided); Circuit switching: time division and space division switch, TDM bus; Telephone Network. (3L) | 6L |
| Module II | Data Link Layer<br>Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sublayer, The Channel Allocation. (5L)<br>Multiple Access Protocols : ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx , Bluetooth, RFID, Bridges, Virtual LANs, Switching. (5L) | 10L |
| Module III | Network Layer<br>IP Addressing, IPv4 and IPv6. Difference IPv4 and IPv6, Conversion of IPv4 and IPv6 , Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network. (5L)<br>Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, : RIP, OSPF, BGP; Routing for Mobile Hosts. (5L) | 10L |
| Module IV | Transport layer<br>Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP :Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. (5L)<br>Advanced topic such as Remote Procedure Call, Delay Tolerant Networks. (1L) | 6L |
| Module V | Application Layer<br>Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls | 3L |

| | | |
|---|---|---|
| Module VI | Socket Programming<br>Introduction to Socket Programming, UDP socket and TCP Socket | 1L |
| | Total | 36L |

**Text Books:**


1. B. A. Forouzan – —Data Communications and Networking (3rd Ed.) – TMH
2. S. Tanenbaum – —Computer Networks (4th Ed.) – Pearson Education/PHI
3. W. Stallings – —Data and Computer Communications (5th Ed.) – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP


**Reference Books:**


1. Kurose and Rose – — Computer Networking -A top down approach featuring the internet – Pearson Education
2. Leon, Garica, Widjaja – —Communication Networks – TMH
3. Walrand – —Communication Networks – TMH.
4. Comer – —Internetworking with TCP/IP, vol. 1, 2, 3 (4th Ed.) – Pearson Education/PHI

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE504C | Internet of Things | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Fundamental knowledge in computer networking and wireless sensor network. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE504C.1 | Understand | Understand the concepts of Internet of Things. |
| EE504C.2 | Analyze | Analyze basic protocols in wireless sensor network. |
| EE504C.3 | Create | Design IoT applications in different domain ethically and be able to analyze their performance. |
| EE504C.4 | Create | Implement basic IoT applications on embedded platform with professional ethics. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | 2 | | | | | | | | | | |
| 2 | CO2 | | 3 | | | 2 | | | | 2 | | | 3 | 2 | 2 | |
| 3 | CO3 | | 2 | 3 | 2 | 3 | | | 3 | 3 | | 3 | 3 | 3 | 3 | |
| 4 | CO4 | | | 3 | 2 | 3 | | | 3 | 3 | | 3 | 3 | 3 | 2 | |

| Module | Content | Hour |
|---|---|---|
| Module I | Fundamental of IoT<br>The Internet of Things , Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Design challenges, Development challenges, Security challenges, Other challenges. | 7L |
| Module II | IoTand M2M<br>A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. | 7L |
| Module III | Wireless Sensor Network<br>Network and Communication aspects, Wireless medium access issues, MAC protocol , routing protocols, Sensor deployment and Node discovery, Data aggregation and dissemination. | 6L |
| Module IV | IoT Architecture<br>Introduction, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. | 7L |
| Module V | IoT Applications for Value Creations<br>Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, Real-time monitoring and control of processes - Deploying smart machines, smart sensors, and smart controllers with proprietary communication and internet technologies, Maximize safety, security and reliability through high precision automation and control, Advanced Metering Infrastructure (AMI), Smart Inverters, Remote control operation of energy consuming devices. | 5L |

| | | |
|---|---|---|
| Module VI | Internet of Things Privacy, Security and Governance<br>Introduction, Overview of Governance, Privacy and Security Issues, Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in smart cities, Security. | 4L |
| | Total | 36L |

**Text Books:**

1 Vijay Madisetti and Arshdeep Bahga, —Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2014.
2 Francis daCosta, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013.

**Reference Books:**

1 Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1
2 Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE505A | Electrical Energy Conseravtion & Auditing | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Familiarity with the fundamentals of C or other programming language.<br>2. A solid background in mathematics, including probability, set theory. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE505A.1 | Apply | Elucidate electricity act 2003, integrated energy policy, relate environmental issue with energy conservation and illustrate sustainable development of energy in indian scenario. |
| EE505A.2 | Apply | Explain economic operation, sketch input-output curves, predict load profiling, classify electricity tariff and energy audit types, elucidate energy conservation act-2001, schemes of bureau of energy efficiency (bee); carry out an economic assessment and audit for specific energy analysis. |
| EE505A.3 | Apply | Idetify energy efficient motors by load matching and selection of motors, explain efficient control strategies, variable speed drives like pumps and fans, evaluate optimal selection by case study |
| EE505A.4 | Apply | Explain transformer loading/efficiency analysis, evaluate feeder/cable loss, elucidate reactive power management & peak demand controls methodologies, classify industrial loads, perform optimal load scheduling, estimate energy conservation in lighting schemes lighting |
| EE505A.5 | Analyze | Classify cogeneration, find optimal operation of air conditioning and refrigeration, cold storage, electric water heating-geysers & solar water heaters, derive power consumption, measures of energy conservation in compressors, |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | 2 | 3 | 3 | | | | | 3 | | 2 |
| 2 | CO2 | | | | 2 | | 2 | | 3 | | | | | 3 | | 2 |
| 3 | CO3 | | 3 | | | | 2 | 3 | | | | | 2 | 3 | | 2 |
| 4 | CO4 | | 3 | 2 | | | | | | | | 2 | 2 | 3 | | 2 |
| 5 | CO5 | | 2 | 2 | | | | | | | | | 2 | 3 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Energy Conservation and Environment<br>Electricity Act 2003, Integrated Energy Policy. Energy and environment, Air pollution, Climate change, United Nations Framework Convention on climate change (UNFCCC), Montreal Protocol, Kyoto Protocol, Clean Development Mechanism (CDM), CDM methodology and Procedures, Sustainable development. | 5L |
| Module II | Electrical Systems<br>Supply and Demand Side, Economic operation, Input-Output curves, Load profiling, Electricity tariff types;<br>Energy auditing: Necessity of Energy audit, Types of energy audit, Energy audit instruments and intervals of EA regulation. Energy Conservation Act-2001 and its features, Notification Under the<br>act, Designated agencies, Schemes of Bureau of Energy Efficiency (BEE); Energy Economics: Economic assessment and Economic methods for specific energy analysis. | 9L |
| Module III | Electric motors<br>Energy efficient controls and starting efficiency-Motor Efficiency and Load Analysis- Energy efficient /high efficient Motors-Case study; Load Matching and selection of motors.<br>Variable speed drives; Pumps and Fans-Efficient Control strategies- Optimal selection and sizing – Optimal operation and Storage; Case study | 6L |

| | | |
|---|---|---|
| Module IV | Electrical Demand Side<br>Transformer Loading/Efficiency analysis, Feeder/cable loss evaluation, case study. Reactive Power management-Capacitor Sizing-Degree of Compensation, Peak Demand controls-Methodologies-Types of Industrial loads-Optimal Load scheduling-case study; Lighting-Energy efficient light sources-Energy conservation in Lighting Schemes- Electronic ballast-Power quality issues-Luminaries, case study. | 7L |
| Module V | Cogeneration<br>Types and Schemes; Electric loads and Energy conservation measures: Air conditioning and Refrigeration, Cold storage-Types-Optimal operation-case study; Electric water heating-Geysers-Solar Water Heaters. Power Consumption in Compressors, Energy conservation measures; Electrolytic Process; Computer Controls: Hardware, Software-EMS. | 9L |
| | Total | 36L |

**Text Books:**


1 Leon K. Kirchmayer, —Economic Operation of power system, Wiley India Pvt Ltd, July 2010.
2 Jean-Claude SabonnadiAre, —Low emission power generation technologies and energy management, John Wiley & Sons, August 2010.
3 Ursula Eicker, —Low energy cooling for sustainable buildings, John Wiley & Sons, August 2010
4 Timothy J. E. Miller, —Reactive power control in electric systems, Wiley edition, August 2010
5 Paul C. Crause, Oleg Wasynczuk, Scott D.sudhoff, —Analysis of electric machinery and drive system, Wiley 2nd Edition, August 2010.
6 Albert Thumann, P.W. —Plant Engineers and Managers Guide to Energy Conservation TWI Press Inc, Terre Haute, 9th edition, 2008
7 Francois, Leveque, —Transport pricing of electricity networks, Springer 2003.
8 Parasiliti F., P. Bertoldi, —Energy Efficiency in motor driven systems, Springer, 2003.


**Reference Books:**


1 Turner, Wayne C., —Energy Management Handbook||, Lilburn, The Fairmont Press, 2001
2 Donald R. W., —Energy Efficiency Manual||, Energy Institute Press,2000
3 Giovanni Petrecca, —.Industrial Energy Management: Principles and Applications||, The Kluwer international series -207, 1999 Springer 2000.
4 Anthony J. Pansini, Kenneth D. Smalling, —Guide to Electric Load Management||, Pennwell Pub,1998
5 Albert Thumann , —Handbook of Energy Audits||, Fairmont Pr; 5th edition,1998
6 Howard E. Jordan, —Energy-Efficient Electric Motors and Their Applications||, Plenum Pub Corp; 2nd edition 1994
7 Petrecca, Giovanni, —Industrial Energy Management||, Springer 1993
8 IEEE Bronze Book- —Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities||, IEEE Inc, USA.,1985
9 NESCAP-Guide Book on Promotion of Sustainable Energy Consumption.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE504B | Electromagnetic Waves | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Familiarity with the fundamentals of C or other programming language.<br>2. A solid background in mathematics, including probability, set theory. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE505B.1 | Apply | Apply Maxwell's equations and wave equation to solve of problems relating to uniform plane wave propagation. |
| EE505B.2 | Apply | Explain the concept of lumped and distributed parameters, define line parameters, propagation constants, characteristic impedance, wavelength, velocity of propagation, solve numerical using transmission line equation |
| EE505B.3 | Apply | Explain parallel planes waveguides, rectangular waveguides, circular waveguides, power transmission in waveguides, dielectric slab waveguides and their application |
| EE505B.4 | Apply | Explain antenna concepts and antenna characteristic; properties of Hertzian dipole and half-wave dipole, operation of array antennas. |
| EE505B.5 | Apply | Classify different modes of propagation, elucidate tilt of radio waves, explain sky wave propagation, and define skip distance, critical frequency, and virtual height. |
| EE505B.6 | Apply | Explain space wave propagation, anomalous propagation, duct propagation, tropospheic propagation, define modified refractive index and diffraction, |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | 2 | | | | | | | | | | | 3 | | |
| 2 | CO2 | 2 | 2 | | | | | | | | | | | 3 | | |
| 3 | CO3 | 2 | 2 | | | | | | | | | | | 3 | | |
| 4 | CO4 | 2 | 2 | | | | | | | | | | | 3 | | |
| 5 | CO5 | 2 | 2 | | | | | | | | | | | 3 | | |
| 6 | CO6 | 2 | 2 | | | | | | | | | | | 3 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Electromagnetic Waves<br>Maxwell's equations, Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power and Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems. | 6L |
| Module II | Transmission Lines<br>Concept of lumped and distributed parameters, Line parameters, Transmission line equation and solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems | 4L |
| Module III | Waveguides<br>Parallel planes waveguides, Rectangular waveguides, Circular waveguides, Power transmission in waveguides, Dielectric slab waveguides, Application of waveguides. | 3L |
| Module IV | Antenna Parameters and Characteristics<br>Antenna Concepts, Antenna Characteristic; Hertzian dipole (Radiation Fields, Radiation Resistance, Radiation patterns, Directive Gain); Properties and typical applications of Half-wave dipole, Yagi- Uda array, Array Antennas. | 5L |
| Module V | Radio Wave Propagation<br>Different modes of propagation, Tilt, Sky wave propagation, MOF maximum Ustable frequency, Skip distance, Critical frequency, Virtual height. | 3L |

| | | |
|---|---|---|
| Module VI | Space Wave Propagation<br>Space wave propagation, Modified refractive index, Diffraction, Anomalous propagation, Duct propagation, Tropospheic propagation. | 3L |
| | Total | 36L |

**Text Books:**


1 Quantum Field Theory, Lewis H. Ryder, 2nd Edition, Cambridge University Press.
2 Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford University press.
3 Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
4 Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH
5 Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press.
6 Elements of Electromagnetic Fields, S.P. Seth, Dhanpat Rai & Sons


**Reference Books:**


1 Electromagnetic with application, Krause, 5th Edition, TMH.
2 Elements of Engineering Electromagnetic, N.N. Rao, 6th Edition, Pearson Education.
3 Electromagnetic Theory & Applications, A. K. Saxena, Narosa Publishing House Pvt. Ltd.
4 Electromagnetic Waves and Transmission Lines- by G.Prasad, J.Prasad and J.Reddy- Scitech.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE505C | Illumination Engineering | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Physics, Basic Electrical Engineering. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE505C.1 | Apply | Classify types of illumination, explain the theory of gas discharge light, define radiation of energy, electromagnetic radiation and electromagnetic spectrum, elucidate visual characteristics, visual performance and spectral sensitivity human eye |
| EE505C.2 | Apply | Define luminous flux, luminous intensity, lumen, candle power, illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, lamp efficiency, brightness or luminance, photometry, calculate luminance and illumination, categorize application of polar photometer and gonio photometer, explain operation of luxmeter, colorimetric instrument, elucidate color rendering index. |
| EE505C.3 | Apply | Explain theory, operation, basic properties, characteristics and application of low and high pressure gas discharge, sodium vapour, mercury vapour, elucidate operation of fluorescent lamp, led, laser, classify types of luminary, describe function different materials used in lamp |
| EE505C.4 | Apply | Elucidate purpose of lighting control in view of energy conservation, explain the operation of electromagnetic and electronic ballast, function of igniter in lamps, operation of fluorescent lamp circuit, low pressure sodium vapour lamp circuit, high pressure sodium vapour lamp circuit, |
| EE505C.5 | Design | Perform lighting design calculation for interior lighting of residential complex, commercial complex, industrial premises, day lighting, categorize sky luminance pattern, estimate average daylight factor, estimate window design for maximum day lighting, elucidate use of photocell, occupancy sensor in lighting controls, concept of isolux contour in lighting design |
| EE505C.6 | Design | Perform lighting calculations of exterior lighting for road lighting, flood lighting, industrial complex, commercial complex, sports complex |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | | | | | | | | | 2 | | |
| 2 | CO2 | | 2 | | | | 2 | | | | | | | 2 | | |
| 3 | CO3 | | 2 | | | | 2 | | | | | | | 3 | | 2 |
| 4 | CO4 | | 2 | | | | 3 | | | | | | | 3 | | 2 |
| 5 | CO5 | | | 3 | 3 | | 3 | | 3 | | | 2 | | 3 | | 3 |
| 6 | CO6 | | | 3 | 3 | | 3 | | 3 | | | 2 | | 3 | | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Fundamentals of Light<br>Types of illumination, Theory of gas discharge and production of light, Perception of light and colour, Radiation of energy, Electromagnetic radiation and Electromagnetic spectrum, Human eye as an optical system, Spectral sensitivity of human eye, Visual characteristics and Visual performance. | 5L |
| Module II | Measurement of Light<br>Definition of luminous flux, Luminous intensity, Lumen, Candle power, Illumination, M.H.C.P, M.S.C.P, M.H.S.C.P, Lamp efficiency, Brightness or luminance, Photometry – Fundamentals of detector, Application of Polar Photometer and Goniophotometer, Calculation of luminance and illumination, Luxmeter, CIE standard source of illuminant, Colorimetry –Source colour and Object colour. Colorimetric instrument, Colour rendering index. | 7L |

| | | |
|---|---|---|
| Module III | Lamp, Accessories and Luminaries<br>Lamp materials – glass, filament, phosphor coating, ceramics, electrodes, gases, capping cement etc., Theory and basic properties of low and high pressure gas discharge. Theory of operation, Life,<br>Characteristics and Application of - High and Low pressure sodium vapour, High and Low pressure mercury vapour, Metal halide, Fluorescent lamp, LED, LASER, Luminaire – Types of luminaire, Design consideration, Indian standard recommendation. | 9L |
| Module IV | Illumination Control and Control circuits<br>Purpose of lighting control in view of energy conservation, Operation of Electromagnetic and Electronic ballast and their comparison in light control, Function of Ignitor in lamps, Control<br>circuits and operation of Fluorescent lamp circuit, Low pressure sodium vapour lamp circuit, High pressure sodium vapour lamp circuit. | 6L |
| Module V | Interior Lighting<br>National standards of interior lighting calculation, Design considerations for interior lighting of Residential complex, Commercial complex, Industrial premises, Day lighting – Sky luminance pattern, Daylight factor, estimation of average daylight factor, window design considerations for maximum day lighting, Application of daylight in interior lighting, Use of photocell, occupancy sensor in lighting controls, Concept of Isolux contour in lighting design. | 6L |
| Module VI | Exterior Lighting<br>Lighting calculations of exterior lighting, Calculation of lighting and design considerations for exterior lighting of Road lighting, Flood lighting, Industrial complex, Commercial complex, Sports<br>complex, National and CIE standards of exterior lighting calculation. | 3L |
| | Total | 36L |

**Text Books:**

1 Generation, Distribution and Utilization of Electrical Energy, C.L. Wadha, New Age International Ltd.
2 Applied Illumination Engineering, Jack L. Lindsey, The Fairmont Press Inc.
3 Art and Science of Utilization of Electrical Energy, H. Partab, Dhanpat Rai & Sons.
4 Standard Hand Book for Electrical Engineers, Fink & Beaty, McGraw Hill International.

**Reference Books:**

1 Utilization of Electric Power, C.L. Wadha, New Age International Ltd.
2 Handbook of Applied Photometry, Casimer M Decusatis, Springer.
3 Light Engineering: Applied calculations, R.H. Simons, Robert Bean, Architectural Press.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE505D | Power Plant Engineering | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Familiarity with the fundamentals of C or other programming language.<br>2. A solid background in mathematics, including probability, set theory. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE505D.1 | Understand | Classify different forms of energy, different energy sources, explain electrical power generation. |
| EE505D.2 | Apply | Elucidate Rankin cycle, identify site for thermal power stations, sketch the layout of modern coal power plan, explain operation of different components, fuel and ash handling, draught system, feed water treatment, list of thermal power stations in the state with their capacities |
| EE505D.3 | Apply | Identify site for nuclear power plants, hydro power stations, gas turbine stations, disel electric station, sketch the layout of power plan, explain operation of different components, list of nuclear power stations, hydro power stations in the state with their capacities |
| EE505D.4 | Apply | Explain the operation of non-conventional energy generation from wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell |
| EE505D.5 | Apply | Define and explain power tariffs, load distribution, load curve, elucidate operation of cold reserve, hot reserve, spinning reserve, illustrate pollution control technologies |
| EE505D.6 | Apply | Elucidate advantages inter connection of power stations, define base load and peak loads, load sharing and transfer of load between power stations |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | | | | | | | | | 2 | | |
| 2 | CO2 | | 3 | | | | | | | | | | | 3 | | 2 |
| 3 | CO3 | | 3 | | | 2 | | 2 | 3 | | | | 2 | 3 | | 2 |
| 4 | CO4 | 2 | 2 | | | | | 3 | | | | | 2 | 3 | | 3 |
| 5 | CO5 | 2 | 3 | | | 2 | 3 | | | | | | 2 | 2 | | 3 |
| 6 | CO6 | | 2 | | | | 3 | | | | | | 2 | 3 | | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Basics of Power Generation<br>Importance of electrical power in daily life, Different forms of energy, Comparison of different energy sources, Power crisis in India and Future Trend, Overview of method of electrical power generation. | 2L |
| Module II | Coal Based Thermal Power Plants<br>List of thermal power stations in the state with their capacities, basic Rankine cycle and its modifications, Selection of site for thermal power stations, Layout of modern coal power plant, Quality of fuel and its effect on quality of power generation, Operation of different components – Super critical boilers, FBC boilers, Economizer, Air pre heater, Super-heaters and re-heaters, Steam turbines, Condensers, Spray ponds and cooling towers, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems, Merits and demerits of Thermal Power Plants. | 8L |
| Module III | Nuclear Power Stations<br>Basics of nuclear energy conversion, Selection of site for Nuclear Power plants, Block diagram and working of Nuclear Power station, Fuels used in Nuclear Power Station, subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants, Merits and demerits of Nuclear Power Plants, List of Nuclear power stations | 6L |

| | | |
|---|---|---|
| | in state and county with their capacities. | |
| Module IV | Hydro Power Stations<br>Selection of site and classification of Hydroelectric Power Plants, Layout and working of Hydro Power Station, Types of Turbines and generators used, Pumped storage Power Plant, Merits and demerits of Hydro Power Station, List of Hydro Power stations with their capacities and number of units in the state. | 5L |
| Module V | Gas Turbine Power Plants<br>Selection of site for Gas Turbine Power Station, Fuels for gas turbine, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems, Merits, demerits and application Gas turbine power plants. | 3L |
| Module VI | Diesel Electric Power Stations<br>Selection of site for Diesel Electric Power Station, Elements of diesel Electric power plants and their working, Operation, maintenance & trouble shooting, chart of diesel Electric plant, Merits, demerits and applications of diesel electric power stations, Performance and thermal efficiency of Diesel Electric Power Plant. | 3L |
| Module VII | Non-ConventionalEnergy Sources<br>Principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems. | 3L |
| Module VIII | Economics of Power Generation<br>Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, firm power, cold reserve, hot reserve, spinning reserve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants. | 3L |
| Module IX | Interconnected Power Systems<br>Advantages of Interconnection, Base load and peak loads, load allocation among various types of power stations, Load sharing and transfer of load between power stations, Inter connection of power stations at state and national level. | 3L |
| | Total | 36L |

**Text Books:**


1. P.K. Nag – Power plant Engineering, Tata McGraw – Hill.
2. T. C. Elliot, K. Chen and R. C. Swanekamp, Power Plant Engineering, 2nd ed., McGraw Hill, 1998.
3. M. M. El Wakil, Power Plant Technology, Tata McGraw Hill, 2010.
4. Arora and Domkundwar – A course in Power plant Engineering, Dhanpat Rai & Sons.


**Reference Books:**


1. Godfrey Boyle, Renewable Energy, Oxford University Press.
2. Soni, Gupta and Bhatnagar, A course in Electrical Power, Dhanpatrai& Sons.
3. Dr. S. L. Uppal, Electrical Power, Khanna Publishers.
4. UmeshRathore, Energy Management, S.K.Katharia& Sons
5. K.K. Ramalingam, Power Plant Engineering, Scitech Publication (India) Pvt. Ltd.
6. S P Sukhatme, Solar Energy, Tata McGrawhill Publishing co. Ltd.
7. A.K.Raja, M. Dwibedi and A.P.Srivastava, Introduction to Non-conventional Energy Sources, Scitech Publication (India) Pvt. Ltd.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE591 | Electrical Machines-II Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concepts of Electrical Machine | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE591.1 | Analyze | Conduct experiments on synchronous machine to perform the slip test, draw the v curve of synchronous machine, determine the voltage regulation and perform the parallel operation of synchronous machine. |
| EE591.2 | Analyze | Conduct experiments on single phase induction motor to analyze the load characteristics, to study the effect of capacitor on the starting and running condition and determination of equivalent circuit parameters. |
| EE591.3 | Analyze | Conduct experiment on induction machine to study and analyze the performance of three-phase induction generator |
| EE591.4 | Apply | Perform experiments on electrical machine in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE591.5 | Apply | Perform experiments on electrical machines, note the observation with ethics and write effective reports to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 3 | | 3 | | | | | | | | | 3 | 3 | 2 |
| 2 | CO2 | 2 | 3 | | 3 | | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | 2 | 3 | | 3 | | | | | | | | | 3 | 3 | 2 |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiment**

Experiment - 1 To observe the effect of excitation and speed on induced e.m.f of a three-phase alternator and plot the O.C.C. of the alternator.

Experiment - 2 Determination of regulation of Synchronous machine by
a) Potier reactance method.
b) Synchronous Impedance method.

Experiment – 3 To determine the direct axis resistance [Xd] and quadrature reactance [Xq] of a 3-phase synchronous machine by slip test.

Experiment - 4 Parallel operation of three-phase Synchronous generators.

Experiment - 5 V-curve of Synchronous motor.

Experiment - 6 Determination of equivalent circuit parameters of a single-phase Induction motor.

Experiment - 7 Load test on single-phase Induction motor to obtain the performance characteristics.

Experiment - 8 To study the performance of Three-Phase Induction generator.

Experiment - 9 To study the effect of capacitor on the starting and running condition of a Single-Phase Induction motor and to determine the method of reversing the direction of rotation.

Experiment - 10 Innovative Experiments.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE592 | Power System-I Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concepts of Power System. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE592.1 | Analyze | Draw the Schematic diagram of structure of power system and power transmission line and Symbol of Electrical Equipment |
| EE592.2 | Analyze | Conduct experiment to measurement of earth resistance by earth tester, dielectric strength of insulating oil, solid Insulating Material. |
| EE592.3 | Analyze | Conduct experiment to do simulation of DC distribution by network analyzer, determine A, B, C, D constants of long transmission line. |
| EE592.4 | Analyze | Conduct experiment to calculate different parameter from power circle diagram, perform active and reactive power control of alternator |
| EE592.5 | Apply | Perform experiments on power system in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE592.6 | Apply | Perform experiments on power system, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 3 | | | | | | | | | | 3 | 2 |
| 2 | CO2 | | | | 3 | | | | | | | | | | 3 | 2 |
| 3 | CO3 | | | | 3 | | | | | | | | | | 3 | 2 |
| 4 | CO4 | | | | 3 | | | | | | | | | | 3 | 2 |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Draw the Schematic diagram of structure of power system and power transmission line and Symbol of Electrical Equipment.
Experiment - 2 Simulation of DC distribution by network analyzer.
Experiment - 3 Measurement of earth resistance by earth tester.
Experiment - 4 Dielectric strength test of insulating oil, solid Insulating Material.
Experiment - 5 Different parameter calculation by power circle diagram.
Experiment - 6 Study of different types of insulator.
Experiment - 7 Determination of the generalized constants A, B, C, D of long transmission line.
Experiment - 8 Active and reactive power control of alternator.
Experiment - 9 Study and analysis of an electrical transmission line circuit with the help of software.
Experiment – 10 Dielectric constant, tan delta, resistivity test of transformer oil.
Experiment - 11 Any Innovative experiment according to knowledge of power System – I.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE593 | Control System-I Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concept of Simulation Software and Control System. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE593.1 | Analyze | Conduct simulation using MATLAB Control System Toolbox and Simulink Toolbox to find the solution in control system |
| EE593.2 | Analyze | Conduct simulation using MATLAB to analyze time domain behavior of different systems for common input signals and predict different time domain specification parameters. |
| EE593.3 | Analyze | Conduct simulation using MATLAB to conclude system stability using different stability analysis tools, to illustrate effects of variation of controller parameters on system response. |
| EE593.4 | Analyze | Conduct experiment using experimental kit to study the use of potentiometric error detector in control engineering |
| EE593.5 | Analyze | Perform experiments on control system in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE593.6 | Analyze | Perform experiments on control system, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 3 | 3 | | | | | | | | 3 | 3 | 2 |
| 2 | CO2 | | 2 | 2 | 3 | 3 | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | | 2 | 2 | 3 | 3 | | | | | | | | 3 | 3 | 2 |
| 4 | CO4 | | | | 3 | | | | | | | | | 3 | 3 | 2 |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Familiarization with MATLAB control system tool box, MATLAB simulink tool box and PSPICE.
Experiment - 2 Determination of Step response for first order and Second order system with unity feedback on CRO and calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response.
Experiment - 3 Simulation of Step response and Impulse response for Type-0, Type-1 and Type-2 system with unity feedback using MATLAB and PSPICE.
Experiment - 4 Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for 2nd order system and determination of different control system specification from the plot.
Experiment - 5 Determination of PI, PD and PID controller action of first order simulated process.
Experiment - 6 Determination of approximate transfer functions experimentally from Bode plot.
Experiment - 7 Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin with addition of Lead.

**Reference Books:**

1 MATLAB and Simulink for Engineers, Agam Kumar Tyagt, Oxford.
2 Modeling and Simulation Using MATLAB - Similink, Dr. S. Jain, Wiley India.
3 MATLAB and Its Application in Engineering, Raj K Bansal, A.K. Goel and M.K. Sharma, Pearson.
4 MATLAB programming for Engineers, S.J. Chapman, 3rd Edition, Cengage.

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|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE594A | Data Structure Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Computer Fundamentals and Principal of Computer Programming Laboratory. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE594A.1 | Remember | Choose appropriate data structure and handle operations like searching, insertion, deletion, traversing mechanism on various data structures. |
| EE594A.2 | Apply | Conduct experiment to store, manipulate and arrange data in an efficient manner. |
| EE594A.3 | Apply | Conduct experiment to implement linked list, queue and stack using arrays and search. |
| EE594A.4 | Apply | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE594A.5 | Apply | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | | | | | | | | | | 2 | |
| 2 | CO2 | | | | 2 | 3 | | | | | | 2 | | | 2 | |
| 3 | CO3 | | | | 2 | 3 | | | | | | 2 | | | 2 | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | 2 | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Write a C program to implement Single Link List.
Experiment - 2 Write a C program to implement Double Link List.
Experiment – 3 Write a C program to implement Single Circular Link List.
Experiment - 4 Write a C program to implement Double Circular Link List.
Experiment – 5 Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
Experiment - 6 Write a C program to convert a given infix expression into its postfix Equivalent.
Experiment – 7 Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.
Experiment - 8 Write a C program to implement Binary Search Tree (BST).
Experiment – 9 Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
a) Insertion sort
b) Merge sort
Experiment – 10 Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
a) Quick sort
b) Selection sort
Experiment – 11 Write C programs for implementing the following searching methods:
a) Linear Search
b) Binary Search
Write a C program to implement all the functions of a dictionary (ADT) using hashing.
Experiment - 12 Write C programs for implementing the following graph traversal algorithms:
a) Depth first search
b) Breadth first search

**Text Books:**

1 Data Structures using C, R. Thareja, 2nd Edition, Oxford University Press.
2 Data Structures Using C E. Balagurusamy, Mcgraw Hill.

**Reference Books:**

1 Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson
2 Data Structures Through ‗C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
3 Data structures using C, A.K.Sharma, 2nd Edition, Pearson
4 Fundamentals of Data Structures of C by Ellis Horowitz, SartajSahni, Susan Andersonfreed 2nd Edition, Universities Press

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE594B | Computer Network Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | 1. Familiarity and knowledge of Computer Network and Computer Architecture<br>2. Also require strong knowledge of programming languages like C, Java and UNIX or Linux environment. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE594B.1 | Understand | Conduct experiments to demonstrate the socket program, develop simple applications using TCP and UDP, develop the code for Data link layer protocol simulation. |
| EE594B.2 | Analyze | Conduct experiments to examine the performances of Routing protocol. |
| EE594B.3 | Analyze | Conduct experiments with congestion control algorithm using network simulator. |
| EE594B.4 | Create | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE594B.5 | Create | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | | | | | | | | | | 2 | |
| 2 | CO2 | | | | 2 | | | | | | | | | | 2 | |
| 3 | CO3 | | | | 2 | 3 | | | | | | | | | 2 | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | 2 | | | | 2 | | 3 | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems – Configurations. |
| Experiment - 2 | Socket Programming using TCP and UDP. |
| Experiment - 3 | Implementing routing protocols such as RIP, OSPF. |
| Experiment - 4 | Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS. |
| Experiment - 5 | Server Configuration: only web server (If time permit..instructor can do more than that). |

**Text Books:**

1 TCP sockets in C programs-Practical guide for Programmers By Micheal J Donahoo and Kenneth L Calvert.
2 Socket Programming by RajkumarBuyaa.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE594C | Internet of Things Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | 1. Fundamental knowledge in computer networking and wireless sensor network.<br>2. Basic Programming Knowledge. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE594C.1 | Understand | Conduct experiments to understand the concepts of Internet of Things, to explain the IoT tools like Arduino Uno, Raspberry Pi. |
| EE594C.2 | Analyze | Conduct experiments to design IoT applications in different domain and be able to analyze their performance. |
| EE594C.3 | Analyze | Conduct experiments to implement basic IoT applications on embedded platform. |
| EE594C.4 | Create | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE594C.5 | Create | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | 3 | | | | | | | | | 2 | |
| 2 | CO2 | | | | 2 | 3 | | | | | | 3 | | 3 | 2 | |
| 3 | CO3 | | | | 2 | 3 | | | | | | 3 | | 3 | 2 | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Introduction to various sensors and various actuators and its Application. Perform experiment using Arduino Uno using following Ultrasonic Sensor:<br>a) PIR Motion Sensor.<br>b) Rain Drop Sensor.<br>c) Moisture Sensor.<br>d) Temperature Sensor.<br>e) Touch Sensor.<br>f) Infrared Sensor.<br>g) Servo Moto.<br>h) RFID Sensor.<br>i) Bluetooth Module.<br>j) Wi-Fi Module. |
| Experiment - 2 | Getting Started with ESP8266 Wi-Fi SoC and hands on. |
| Experiment - 3 | Demonstrate NodeMCU and its working principal. |
| Experiment - 4 | Create a circuit using Arduino and sensors. Perform experiment using Arduino Uno to Learn Working of Servo Motor. |
| Experiment - 5 | Define and Explain Eclipse IoT Project, List and summarize few Eclipse IoT Projects. |
| Experiment - 6 | Creating a webpage and display the values available through Arduino. |
| Experiment - 7 | Demonstration of Setup & Working principal of Raspberry Pi. |
| Experiment - 8 | Connect Raspberry Pi with your existing system components. |

**Text Books:**

1 Vijay Madisetti and Arshdeep Bahga, —Internet of Things (A Hands-on Approach), 1st Edition, VPT, 2014.
2 Francis daCosta, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013.

**Reference Books:**

1 Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1
2 Waltenegus Dargie, Christian Poellabauer, —Fundamentals of Wireless Sensor Networks: Theory and Practice.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | V |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| MC501 | Constitution of India | 3 | - | - | - | - | 100 | - | 100 |
| Pre-requisite | NA. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| MC501.1 | Understand | Develop human values, create awareness about law ratification and significance of constitution. |
| MC501.2 | Understand | Comprehend the fundamental rights and duties of the Indian citizen to implant morality, social values and their social responsibilities. |
| MC501.3 | Apply | Create understanding of their surroundings, society, social problems and their suitable solutions. |
| MC501.4 | Understand | Familiarize with distribution of powers and functions of local self government. |
| MC501.5 | Understand | Realize the national and financial emergency and their impact on economy of the country |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | 3 | | | | 3 | | | |
| 2 | CO2 | | | | | | | | 3 | | 2 | | | | | |
| 3 | CO3 | | | | | | | | 2 | | 2 | | | | | |
| 4 | CO4 | | | | | | | | | | 2 | 3 | | | | |
| 5 | CO5 | | | | | | | | 2 | | 2 | 3 | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Meaning of the constitution law and constitutionalism. | 2L |
| Module II | Historical perspective of the Constitution of India | 2L |
| Module III | Salient features and characteristics of the Constitution of India | 1L |
| Module IV | Scheme of the fundamental rights | 2L |
| Module V | The scheme of the Fundamental Duties and its legal status | 2L |
| Module VI | The Directive Principles of State Policy – Its importance and implementation | 2L |
| Module VII | Federal structure and distribution of legislative and financial powers between the Unionand the States | 3L |
| Module VIII | Parliamentary Form of Government in India – The constitution powers and status of the President of India | 2L |
| Module IX | Amendment of the Constitutional Powers and Procedure | 2L |
| Module X | The historical perspectives of the constitutional amendments in India | 2L |
| Module XI | Emergency Provisions: National Emergency, President Rule, Financial Emergency | 3L |
| Module XII | Local Self Government – Constitutional Scheme in India | 3L |
| Module XIII | Scheme of the Fundamental Right to Equality | 2L |
| Module XIV | Scheme of the Fundamental Right to certain Freedom under Article 19 | 2L |
| Module XV | Scope of the Right to Life and Personal Liberty under Article 21. | 2L |
| | Total | |

**Text Books:**

1 Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2 The Constitution of India, PM Bhakshi, Universal Law

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE601 | Microprocessor & Microcontroller | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Knowledge in Digital Electronics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE601.1 | Apply | Elucidate evolution of microprocessor and microcontrollers, sketch architecture of 8085 microprocessor, use instruction set of 8085 microprocessor, sketch timing diagram of the instructions, memory interfacing, explain interrupts of 8085 processor, write program instructions to model problem statement. |
| EE601.2 | Apply | Sketch and illustrate 8086 architecture, sketch pin diagram, memory segmentation, explain addressing modes, familiarization of basic instructions, interrupts & direct memory access, memory interfacing, ADC / DAC interfacing |
| EE601.3 | Apply | Illustrate 8051 architecture, sketch pin diagram, memory segmentation, classify internal and external memory, explain counters and timers, instruction set, interrupts, memory interfacing, ADC / DAC interfacing |
| EE601.4 | Apply | Write assembly language programming with 8085, 8086, 8051 for addition, subtraction, multiplication, block transfer, ascending order, descending order, finding largest & smallest number |
| EE601.5 | Design | Design and analyze peripheral interfacing model using IC 8255, 8253, 8251 with IC 8085, 8086 and 8051. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | 2 | 2 | 2 | | | | 2 | | | | 2 | 2 | 3 |
| 2 | CO2 | | | 2 | 2 | 2 | | | | 2 | | | | 2 | 2 | 3 |
| 3 | CO3 | | | 2 | 2 | 2 | | | | 2 | | | | 2 | 2 | 3 |
| 4 | CO4 | | | 3 | 2 | 3 | | | | 2 | | | 3 | 2 | 3 | 3 |
| 5 | CO5 | | | 3 | 2 | 3 | | | | 2 | | | 3 | 2 | 3 | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | 8085 Microprocessor<br>Introduction to Microcomputer based system, Evolution of Microprocessor and microcontrollers and their advantages and disadvantages, Architecture of 8085 Microprocessor, Address / Data Bus multiplexing and demultiplexing, Status and Control signal generation, Instruction set of 8085 Microprocessor, Classification of instructions, addressing modes, timing diagram of the instructions, Memory interfacing , IO interfacing, ADC / DAC interfacing, Stack and Subroutine, Delay Calculation, Interrupts of 8085 processor, classification of interrupts, Serial and parallel data transfer – Basic concept of serial I/O, DMA, Asynchronous and synchronous serial transmission using SID and SOD pins of 8085. | 6L |
| Module II | Assembly language programmingwith 8085<br>Addition, Subtraction, Multiplication, Block Transfer, ascending order, descending order, Finding largest & smallest number, Look-up table etc. Programming using interrupts (programming using INTR is not required). | 2L |
| Module III | 8086 Microprocessor<br>8086 Architecture, Pin details, memory segmentation, addressing modes, Familiarization of basic Instructions, Interrupts & Direct Memory Access, Memory interfacing, ADC / DAC interfacing. | 8L |
| Module IV | Assembly language programmingwith 8086<br>Addition, Subtraction, Multiplication, Block, Transfer, ascending order, descending order, Finding largest & smallest number etc. | 3L |

| | | |
|---|---|---|
| Module V | 8051 Microcontroller<br>8051 architecture, hardware, input/output pins, ports, internal and external memory, counters and timers, instruction set, addressing modes, serial data i/o, interrupts, Memory interfacing, ADC / DAC interfacing. | 7L |
| Module VI | Assembly language Programming using 8051<br>Moving data: External data moves, code memory read only data moves, PUSH and POP opcodes, data exchanges; Logical operations: Byte-level, bit-level, rotate and swap operations; Arithmetic operations: Flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: Jump and call program range, jumps, calls and subroutines, interrupts and returns. | 4L |
| Module VII | Support IC chips<br>8255, 8253 and 8251: Block Diagram, Pin Details, Modes of operation, control word(s) format. Interfacing of support IC chips with 8085, 8086 and 8051. | 6L |
| | Total | 36L |

**Text Books:**


1. Microprocessor architecture, programming and application with 8085 – R. Gaonkar, Penram International
2. The 8051 microcontroller - K. Ayala, Thomson
3. Microprocessors & interfacing – D. V. Hall, Tata McGraw-hill
4. Ray &Bhurchandi, Advanced Microprocessors & Peripherals, TMH
5. The 8051 microcontroller and Embedded systems - Mazidi, Mazidi and McKinley, Pearson
6. An Introduction to Microprocessor and Applications –Krishna Kant,Macmillan


**Reference Books:**


1. Microprocessors and microcontrollers - N. Senthil Kumar, M. Saravanan and Jeevananthan, Oxford university press
2. 8086 Microprocessor –K Ayala, Cengage learning
3. The 8051 microcontrollers – Uma Rao and AndhePallavi, Pearson

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE602 | Power System - II | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Basic Electrical Engineering, Circuit Theory, Electrical Machines – II, Power System – I. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE602.1 | Apply | Sketch single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram, explain per unit system, classify substations, define feeder and distributors, illustrate radial and loop systems, explain real and reactive power control connected to infinite bus. |
| EE602.2 | Apply | Formulate network model, Y bus, solve load flow problem by Gauss-Siedel method, Newton-Raphson method, explain decoupled load flow studies with flowchart, and compare different load flow methods. |
| EE602.3 | Apply | Illustrate steady state stability and transient stability, solve numericals on equal area criteria, swing equation, explain multi machine stability concept, elucidate voltage stability and voltage collapsed. |
| EE602.4 | Analyze | Explain the transient on a transmission line, short circuit of a synchronous machine under no load and loaded condition, perform symmetrical faults (L-L-L, L-L-L-G fault) and symmetrical component analysis of unsymmetrical faults (L-G, L-L, L-L-G fault) |
| EE602.5 | Apply | Illustrate the construction, explain the operating principles and functions of protective relaying, define different terminologies used in protective relaying, explain protection scheme for transformer, generators and motors, bus zone protection, protection of transmission lines, |
| EE602.6 | Apply | Illustrate the construction, explain the operating principles of circuit breaker, classify and define different terminologies associated with circuit breaker, demonstrate testing of circuit breakers |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | | | | | | | | | 3 | 2 | 2 |
| 2 | CO2 | 2 | 3 | 2 | 3 | 3 | | | | | | | | 3 | 3 | 3 |
| 3 | CO3 | 3 | | 2 | 3 | | | | | | | | | 3 | 2 | 2 |
| 4 | CO4 | 3 | 3 | 2 | 3 | | | | | | | | | 3 | 3 | 3 |
| 5 | CO5 | 2 | | | | | | | | | | | | 3 | 2 | 2 |
| 6 | CO6 | 2 | 3 | | | | | | | | | | | 3 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Representation of Power System Components<br>Single-phase representation of balanced three phase networks, the one-line diagram and the Impedance or reactance diagram, per unit (PU) system. Distribution substation: Types of substations, location of substations, substation equipments and accessories, Earthling (system and equipment), feeder and distributors, radial and loop systems. | 4L |
| Module II | Basic Idea of Real and Reactive Power Control<br>Introduction to Real and Reactive Power Control (SMIB)Single machine connected to Infinite Bus. | 2L |
| Module III | Load Flow Studies<br>Network model formulation, formation of Ybus, load flow problem, Gauss-Siedel method, Newton- Raphson method, Decoupled load flow studies with flowchart, comparison of load flow methods. | 7L |
| Module IV | Power System Stability<br>Steady state stability, transient stability, equal area criteria, swing equation, multi machine Stability concept, Introductory idea of Voltage Stability and Voltage Collapsed. | 4L |

| | | |
|---|---|---|
| Module V | Faults in Electrical Systems<br>Transient on a transmission line, short circuit of a synchronous machine under no load and Loaded condition. Symmetrical component transformation, sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. Symmetrical component analysis of unsymmetrical faults, L-G fault, L-L fault, L-L-G fault. | 7L |
| Module VI | Power System Protection<br>i) Operating Principles and Relay Constructions (6L):-<br>Functions of Protective Relaying, different terminologies used in protective relaying, Basic Operation of Relay, Electromagnetic Attraction Relays (Plunger Type, Hinged Armature Type, Balanced Beam Type, Polarized Moving Iron Type), Advantages and Disadvantages, Applications of Electromagnetic Attraction Relays, Electromagnetic Induction Type Relays, Theory of Induction Relay Torque, Induction Type Over Current Relay (Non-Directional), Induction Type Directional Power Relay, Directional Over Current Relay, Distance Relay (Impedance Relays, Reactance Relay, MHO Relay), Differential Relay (Current Differential Relay, Voltage Balance DifferentialRelay) Translay Relay, Directional Relay (Single Phase Directional Relays), Negative Sequence Relays, Under Frequency Relays, Over Current Relays, Static Relays (Transductor Relays, Rectifier Bridge Relays, Transistors Relays, Hall Effect Relays, Gauss Effect Relays). Over Current Relays (Static Time Over Current Relays, Directional Static Over Current Relay), Static Differential Relay, Static Distance Relays, Microprocessor Based Relays, Universal Relay Torque Equations, Protection Scheme for Transformer, Generators and Motors, Bus Zone Protection, Protection of Transmission Lines, C.T.s and P.T.s and their applications in the protective schemes. Static Relays and Numerical Protections.<br>ii) Construction and operating principle of circuit Breaker (6L):-<br>Brief description of Circuit Breakers, Operating principle of Circuit Breaker, Arc Phenomenon, Principles of Arc Extinction, Methods of Arc Extinction, Voltage Breaking Transients, Transient Recovery Voltage, Current Chopping and Resistance Switching, Circuit Breaker Rating, Arc and Arc Extinction, Circuit Breaker Types, Oil Circuit Breaker, Vacuum Circuit Breaker, Air Blast Circuit Breaker, SF6 Circuit Breaker and Operating Mechanism, Advantages and Disadvantages of Different Types of Circuit Breakers. Testing of Circuit Breakers. | 12L |
| | | Total 36L |

**Text Books:**


1 Electrical Power System, Subir Roy, Prentice Hall
2 Power System Engineering, Nagrath & Kothary, TMH
3 Elements of power system analysis, C.L. Wodhwa, New Age International.
4 Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors
5 Principles of Power System, V.K. Mehta and Rohit Mehta, S.Chand.
6 A Course in Power Systems, J.B. Gupta, S.K. Kataria& Sons.


**Reference Books:**


1 Electric Power transmission & Distribution, S.Sivanagaraju, S.Satyanarayana, Pearson Education.
2 A Text book on Power system Engineering, Soni, Gupta, Bhatnagar&Chakrabarti, Dhanpat Rai & Co.
3 Power System Protection and Switchgear, Badri Ram, TMH
4 Electric Power distribution system Engineering, 2nd Edition, T. Gonen, CRC Press.
5 www.powermin.nic.in/acts_notification/pdf/ier1956.pdf

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| EE603 | Control System - II | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Any introductory course on Matrix Algebra, Calculus, Engineering Mechanics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE603.1 | Apply | Develop state model of Physical systems |
| EE603.2 | Apply | Apply laplace transform method and state transition matrix to get the solution of state equations. |
| EE603.3 | Apply | Judge controllability and observability and stability of a system and design parameters of state feedback controllers. |
| EE603.4 | Apply | Use properties of Z Transform to study digital control systems. |
| EE603.5 | Apply | Construct describing function of common non linearities of control systems |
| EE603.6 | Apply | Use phase plane method, Lyapunov's stability analysis tools to model non linear systems |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 2 | 3 | 3 | | | | | | | | | 3 | 3 | 3 |
| 2 | CO2 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | 3 |
| 3 | CO3 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | 3 |
| 4 | CO4 | | 3 | 3 | 3 | 3 | | | | | | | | 3 | 3 | 3 |
| 5 | CO5 | | 3 | 3 | | 2 | | | | | | | | 3 | 3 | 3 |
| 6 | CO6 | | 3 | 3 | | 3 | | | | | | | | 3 | 3 | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | State Variable Model of Continuous Dynamic Systems<br>Converting higher order linear differential equations into state variable form. Obtaining SV model from transfer functions. Obtaining characteristic equation and transfer functions from SV model. Obtaining SV equations directly for R-L-C and spring-mass-dashpot systems. Concept and properties associated with state equations. Linear Transformations on state variables. Canonical forms of SV equations. Companion forms. Solutions of state equations, state transition matrix, properties of state transition matrix. Controllability and observability. Linear State variable feedback controller, the pole allocation problems. Linear system design by state variable feedback. | 13L |
| Module II | Analysis of Discrete Time (Sampled Data) Systems Using Z-Transform<br>Difference Equations. Inverse Z transform. Stability and damping in z-domain. Practical sampled data systems and computer control. Practical and theoretical samplers. Sampling as Impulse modulation. Sampled spectra and aliasing. Anti-aliasing filters. Zero order hold. Approximation of discrete (Z domain) controllers with ZOH by Tustin transform and other methods. State variable analysis of sampled data system. Digital compensator design using frequency response. | 10L |
| Module III | Introduction to Non-Linear Systems<br>Block diagram and state variable representations. Characteristics of common nonlinearities. Phase plane analysis of linear and non-linear second order systems. Methods of obtaining phase plane trajectories by graphical method – isoclines method. Qualitative analysis of simple control systems by phase plane methods. Describing Function method. Limit cycles in non-linear systems. Prediction of limit cycles using describing function.Stability concepts for nonlinear systems. BIBO vs. State stability. Lyapunov's definition. Asymptotic stability, Global asymptotic stability. The first and second methods of Lyapunov methods to analyze nonlinear systems. | 13L |
| | | Total 36L |

**Text Books:**

1 Gopal M : Digital Control and State Variable Methods, 2e, – TMH
2 Roy Choudhuri, D., Control System Engineering, PHI
3 Nagrath I J & Gopal M : Control Systems Engg. - New Age International
4 Anand,D.K, Zmood, R.B., Introduction to Control Systems 3e, (Butterworth-Heinemann), Asian Books

**Reference Books:**

1 Goodwin, Control System Design, Pearson Education
2 Bandyopadhyaya, Control Engg. Theory and Practice, PHI
3 Kuo B.C. : Digital Control System, Oxford University Press.
4 Houpis, C.H, Digital Control Systems, McGraw Hill International.
5 Ogata, K., Discrete Time Control Systems, Prentice Hall, 1995
6 Jury E.I. : Sampled Data Control System- John Wiley & Sons Inc.
7 Umez-Eronini, Eronini., System Dynamics and Control, Thomson
8 Dorf R.C. & Bishop R H. Modern Control System- Pearson Education.
9 Ramakalyan, Control Engineering, Vikas
10 Natarajan A/Reddy, Control Systems Engg., Scitech
11 Lyshevski, Control System Theory with Engineering Applications, Jaico
12 Gibson J E : Nonlinear Control System - McGraw Hill Book Co.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE604A | Data Base Management System | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Logic of programming language<br>2. Basic concepts of data structure and algorithms | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE604A.1 | Apply | Apply the knowledge of Entity Relationship (E-R) diagram for an application. |
| EE604A.2 | Analyze | Create a normalized relational database model. |
| EE604A.3 | Analyze | Analyze real world queries to generate reports from it. |
| EE604A.4 | Apply | Determine whether the transaction satisfies the ACID properties. |
| EE604A.5 | Apply | Create and maintain the database of an organization. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 2 | | | 3 | | | | | | | 2 | 2 | | |
| 2 | CO2 | | 2 | 3 | | 3 | | | | | | | 2 | 2 | | |
| 3 | CO3 | | 3 | | | 3 | 3 | | 3 | 2 | | 3 | 3 | 3 | 2 | 3 |
| 4 | CO4 | | 2 | | 2 | 3 | | | 3 | | | | 2 | 2 | | 2 |
| 5 | CO5 | | | 3 | 2 | 3 | | | 3 | 2 | | 3 | 2 | 3 | 2 | |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction<br>Concept and Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. | 3L |
| Module II | Entity-Relationship and Relational Database Model<br>Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database. | 11L |
| Module III | SQL and Integrity Constraints<br>Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers. | 6L |
| Module IV | Relational Database Design<br>Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF , Case Study | 8L |
| Module V | Internals of RDBMS<br>Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model<br>properties, state serializability, lock base protocols; two phase locking, Dead Lock handling | 9L |
| Module VI | File Organization and Index Structures<br>File and Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes | 6L |
| | Total | 36L |

**Text Books:**


1. Henry F. Korth and Silberschatz Abraham, —Database System Concepts, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, —Fundamentals of Database Systems, Benjamin Cummings Publishing Company.
3. Ramakrishnan: Database Management System , McGraw-Hill
4. Gray Jim and Reuter Address, —Transaction Processing : Concepts and Techniques, Moragan Kauffman Publishers.
5. Ullman JD., —Principles of Database Systems, Galgottia Publication.


**Reference Books:**


1. Jain: Advanced Database Management System CyberTech
2. Date C. J., —Introduction to Database Management||, Vol. I, II, III, Addison Wesley.
3. Fundamentals of Database Systems||, Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing Edition
4. Database Management Systems||, Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE604B | Embedded Systems | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Digital Electronics, Microprocessor and Microcontrollers. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE604B.1 | Remember | Familiarize with concepts related to the fundamental principles embedded systems design, explain the process and apply it. |
| EE604B.2 | Understand | Understand knowledge of the advanced embedded technology both for hardware and software. |
| EE604B.3 | Understand | Understand Hardware/Software design techniques for microcontroller-based embedded systems and apply techniques in design problems. |
| EE604B.4 | Apply | Work collaboratively in a small team environment to develop embedded system programming in C and assembly language using Integrated Development Environments and using debugging technique. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | 3 | | | | | 2 | | | | | |
| 2 | CO2 | 2 | | | | 3 | | | | | | | 3 | 2 | | |
| 3 | CO3 | 2 | | 3 | | 3 | | | | 2 | | 3 | 3 | 2 | | |
| 4 | CO4 | | | 3 | 2 | 3 | | | | 2 | | 3 | 3 | | 3 | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction to Embedded System<br>Basics of Embedded computer Systems, Microprocessor and Microcontroller difference, Hardware architecture and software components of embedded system List of various applications [Mobile phones, RFID, WISENET, Robotics, Biomedical Applications, Brain machine interface etc.], Difference between embedded computer systems and general-purpose computer Systems. Characteristics of embedded systems, Classifications of embedded system. | 12L |
| Module II | Hardware Software Co-Design<br>Co-Design Types: Microprocessors/Microcontrollers/DSP based Design, FPGA/ASIC/pSOC based Design, Hybrid Design. Methodology: i) System specifications; ii) co-specifications of hardware and software; iii) System Design Languages (capturing the specification in a single Description); iv) System modelling/simulation; v) Partitioning (optimizing hardware/software partition); vi) Coverification(simulation interaction between custom hardware and processor) f) Co-implementation; vii) Embedded Systems Design development cycle. Programming concepts and embedded programming in C. | 16L |
| Module III | Real Time Operating System (RTOS)<br>Introduction, Types, Process Management, Memory Management, Interrupt in RTOS, Task scheduling, Basic design using RTOS; Basic idea of Hardware and Software testing in Embedded Systems | 8L |
| | Total | 36L |

**Text Books:**

1 Embedded system Design: Peter Marwedel, Springer
2 Embedded Systems - Raj Kamal
3 Embedded Systems - K. Shibu

**Reference Books:**

1 M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, —The8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson Education, 2007.
2 R. Kamal, —Embedded System, McGraw Hill Education, 2009.
3 K. J. Ayala, —8051 Microcontroller, Delmar Cengage Learning, 2004.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| EE604C | Software Engineering | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. An understanding of basic computer software.<br>2. Object Oriented programming skills. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE604C.1 | Understand | Understand the structure and behaviour a software system the UML class diagrams and state diagrams. |
| EE604C.2 | Understand | Understand common lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches. |
| EE604C.3 | Apply | Apply software testing and quality assurance techniques at the module level, and understand these techniques at the system and organization level. |
| EE604C.4 | Apply | Work collaboratively in a small team environment to develop a moderate-sized software system from conceptualization to completion, including requirements elicitation, system modelling, system design, implementation, unit and system testing, integration, source code management configuration management, and release management. |
| EE604C.5 | Analyze | Prepare technical documentations and make presentations on various aspects of a software development project, including the technical aspects (architecture, design, quality assurance) as well as the managerial aspects (planning, scheduling, and delivery). |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | 3 | | | | | 2 | | | | | |
| 2 | CO2 | 2 | | | | 3 | | | | | | | 3 | 2 | | |
| 3 | CO3 | | 2 | 3 | | 3 | | | | 2 | | 3 | 3 | 2 | | |
| 4 | CO4 | | | 3 | 2 | 3 | | | | 2 | | 3 | 3 | | 3 | 3 |
| 5 | CO5 | | | | | | | | | | 3 | 2 | | | 2 | |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction<br>Definition of SE, Software crisis, Evolution of technology- Hype curve, Exploratory style of Software development vs SE, Human cognition mechanism, SE principle- abstraction and decomposition. | 3L |
| Module II | Softwarelife-cycle models<br>Water fall model, V Model, Prototyping Model, Spiral Model, RAD Agile Model. | 4L |
| Module III | Software Project Management<br>Responsibility of a project manager, Project planning, Metrics for project size estimation, Project estimation techniques, COCOMO model, Halstead's Software Science, Scheduling- CPM, PERT, Gantt chart, Risk management, Software configuration management, Staffing and team leader project and planning. | 10L |
| Module IV | Requirement analysis and specification<br>SRS, Requirement gathering and specification, Functional requirement, Traceability, 4GL. | 4L |
| Module V | Software Design<br>Characteristics of a good software, Cohesion and coupling, Function oriented design- DFD, Structure chart. Object oriented design- class and relationship, Design phase in life cycle, System Design Definitions, Concept and methodologies, data flow oriented Design, Program Design and the requirements | 7L |
| Module VI | Coding and Testing<br>Coding Standard, software documentation, Testing- unit testing, black box testing- equivalenceclass partitioning, boundary value analysis, white box testing- McCabe's Cyclomatic Complexity, Mutation Testing, Debugging, Program analysis tool, Integration | 10L |

| | | |
|---|---|---|
| | Testing, Grey box testing, System testing- Smoke and performance testing. | |
| Module VII | Software Reliability and Quality Management<br>Reliability, Hazard, MTTF, Repair and Availability, Software quality, SEI CMM and ISO-9001.<br>Software reliability and fault-tolerance, Six sigma | 5L |
| Module VIII | Computer-aided software engineering (CASE)<br>Environment and benefit, Function point methods (FSM, ISO, OMG) & Metrics. Standards:<br>Capability Maturity Model Integration, ISO 9001. | 4L |
| | Total | 36L |

**Text Books:**

1 Rajib Mall: Software Engineering, PHI

2 Roger S. Pressman, —Software Engineering – A Practitioner‘s Approach, Seventh Edition, McGraw-Hill International Edition.

**Reference Books:**

1 Ian Sommerville, —Software Engineering, 9th Edition, Pearson Education Asia, 2011.

2 Pankaj Jalote, —Software Engineering, A Precise Approach, Wiley India, 2010.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE605A | Digital Signal Processing | 3 | - | - | - | 3 | 30 | 70 | 100 |
| **Pre-requisite** | Prerequisites for Digital signal Processing are required a thorough understanding of various signals, systems, and the methods to process a digital signal and also the knowledge of arithmetic of complex numbers and a good grasp of elementary calculus. The questions reflect the kinds of calculations that routinely appear in Signals. The candidates are expected to have a basic understanding of discrete mathematical structures.<br>The candidates required the concept of Z-transform, Relation between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Initial value theorem and final value theorem, stability considerations for LTI systems using Z-transform, Perseval's relation, Inverse Ztransform by Residue method, power series & partial-fraction expansions. | | | | | | | |

| **Course Outcomes** | | |
|---|---|---|
| EE605A.1 | Apply | Explain the concept of discrete-time signal, sampling and reconstruction of signal, describe sampling theorem, define unit-sample, unit step, unit ramp and complex exponentials, perform arithmetic operations on sequences. |
| EE605A.2 | Apply | Defin impulse response, derive derivation for the output sequence, explain concept of convolution and compute convolution, describe LTI systems with physical interpretations, elucidate recursive and non-recursive systems. |
| EE605A.3 | Apply | Define mapping between S-plane and Z-plane, explain concepts in the complex S-plane, perform Z-transform and convolution, inverse Z-transform by contour integration with examples and exercises. |
| EE605A.4 | Apply | Representation of LTI systems in complex frequency domain, perform freq. response analysis in discrete and continuous domain for sinusoidal/complex inputs (DTFT), perform computation of DFT/IDFT, circular convolution, linear filtering using DFT with examples and exercises, elucidate decimation-in-time, decimation-in-frequency algorithm, signal flow graph, practice to solve examples for DIT and DIF FFT |
| EE605A.5 | Design | Design FIR and IIR Digital filters - Low-pass, Band-pass, Bandstop and High-pass filters, explain Butterworth, Chebyshev and Elliptic Approximations and multi-rate signal processing. |
| EE605A.6 | Apply | Sketch the architecture and important instruction sets of TMS320C 5416/6713 processor, write small programs in assembly Language to measure A.C. and D.C. voltage, current, power and energy |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No.** | **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| 1 | CO1 | 3 | | | | | | | | 2 | | | | 3 | | 3 |
| 2 | CO2 | 3 | | | | | | | | 2 | | 2 | | 3 | | 3 |
| 3 | CO3 | 3 | 2 | 3 | 3 | 3 | | | | 2 | | 2 | 3 | 3 | | 3 |
| 4 | CO4 | | 3 | 3 | 3 | 3 | | | | 2 | | 3 | 3 | 3 | | 3 |
| 5 | CO5 | | 3 | 3 | 3 | 3 | | | | 2 | | 3 | 3 | 3 | | 3 |
| 6 | CO6 | 2 | | 2 | | | | | | 2 | | 2 | 2 | 3 | | 3 |

| **Module** | **Content** | **Hour** |
|---|---|---|
| Module I | Discrete-time Signals and Systems<br>i) Discrete-time signals:<br>Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences,-periodic, energy, power, unit-sample, unit step, unit ramp and complex exponentials, arithmetic operations on sequences.<br>ii) LTI systems:<br>Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution | 6L |

| | | |
|---|---|---|
| | supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems. | |
| Module II | Z-Transforms<br>Definition, mapping between s-plane and Z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples and exercises, characteristic families of signals along with ROC, convolution, correlation and multiplication using Z-transform, initial value theorem, Perseval's relation, inverse Z-transform by contour integration, power series and partial fraction expansions with examples and exercises. | 4L |
| Module III | Fourier Transforms<br>i) Discrete Time Fourier Transform (DTFT):<br>Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain.<br>ii) Discrete Fourier Transform:<br>Concept and relations for DFT/IDFT, Relation between DTFT and DFT. Twiddle factors and their properties, computational burden on direct DFT, DFT/DFT as linear transformation, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences Overlap-Save and Overlap-Add methods with examples and exercises.<br>iii) Fast Fourier Transforms:<br>Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT and DIF FFT, Butterfly computations and exercises. | 10L |
| Module IV | Filter Design<br>Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Bandstop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing. | 10L |
| Module V | Digital Signal Processor<br>Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language to measure A.C. and D.C. voltage, current, power and energy. | 6L |
| | Total | 36L |

**Text Books:**


1. Digital Signal Processing – Principles, Algorithms and Applications, J.G.Proakis&D.G.Manolakis, Pearson Ed.
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
4. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.


**Reference Books:**


1. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
2. Texas Instruments DSP Processor user manuals and application notes.

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE605B | High Voltage Engineering | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Basic Physics, Measurement and Instrumentation, Fundamentals of Power System, Switchgear, Travelling waves. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE605B.1 | Apply | Illustrate breakdown of gases, determine minimum breakdown voltage in uniform and non-uniform gaps, elucidate corona discharge, explain breakdown of liquid in pure and commercial liquids, intrinsic breakdown, electromechanical breakdown, thermal breakdown, streamer breakdown for solid, define partial discharge and explain the development in solid dielectrics and composite dielectrics, elucidate breakdown in vacuum |
| EE605B.2 | Apply | Explain the generation of high alternating voltages and currents and high d.c. Voltages and currents, define impulse voltage and current, illustrate the generation of impulse voltage. |
| EE605B.3 | Apply | Elucidate the measurement of high voltages and currents as per Indian standard specifications, explain the operation of cathode ray oscillographs for impulse voltage and current measurement, sphere gap voltmeter, resistance and capacitance potential dividers, peak voltmeters, capacitance voltage transformer, rotating voltmeter, partial discharge measurements and electrostatic voltmeter. |
| EE605B.4 | Apply | Elucidate lightning phenomena, explain development of lightning stroke, operation of lightning arrestors, select location of lightning arresters, explain function of ground wires, surge diverters, surge absorbers, define insulation coordination, insulation level, impulse level, switching impulse level and determination impulse level of substation equipment. |
| EE605B.5 | Apply | Elucidate various standards for HV testing, testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and high voltage equipment, induced over voltage and impulse test on transformers, power frequency dry and wet withstand test of insulators, impulse test on insulators, sketch high voltage laboratory layout, explain safety precautions in HV Laboratories. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | | | |
| 2 | CO2 | 2 | 3 | | | | | | | | | | 2 | 3 | 2 | 2 |
| 3 | CO3 | 2 | 3 | | | 2 | | | | | | | | 3 | 2 | 2 |
| 4 | CO4 | 2 | 3 | | | 3 | | | | | | | 2 | 3 | 2 | 2 |
| 5 | CO5 | 2 | 3 | | 3 | 3 | | | | | | | 2 | 3 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Breakdown Occurrences<br>i) Breakdown of Gases: Ionization processes and de-ionization processes, Types of Discharge, Charge multiplication, Secondary emission, Townsend's Theory, Streamer Mechanism, Paschen's Law, Gases as insulating materials, Determination of Minimum breakdown voltage, Breakdown in uniform and non-uniform gaps, Corona discharge.<br>ii) Breakdown of Liquid: Breakdown in pure and commercial liquids, Cavitation Theory, Suspended Particle Theory.<br>iii) Break Down of Solids: Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown, Streamer Breakdown.<br>iv) Partial Discharge: Definition and development in solid dielectrics and composite dielectrics.<br>v) Breakdown in Vacuum: Non-metallic electron emission mechanism, Clump mechanism, Effect of pressure on breakdown voltage. | 13L |

| | | |
|---|---|---|
| Module II | Generation of High Voltages and Currents<br>i) Generation of High Alternating Voltages and Currents: Testing transformer, Cascaded transformer, Series resonant circuit, single stage and multi stage. Advantages of Series Resonant Circuit in testing of cables.<br>ii) Generation of High D.C. Voltages and Currents.: Cockcroft Walton doubler and multistage circuit, Electrostatic generator. Definition of Impulse Voltage and current as per Indian Standard Specification, Wave front and wave tail time, Generation of Impulse Voltage, Multistage Impulse generator, tripping and control of impulse generators. | 6L |
| Module III | Measurement of High Voltages and Currents<br>Peak voltage, impulse voltage and high direct current measurement method as per Indian Standard Specifications, cathode ray oscillographs for impulse voltage and current measurement, Sphere gap voltmeter, Resistance and Capacitance Potential dividers, Peak voltmeters for measurement of high A.C. voltage in conjunction with capacitance dividers. Capacitance Voltage Transformer, Rotating Voltmeter for the measurement of D.C. high voltage, partial discharge measurements, Electrostatic Voltmeter. | 4L |
| Module IV | Lightning and Switching Over-voltages<br>Lightning Phenomena, Charge formation in the Clouds, Development of Lightning Stroke, lightning induced over voltage, direct stroke, indirect stroke. Protection of Electrical Apparatus against over voltage, Lightning Arrestors, Valve Type, Metal Oxide arresters, Expulsion type. Effect of location of lightning arresters on protection of transformer. Protection of substation, Ground wires, Surge diverters, Surge absorbers, Insulation Coordination, Basic Insulation level. Basic Impulse level, Switching Impulse level. Volt time characteristics of protective devices, Determination of Basic Impulse level of substation equipment. | 8L |
| Module V | High Voltage Testing of Electrical Apparatus and High Voltage Laboratories<br>Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, induced over voltage and impulse test on transformers, Power frequency dry and wet withstand test of insulators, Impulse test on insulators, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H.V. Laboratories. | 5L |
| | Total | 36L |

**Text Books:**


1 High Voltage Engineering, C.L. Wadhwa, New Age International Publishers.
2 High Voltage Engineering, M.S. Naidu & V. Kamaraju, Tata McGraw Hill Publication.
3 Extra High Voltage AC Transmission Engineering, R.D. Bgamudre, New Age Internal Publishers.
4 D. V. Razevig (Translated by Dr. M. P. Chourasia), —High Voltage Engineering Fundamentals, Khanna Publishers.


**Reference Books:**


1 High Voltage Engineering, M.A. Salem, H. Anis, A. E. Morahedy, R. Radwan, Marcel Dekker, Inc.
2 E. Kuffel, W. S. Zaengl and J. Kuffel, —High Voltage Engineering Fundamentals, NewnesPublication.
3 R. Arora and W. Mosch —High Voltage and Electrical Insulation Engineering, John Wiley & Sons.
4 Various IS standards for HV Laboratory Techniques and Testing.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE605C | Computer Architecture | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Digital Electronics and Computer Organization. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE605C.1 | Apply | Explain basics of computer architecture, compare RISC vs CISC, illustrate Amdahl's law and Benchman Programs |
| EE605C.2 | Apply | Illustrate Basic concepts of Pipelining, differentiate Linear vs. Non Linear, Static vs. Dynamic, Unifunction vs. Multifunction. define Instruction Pipeline, Arithmetic pipeline. explain Data hazards and Techniques for handling hazards |
| EE605C.3 | Apply | Explain Basic Concepts Instruction-Level Parallelism, Techniques For Increasing ILP, define Superscalar and Super Pipelined, illustater VLIW Processor Architectures and Array and Vector Processors |
| EE605C.4 | Apply | Illustrate Memory Hierarchy, Mapping Technique in cache memory and explain Performance Implementation in Cache Memory |
| EE605C.5 | Apply | Explain Parallel Architecture, classify different classification scheme, elucidate performance of parallel, operation of Interconnection Network, Multi-Core Processor, differentiate Different Classification scheme: Serial Vs. Parallel, Pipeline vs. Parallel |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | | | | | | | | | 3 | | |
| 2 | CO2 | 2 | 3 | | | | | | | | | | | 2 | | |
| 3 | CO3 | 2 | 3 | | | | | | | | | | | 3 | | |
| 4 | CO4 | 2 | 3 | | | | | | | | | | | 2 | | |
| 5 | CO5 | 2 | 3 | | | | | | | | | | | 3 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction<br>Introduction to basic computer architecture. (1L)<br>Stored Program Concepts: Von Neumann & Havard Architecture. (1L)<br>RISC VS CISC (1L)<br>Amdahl's law. (1L)<br>Performance Measure: MIPS, Benchman Programs (SPECINT,SPECFP). (1L) | 5L |
| Module II | Pipelining<br>Pipelining: Basic concepts, Linear vs. Non Linear, Static vs. Dynamic, Unifunction vs. Multifunction. (2L)<br>Instruction Pipeline. (1L)<br>Arithmetic pipeline. (1L)<br>Hazards: Data hazards, control hazards and structural hazards. (1L)<br>Techniques for handling hazards. (1L) | 6L |
| Module III | Instruction-level parallelism<br>Instruction-Level Parallelism: Basic Concepts (1L)<br>Techniques For Increasing ILP, Superscalar, Super Pipelined (1L)<br>VLIW Processor Architectures (1L)<br>Array and Vector Processors (1L) | 4L |
| Module IV | Memory<br>Memory Hierarchy: Internal Memory, Main Memory, Cache Memory, Secondary memory. (2L)<br>Mapping Technique in cache memory: Direct, Full Associative and Set Associative. (2L)<br>Performance Implementation in Cache Memory. (1L) | 5L |
| Module V | Multiprocessor Architecture<br>Introduction to Parallel Architecture-Different Classification scheme, Performance of | 16L |

Parallel Computers, PRAM model (EREW, CREW, CRCW) (6L)
Interconnection Network (Omega, Baseline, Butterfly, Crossbar) (6L)
Multi-Core Processor with case study (INTEL) (2L)
Different Classification scheme: Serial Vs. Parallel, Pipeline vs. Parallel (2L)

Total 36L

**Text Books:**


1 Patterson D.A. and Hennessy , J.L. —Computer architecture a quantitative approach, 2nd ed., Morgan Kaufman, 1996
2 Stone, H.S., —Advanced Computer, Addison Wesley, 1989
3 Siegel, H.J., —Interconnection Network for Large Scale parallel Processing, 2nd Ed., McGraw Hill, 1990


**Reference Books:**


1 Hwang & Briggs—Computer Architecture & Parallel Processing, TMH
2 Hayes J. P., —Computer Architecture & Organisation||, McGraw Hill
3 Design and Analysis of Prallel Algorithm-Schim G. Akl

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE691 | Microprocessor & Microcontroller Laboratory | - | - | 2 | - | 1 | 40 | 60 | 100 |
| Pre-requisite | Knowledge in Digital Electronics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE691.1 | Apply | Conduct experiment to familiarize with 8085 register level architecture, write programming using 8085 kit for addition, subtraction, multiplication by repeated addition method, square, complement, look up table, copying a block of memory, shifting, packing and unpacking of BCD numbers, addition of BCD numbers. Binary to ASCII conversion. |
| EE691.2 | Apply | Write programming using 8086 trainer kit for addition, subtraction, multiplication & division of two 16-bit numbers, factorial of two 16-bit numbers, smallest and largest number from an array of numbers, ascending order, descending order, string matching, multiplication using shift and add method |
| EE691.3 | Apply | Conduct experiment to interface stepper motor with 8086 trainer kit using 8255, interface seven segment display using 8086 trainer kit and to display a string |
| EE691.4 | Apply | Write program using arithmetic, logical and bit manipulation instructions of 8051, verify timer/counter, verify interrupt handling, display a string on screen |
| EE691.5 | Apply | Perform experiments on microprocessor in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE691.6 | Apply | Perform experiments on microprocessor, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | 2 | 3 | 2 | | | | | | | | | 3 | 2 |
| 2 | CO2 | | | 2 | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | | | 2 | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 4 | CO4 | | | 2 | 3 | 2 | | | | | | | | 3 | 3 | 2 |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Demonstration Programs for 8085 Trainer Kit

Experiment - 1 Familiarization with 8085 register level architecture, the basic instruction sets (data transfer, arithmetic, logical, branching) and the trainer kit components including thememory map.

Experiment – 2 Familiarization with the process of storing, executing and viewing the contents of memory as well as registers in the trainer kit 8085 and simulator through small assignments.

Experiment – 3 Programming using 8085 kit and simulator for: Addition, Subtraction, Multiplication by repeated addition method, Square, Complement, look up table, copying a block of memory, Shifting, Packing and unpacking of BCD numbers, Addition of BCD numbers, Binary to ASCII conversion.

Demonstration Programs for 8086 Trainer Kit

Experiment - 4 Addition, Subtraction, Multiplication & division of two 16-bit numbers using 8086 trainer kit

Experiment – 5 Factorial of two 16-bit numbers using 8086 trainer kit

Experiment – 6 Smallest and Largest number from an array of numbers, Ascending order, Descending Order, String Matching, Multiplication using shift and add method using 8086 trainer kit.

Interfacing with 8086

Experiment – 7 Interfacing Stepper motor with 8086 trainer kit using 8255

Experiment – 8 Interfacing Seven Segment Display using 8086 trainer kit and to display a string

Interfacing with 8051

Experiment – 9 Programming using arithmetic, logical and bit manipulation instructions of 8051

Experiment – 10 Program and verify Timer/Counter in 8051
Experiment – 11 Program and verify Interrupt handling in 8051
Additional Programs
Experiment – 12 Read a character from a keyboard and display it on Screen
Experiment – 13 Display a string on screen
Experiment - 14 To check for a Password

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE692 | Power System-II Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Circuit Theory, Electrical Machines – I, Power System – I. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE692.1 | Analyze | Conduct experiment to study on (i) on load time delay relay, (ii) off load time delay relay, (iii) under voltage relay and (iv) earth fault relay (v) over current relay. |
| EE692.2 | Analyze | Conduct experiment on polarity and ratio test and study magnetization characteristics of CT & PT. |
| EE692.3 | Analyze | Conduct experiment to study on dc load flow, ac load flow using Gauss – Seidel method and Newton – Raphson method, software simulation (Etap, MATLAB or others). |
| EE692.4 | Analyze | Perform simulation experiment to study of transformer protection, generator protection and motor protection. |
| EE692.5 | Apply | Perform experiments on power system in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE692.6 | Apply | Perform experiments on power system, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | 3 | | | | | | | | | | 3 | 2 | 2 |
| 2 | CO2 | 2 | | 3 | | | | | | | | | | 3 | 2 | 2 |
| 3 | CO3 | | 3 | 3 | 2 | | | | | | | | | 3 | 2 | |
| 4 | CO4 | | | 3 | 2 | | | | | | | | | 3 | | |
| 5 | CO5 | | | | | | | | 3 | | | | | | | |
| 6 | CO6 | | | | | | | 2 | | 3 | | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Study on (i) on load Time Delay Relay (ii) off load Time Delay Relay
Experiment - 2 Polarity, Ratio and Magnetization Characteristics Test of CT & PT
Experiment – 3 Testing on (i) Under Voltage Relay and (ii) Earth Fault Relay
Experiment - 4 Study on D C Load Flow
Experiment – 5 Study of A C Load Flow Using Gauss – Seidel Method
Experiment - 6 Study of A C Load Flow Using Newton – Raphson Method
Experiment – 7 Study of IEEE 30, 66 bus Load Flow by Software Simulation (ETAP, MAT Lab or others)
Experiment - 8 Study on Economic Load Dispatch by software
Experiment – 9 Study of Transformer Protection by Simulation
Experiment – 10 Study of Generator Protection by Simulation
Experiment – 11 Study of Motor Protection by Micon Relay
Experiment - 12 Study of Different Characteristics of Over Current Relay.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE693 | Control System-II Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Knowledge of MATLAB. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE693.1 | Analyze | Use MATLAB simulation software to study state variable analysis simulation tools, design of lead and lag compensation, state variable analysis using CACSAD command & block diagram tool, analysis performance of a discrete time system using CACSAD tool |
| EE693.2 | Analyze | Use MATLAB simulation software to study the effects of nonlinearity in a feedback controlled system using time response and phase plane plots |
| EE693.3 | Apply | Perform experiments on control system in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE693.4 | Apply | Perform experiments on control system, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | 3 |
| 2 | CO2 | | 3 | 3 | 3 | 2 | | | | | | | | 3 | 3 | 3 |
| 3 | CO3 | | | | | | | | | 3 | | | | | | |
| 4 | CO4 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Study of a Practical Position Control System:
Obtaining closed step responses for gain setting corresponding to over-damped and underdamped responses. Determination of rise time and peak time using individualized components in SIMULINK. Determination of un-damped natural frequency and damping ratio from the experimental data.

Experiment - 2 Tuning of P, PI and PID Controller for First Order Plant with Dead Time using Z-N Method:
Process parameters (time constant and delay/lag) will be provided, the students would compute controller gains by using Z-N method. Steady state and transient performance of the closed loop plant with and without steady disturbances will have to be noted.
Theoretical phase and gain margins will have to be manually computed for each gain settings.

Experiment - 3 Design of Lead and Lag Compensation Using Cacsad Tools:
Plant transfer function will be provided. Step response is to be obtained. (PSPICE, MATLAB, SciLab may be used).

Experiment - 4 State Variable Analysis using Cacsad Command Tool:
Familiarization and use of CACSAD command for state variable analysis. Obtaining transfer function from SV model and vice versa. Obtaining step response for a SISO system given in SV form. (PSPICE, MATLAB, SciLab may be used).

Experiment - 5 State Variable Analysis using Cacsad Block Diagram Tool:
Familiarization and use of CACSAD BLOCK DIAGRAM TOOL for state variable analysis. Obtaining step response and initial condition response for a single input, two output system given in SV form. (PSPICE, MATLAB, SciLab may be used).

Experiment - 6 Performance Analysis of a Discrete Time System using Cacsad Tool:
Familiarization and use of CACSAD block diagram tool for Digital Control System. Study of closed response of a continuous system with a digital controller with sample and hold. (PSPICE, MATLAB, SciLab may be used).

Experiment - 7 Studying The Effects of Nonlinearity in a Feedback Controlled System using Time Response:
Determination of step response with a limiter nonlinearity introduced into the forward path of 2nd order unity feedback control systems. The open loop plant will have one pole at the origin and the other pole will be in LHP or RHP. To verify that (i) with open loop stable

| | |
|---|---|
| | pole, the response is slowed down for larger amplitude input and (ii) for unstable plant, the closed loop system may become oscillatory with large input amplitude. (PSPICE, MATLAB, SciLab may be used). |
| Experiment - 8 | Studying The Effects of Nonlinearity in a Feedback Controlled System using Phase Plane Plots: Determination of phase plane trajectory and possibility of limit cycle of common nonlinearities. CACSAD block diagram tool will be used (PSPICE, MATLAB, SciLab may be used). |

**Reference Books:**

1 Herniter, Programming in MATLAB, Vikas
2 Ogata K : Modern Control Engg. 4e, Pearson/PHI

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE694A | Data Base Management System Laboratory | L | T | P | S | C | IA | SEE | Total |
| | | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | 1. Logic of programming language<br>2. Basic concepts of data structure and algorithms | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE694A.1 | Understand | Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery. |
| EE694A.2 | Understand | Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases. |
| EE694A.3 | Understand | Conduct experiment on DBMS to design using E-R model and Normalization, design and implementation Library Management System |
| EE694A.4 | Analyze | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE694A.5 | Apply | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | 2 | | | | | | | | | 2 | |
| 2 | CO2 | | | | 2 | 2 | | | | | | | | | 2 | |
| 3 | CO3 | | | | 2 | 3 | | | | | | 3 | | 3 | 3 | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment - 1 Structured Query Language

1) Creating Database:- a) Creating a Database, b) Creating a Table Specifying Relational Data Types, c) Specifying Constraints Creating Indexes
2) Table and Record Handling:- a) INSERT statement, b) Using SELECT and INSERT together, c) DELETE, UPDATE, TRUNCATE statements, d) DROP, ALTER statements
3) Retrieving Data from a Database:- a) The SELECT statement, b) Using the WHERE clause, c) Using Logical Operators in the WHERE clause , d) Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using Aggregate Functions, e) Combining Tables Using JOINS, f) Sub-queries
4) Database Management:- a) Creating Views, b) Creating Column Aliases, c) Creating Database Users, d) Using GRANT and REVOKE

Experiment - 2 PL/SQL
Experiment - 3 Database design using E-R model and Normalization
Experiment - 4 Design and implementation of some on line system [Library Management System]

**Text Books:**

1 SQL, PL/SQL by Ivan Bayross, BPB Publications
2 Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE694B | Embedded Systems Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Concept of Digital Electronics Lab, Microprocessor and Microcontroller Lab. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE694B.1 | Understand | Familiarization of PIC kit, interface and control a LED, LCD, Keyboard, ADC & DAC using PIC, connect two PIC kit and transfer data serially, design a digital watch based on PIC, control a stepper motor and display temperature from a temperature sensor on a LCD. |
| EE694B.2 | Apply | Familiarization with ARM evaluation system, with Raspberry Pi, with image processing using ARM, interfacing with a real time clock using a serial port to display time, interface a Keyboard and display the keystrokes on a LCD, LED. |
| EE694B.3 | Apply | Design a 3 to 8 decoder circuit, an UP/DOWN counter and display the count on a 7-segment display, an ALU and verify with mathematical operations usig FPGA |
| EE694B.4 | Apply | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE694B.5 | Apply | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | 2 | | | | | | | | | 2 | |
| 2 | CO2 | | | | 2 | 2 | | | | | | | | | 2 | |
| 3 | CO3 | | | 3 | 3 | 3 | | | | | | 3 | | 3 | 3 | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment – 1 PIC based experiment (Any Five)
a) Familiarization of PIC kit.
b) Interface and control a LED, LCD, Keyboard, ADC & DAC using PIC.
c) Connect two PIC kit and transfer data serially.
d) Design a Digital watch based on PIC.
e) Control a stepper motor and display temperature from a temperature sensor on a LCD.

Experiment – 2 ARM based experiment (Any Four)
a) Familiarization with ARM evaluation system
b) Familiarization with Raspberry Pi
c) Interfacing with a real time clock using a serial port to display time.
d) Interface a Keyboard and display the keystrokes on a LCD, LED.
e) Familiarization of image processing using ARM

Experiment - 3 FPGA based experiment
a) Design a 3 to 8 decoder circuit.
b) Design an UP/DOWN counter and display the count on a 7-segment display.
c) Designing an ALU and verify with mathematical operations.
d) Innovative Project.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VI |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE694C | Software Engineering Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | For Software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE694C.1 | Remember | Handle software development models through rational method. |
| EE694C.2 | Understand | Prepare SRS document, design document, test cases and software configuration management and risk management related document. |
| EE694C.3 | Apply | Develop function oriented and object oriented software design using tools like rational rose. |
| EE694C.4 | Apply | Perform unit testing, integration testing, apply various white box and black box testing techniques. |
| EE694C.5 | Create | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | 2 | | | | | | | | | 2 | |
| 2 | CO2 | | | | 2 | 2 | | | | | | | | | 2 | |
| 3 | CO3 | | | 3 | 3 | 3 | | | | | | 3 | | 3 | 3 | |
| 4 | CO4 | | | | | | | | | 3 | | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems. |
| Experiment - 2 | Project Schedule preparation. Software Requirement Analysis: Describe the individualPhases/ modules of the project, Identify deliverables. |
| Experiment - 3 | Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepareSoftware Design Document using tools like Rational Rose.( For standard application problems) |
| Experiment - 4 | Software Development and Debugging. Estimation of project size using Function Point (FP) for calculation. |
| Experiment - 5 | Design Test Script/Test Plan(both Black box and White Box approach) |
| Experiment - 6 | Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Costetc.) Cost Estimation models. COCOMO |

**Text Books:**

1 Software Engineering: Apractitioner‘s approach – Pressman (TMH)
2 Software Engineering – Pankaj Jalote (Wiley-India)

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE701 | Electrical Drivers | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Electrical Machines, and Power Electronics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE701.1 | Apply | Understand to demonstrate the various drive mechanisms and the impact of electrical drives & the dynamics of electrical drive systems. |
| EE701.2 | Apply | Develop closed loop control strategies of drives and selection of motors for a specific application |
| EE701.3 | Apply | Operate solid state drives for speed control of DC machines & other various special electrical machines. |
| EE701.4 | Apply | Evaluate the performance of induction motor drives and synchronous motor drives |
| EE701.5 | Apply | Analyze new control and power conversion schemes and justify it for implementing alternative solutions considering the critical and contemporary issues. |
| EE701.6 | Apply | Apply engineering knowledge in designing, analyzing of electric drive systems. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | 3 | | | | | | | | | | | 3 | | |
| 2 | CO2 | 3 | 3 | 3 | 3 | 2 | | | 2 | | | | | 3 | 2 | 2 |
| 3 | CO3 | 3 | 3 | | | 2 | | | 2 | | | | | 3 | 2 | 2 |
| 4 | CO4 | 3 | 3 | | 2 | 2 | | | 2 | | | | | 3 | 2 | 2 |
| 5 | CO5 | 2 | 3 | 2 | | 2 | | | | | | | | 3 | 2 | 2 |
| 6 | CO6 | 3 | 3 | 3 | | 2 | | | 2 | | | | | 3 | 2 | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Fundamental Concept of Electric Drive<br>Definition of electric drive, type of drives; Speed torque characteristic of driven unit/loads, motors, Concept of Multi-quadrant operation, Classification and components of load torque; Equivalent value of drive parameters for loads with rotational and translational motion. | 3L |
| Module II | Electric Braking<br>Electric Braking of DC motor during lowering of loads and stopping, Regenerative braking, AC and DC rheostatic braking. | 3L |
| Module III | Selection of motor power rating<br>Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, Load equalization | 2L |
| Module IV | DC Motor Drives<br>Ward-Leonard System, Single phase and three phases controlled DC drives, Dual converter control of DC drives. Chopper controlled DC drives, Close loop control of DC drive. | 7L |
| Module V | Induction Motor Drives<br>Review of three phase Induction Motor analysis and performance, Stator voltage control, V/f controlled induction motors, Slip power recovery, CSI fed induction motor drives. | 8L |
| Module VI | Synchronous Motor Drives<br>Introduction, Sinusoidal SPM machine drives, synchronous reluctance machine drives, wound field synchronous motor drive, Load-commutated Synchronous Motor Drives, Model of PMSM. | 10L |
| Module VII | Application and Energy conversion Drives<br>Introduction to Battery Powered Drive for Solar System, Stepper motor Drive, Steel Mills, Paper Mills, Coal Mining, Energy Efficient operation and power factor improvement of drives. | 3L |
| | | Total 36L |

**Text Books:**

1 G. K. Dubey, —Fundamentals of Electrical Drives, Narosa, 2001.
2 R. Krishnan, —Electric Motor Drives: Modeling, Analysis and Control, PHI-India, 2005.
3 N. K. De and P. K. Sen, —Electric Drives, Prentice Hall of India Private Limited, 2006.
4 S. K. Pillai, —A First Course on Electrical Drives, New Age International.
5 S. B. Dewan, G. R. Slemon and A. Straughen, —Power Semiconductor Drives, John Wiley and Sons, New York 1984.

**Reference Books:**

1 G. K. Dubey, —Power Semiconductor Controlled Drives, Prentice Hall international, New Jersey, 1989.
2 B. K. Bose, —Modern Power Electronics and AC Drives, Pearson Education Asia, 2003.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE702A | Object Oriented Programming using JAVA | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Computer Fundamentals.<br>2. Basic understanding of Computer Programming and related Programming Paradigms.<br>3. Problem Solving Techniques with proper logic Implementation. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE702A.1 | Remember | Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming. |
| EE702A.2 | Understand | Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java. |
| EE702A.3 | Apply | Analyze various activities of different string handling functions with various I/O operations. |
| EE702A.4 | Apply | Discuss basic code reusability feature w.r.t. Inheritance, Package and Interface. |
| EE702A.5 | Analyze | Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | 3 | | 3 | | | | 2 | | | | 2 | 3 | |
| 2 | CO2 | 2 | | | | 3 | | | | | | | | 2 | | |
| 3 | CO3 | | 2 | | | 3 | | | | | | | | 2 | 2 | |
| 4 | CO4 | 2 | | | | 3 | | | | | | | | 2 | | |
| 5 | CO5 | | 2 | | | 3 | | | | | | 2 | | 2 | 2 | |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction<br>Object Oriented Analysis and Design-Concepts of object oriented programming language, Object, Class; Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class; Object Oriented Programming concepts – Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, Method; Properties of OOP- message passing, inheritance, encapsulation, polymorphism, Data abstraction; Difference between different OOPs Languages. | 5L |
| Module II | Java Basics<br>Basic concepts of java programming - Advantages of java, Byte-code and JVM, Data types, Different types of Variables; Access specifiers, Operators, Control statements and loops; Array; Creation of class, object, method; Constructor - Definition, Usage of Constructor, Different types of Constructor; finalize method and garbage collection, Method and Constructor overloading; this keyword, use of objects as parameter & methods returning objects; Call by value & call by reference; Static variables & methods. Nested & inner classes. | 9L |
| Module III | Basic String handling & I/O<br>Basic string handling concepts- Concept of mutable and immutable string, Methods of String classcharAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length(), substring(); toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt(); ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(); Command line arguments, basics of I/O operations – keyboard input using BufferedReader&Scanner classes. | 4L |
| Module IV | Inheritance and Java Packages<br>Inheritance - Definition, Advantages, Different types of inheritance and their implementation;Super and final keywords, super() method; Method overriding, Dynamic method dispatch; Abstract classes and methods; Interface - Definition, Use of Interface; | 8L |

| | | |
|---|---|---|
| | Multiple inheritance by using Interface; Java Packages - Definition, Creation of packages; Importing packages, member access for packages. | |
| Module V | Exception handling, Multithreading and Applet Programming<br>Exception handling - Basics, different types of exception classes. Difference between Checked &Unchecked Exception; Try & catch related case studies; Throw, throws & finally; Creation of user defined exception; Multithreading - Basics, main thread, thread life cycle; Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive(); Thread priorities, thread synchronization; Interthread communication, deadlocks for threads; Applet Programming - Basics, applet life cycle, difference between application & applet programming; Parameter passing in applets. | 10L |
| | Total | 36L |

**Text Books:**

1 Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2 E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

**Reference Books:**

1 R. K. Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2 Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE702B | Big Data Analysis | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Familiarity and knowledge of Database Management Systems. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE702B.1 | Apply | Identify the difference between structured, semi-structured and unstructured data. |
| EE702B.2 | Apply | Summarize the challenges of big data and how to deal with the same. |
| EE702B.3 | Apply | Explain Hadoop Ecosystem. |
| EE702B.4 | Apply | Identify the difference between Pig and Hive. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | 3 | | | | | | | | 2 | | |
| 2 | CO2 | 2 | | | | 3 | 3 | | 3 | 2 | 3 | 3 | 3 | 3 | | |
| 3 | CO3 | | 2 | | | 3 | | | | | | | | 2 | | |
| 4 | CO4 | | 2 | | 2 | 3 | | | | | | | | 2 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Data and Big Data Analytics<br>Types of digital data: Structured: Sources of structured data and Ease with Structured data Semi- Structured: sources of semi-structured data Unstructured: sources of unstructured data: Issues with terminology, dealing with unstructured data. (2L)<br>Big data analytics-1: Characteristics of data-Definition of big data-Challenges of big data Traditional BI vs. Big data-A typical BI environment-A big data environment-Big data stack. (2L)<br>Big data analytics-2: Classification of analytics-Top challenges facing big data-Data science. (2L)<br>Terminologies used in big data environment: In memory analytics-In database processing. Massively parallel processing-Parallel vs distributed systems-Shared Memory architecture CAP (Consistency, Availability, Partition Tolerance) theorem explained- BASE (Basically Available Soft State Eventual Consistency)-Few top Analytics tools. (2L) | 8L |
| Module II | Big Data Technology and Hadoop<br>The big data technology landscape: NoSQL-Types of NoSQL databases-Why NoSQL - Advantages of NoSQL- What we miss with NoSQL?-NoSQL Vendors SQL Vs. NoSQL. NewSQL - Comparison of SQL, NoSQL and NewSQL. (1L)<br>Hadoop: Features of Hadoop- Key advantages of Hadoop- Versions of Hadoop-Hadoop 1.0 Hadoop2.0- Overview of Hadoop Ecosystems- Hadoop Vs. SQL- Integrated Hadoop systems offered by leading market vendors-Cloud based Hadoop solutions. (2L)<br>Introducing Hadoop: Why not RDBMS-Distributed Computing Challenges. Hadoop Overview: Hadoop Components-High Level Architecture of Hadoop. Hadoop Distributed File System: HDFS Architecture-Daemons Related to HDFS- Working with HDFS Command-Special Features of Hadoop. (2L)<br>Processing Data With Hadoop: Introduction-How Map Reduce Works-Map Reduce Example. Word Count Example using Java. (2L)<br>Managing Resources and Applications with YARN: Introduction-Limitation of Hadoop 1.0-Hadoop2: HDFS-Hadoop 2: YARN-Business Intelligence on Hadoop. (2L) | 9L |
| Module III | Hadoop Hive<br>Introduction to Hive - The Problem Solution: Hive Use Case- Data Growth- Schema Flexibility and Evolution- Extensibility. What is Hive: History of Hive and Recent Releases of Hive-Hive Features-Hive Integration and Work Flow- Hive Data Units. Hive Architecture-Hive Primitive Data Types and Collection Types-Hive File Formats-Hive Query Language Statements: DDL-DML. Hive Partitions-Bucketing-Views-Sub Query-Joins Hive User Defined. (4L) | 10L |

| | | |
|---|---|---|
| | Function-Aggregations in Hive-Group by and Having-Serialization and Deserialization-Hive Analytic Functions. (6L) | |
| Module IV | Hadoop – Pig<br>Hadoop – Pig: Introducing Pig: History and Anatomy of Pig-Pig on Hadoop-Pig Features-PigPhilosophy-Word count example using Pig-Use Case for Pig-Pig Primitive Data Types, Collection Typesand NULL. (2L)<br>Pig Latin Overview: Pig Latin Grammar - Comments, Keywords, Identifiers-Case sensitivity in Pig-Common Operators in Pig. (1L)<br>Pig Statements: LOAD-STORE-DUMP-Interactive Shell – GRUNT: FILTER- SORTGROUP BYORDER BYJOIN-LIMIT. (2L)<br>Pig Latin Script: Local Mode-Map Reduce Mode-Running Pig Script. Working with: Field Tuple- Bag. User Defined Function-Parameters in Pig. (2L)<br>Jasper Report using Jasper soft studio: Introduction to Jasper Report using Jasper Soft Studio Reportingusing MongoDB-Reporting using Cassandra. (2L) | 9L |
| | | Total 36L |

**Text Books:**


1 Mark Dexter, Louis Landry, —Joomla Programming, 2012 Pearson Education.
2 Seema Acharya and Subhashini C, —Big Data and Analytics, Wiley Publication, 2015


**Reference Books:**


1 Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, —Big data for dummies, Wiley Publication, 2013.
2 Tom White, —Hadoop: The Definitive Guide, O‟Rilly Publication, 2015.
3 Chuck Lam, —Hadoop in action, Dreamtech Press, 2011.
4 Dirk Deroos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, —Hadoop for dummies, Wileypublication, 2015.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE702C | Digital Image Processing | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Basic concept of vectors and matrices (relation between a column matrix and vector), inner product of two vectors, matrix multiplication, inversion, extracting Eigenvectors and Eigen values of a matrix, covariance matrix. Perception of dimensionality and hyper plane. Distance measures in Euclidean space between two points (e.g. Euclidean distance) and a point with a group of points (Mahalanobisdistance). Knowledge about statistical distributions (e.g. Normal/ Gaussian), statistical independence, probability distribution function, condition probability, the law of total probability and Bayes rule. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE702C.1 | Apply | Explain the structure of human eye, image formation, Brightness, sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, spectrum analysis. |
| EE702C.2 | Apply | Illustrate image Enhancement in the Spatial and Frequency Domain, image transformations, Histogram processing, time and Spatial filtering. |
| EE702C.3 | Apply | Evaluate Image and video Data Compression, Redundancies. |
| EE702C.4 | Apply | Develop Morphological Processed Image using Dilation, Erosion, Opening, closing, Hit -or-miss transformation. |
| EE702C.5 | Apply | Evaluate Image Segmentation by detection of discontinuities, Edge linking and Boundary detection, Thresholding, Image Representation schemes, Boundary descriptors, and Regional descriptors. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | | | | | | | | | | | |
| 2 | CO2 | | 2 | | | 3 | | | | | | | 2 | 2 | | |
| 3 | CO3 | | 3 | 2 | | 3 | | | | 2 | 3 | 2 | 2 | 2 | | |
| 4 | CO4 | | | 3 | | 3 | | | | 2 | | | 2 | 2 | | |
| 5 | CO5 | | 3 | 2 | | 3 | | | | 2 | 3 | 2 | 2 | 2 | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Digital Imaging Fundamentals and Its Transform<br>Digital Imaging Fundamentals: Basic idea of Digital image, Image formation in human eye, Pixel, Mathematical operation of Digital Image, Sampling, Quantization, application of digital Image Processing. (3L)<br>Transform of Digital Images: Importance of Digital Image Transform, Fourier Transform of Digital Image (DFT), Inverse Fourier Transform (IDFT), Fast Fourier Transform, Inverse Fast Fourier Transform, Application of Digital Image Transform in different area. (4L) | 7L |
| Module II | Digital Image Enhancement<br>Importance of Digital Image enhancement, enhancement in spatial and frequency domain, Bit plane slicing, Histogram, Histogram Equalization , Mean and Median filtering in Digital Images, Frequency domain filtering in Digital Images – LPF, HPF and BPF. | 6L |
| Module III | Digital Image Compression<br>Importance of Digital Image Compression, Types of Image Compression, example of lossless and lossy compression, Image compression standards, Compression in spatial domain, compression using Huffman coding, DCT and Wavelet based Digital image compression. | 6L |
| Module IV | Digital Image Restoration and Segmentation<br>Digital Image Restoration: Application and Importance of Digital Image Restoration, Reason for Image degradation, Inverse filtering. (3L)<br>Segmentation of Digital Images: Importance and applications of Digital Image Segmentation, Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Segmentation based on Region Growing, Waters head algorithm. (5L) | 8L |

| | | |
|---|---|---|
| Module V | Edge Detection and Security<br>Edge Detection in Digital Image Processing: Importance of Edge detection in Digital Image Processing, Types of Edge Detection, Mathematical Equation of each operator. (4L)<br>Security in Digital Image Processing: Importance of Digital Image Security, Watermarking, Image encryption in spatial and frequency domain, Steganography. (4L) | 8L |
| | Total | 36L |

**Text Books:**


1. Rafael C. Gonzales, Richard E. Woods, —Digital Image Processing||, Third Edition, Pearson Education, 2010.
2. S. Annadurai, R. Shanmugalakshmi, —Fundamentals of Digital Image Processing||, Pearson Education, 2006.


**Reference Books:**


1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, —Digital Image Processing Using MATLAB, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2. Anil Jain K. —Fundamentals of Digital Image Processing, PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, —Digital Image Processing, John Willey, 2002.
4. Malay K. Pakhira, —Digital Image Processing and Pattern Recognition||, First Edition, PHI Learning Pvt. Ltd., 2011.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE703A | Power System-III | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | 1. Familiarity with the fundamentals of C or other programming language.<br>2. A solid background in mathematics, including probability, set theory. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE703A.1 | Apply | Explain the objectives of power system operation, power systems in restructured environment, define distributed and dispersed generation; elucidate environment aspects of electric power generation. |
| EE703A.2 | Apply | Illustrate generation cost curves, economic operation of thermal system, define transmission loss and penalty factor, explain plant scheduling, hydro-thermal scheduling, concept of unit commitment |
| EE703A.3 | Apply | Explain the concept of AVR and ALFC loops, significance of double loop in ALFC; operation of exciter and VAR control, illustrate single area and two area load frequency control |
| EE703A.4 | Apply | Explain the operation of reactive power sensitivity and voltage control, load compensation with capacitor banks, line compensation with reactors, shunt and series compensation, fixed series capacitors, thyristor controlled series capacitors (TCSC), working of SVC and STATCOM, UPFC. |
| EE703A.5 | Apply | Classify and explain types of system transients, explain overvoltage in transmission lines, define propagation of surges and travelling waves, illustrate working of lightning and surges protection |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | | | | | | | | | | | 2 |
| 2 | CO2 | 2 | | | | | | | | | | | | 3 | | 2 |
| 3 | CO3 | | 3 | | | | | | | | | | 2 | 3 | | 3 |
| 4 | CO4 | 2 | | | | | | | | | | | 2 | 3 | | 3 |
| 5 | CO5 | 2 | 3 | | | | | | | | | | 2 | 3 | | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Objectives of Power System Operation<br>Power Systems in Restructured Environment; Distributed and Dispersed Generation; Environment Aspects of Electric Power Generation. | 5L |
| Module II | Economic Operation of Energy Generation Systems<br>Generation Cost Curves; Economic Operation of Thermal System; Plant Scheduling; Transmission Loss and Penalty Factor; Hydro-Thermal Scheduling; Concept of Reserves and Constraints; Unit Commitment. | 9L |
| Module III | Automatic Generation Control<br>Concept of AVR and ALFC Loops, Significance of Double Loop in ALFC; Exciter and VAR Control; Single Area Load Frequency Control; Two Area Load Frequency Control; Frequency Response. | 7L |
| Module IV | Compensation in Power System<br>Reactive Power Sensitivity and Voltage Control; Load Compensation with Capacitor Banks; Line Compensation with Reactors; Shunt and Series Compensation; Fixed Series Capacitors; Thyristor Controlled Series Capacitors (TCSC); Introduction to SVC and STATCOM, UPFC. | 8L |
| Module V | Power System Transients<br>Types of System Transients; Overvoltage in Transmission Lines; Propagation of Surges and Travelling Waves; Protection against Lightning and Surges. | 7L |
| | Total | 36L |

**Text Books:**

1 Kothari and Nagrath, —Power System Engineering, McGraw Hill.
2 John J. Granger and William D. Stevension, —Power System Analysis, McGraw Hill.
3 Allen J. Wood and Bruce F. Woolenberg, —Electric Power Generation, Operation and Control, Willey.

**Reference Books:**

1 Prabha Kundur, —Power System Stability and Control, McGraw Hill.
2 D. P. Kothari and I. J. Nagrath, —Modern Power System Analysis, McGraw Hill.
3 T. K. Nagsarkar and M. S. Sukhija, —Power System Analysis, Pearson.
4 Abhijit Chakrabarti and Sunita Halder, —Power System Analysis, Operation and Control, PHI.
5 Elgerd, Olle Ingemar, —Electric Energy Systems Theory: An Introduction, McGraw Hill.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE703B | Restructured Electrical Power System | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Power System – I and Power System – II. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE703B.1 | Apply | Illustrate the restructuring / deregulation of power industry, explain restructuring process and issues involved in deregulation, identify the reasons and objectives of deregulation of various power systems across the world. |
| EE703B.2 | Apply | Explain the term operational reliability, value of reliability, cost of reliability, procuring reliability resources, operational issues, balancing resources, limits on power transfer, voltage control and reactive support, stability services, system restoration, allocation of transmission capacity between energy and reserve, allocating the costs |
| EE703B.3 | Apply | Classify congestion management methods, calculate ATC, define the term nodal pricing, explain price area congestion management |
| EE703B.4 | Apply | Illustrate the term transmission pricing, classify them, explain roll of transmission pricing, define marginal & composite transmission pricing paradigm and their merits and de-merits, elucidate loss allocation and financial markets associated with electricity markets |
| EE703B.5 | Apply | Explain nature of transmission business, cost based transmission expansion, allocating the cost of transmission, optimal transmission capacity, effect of load fluctuation, load duration curve, transmission demand function, recovery of investment cost, sharing reserve |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | | | | | | | | | 3 | | 2 |
| 2 | CO2 | | 2 | | | | | | | | | | | 3 | | 2 |
| 3 | CO3 | | 2 | | | | | | | | | | | 3 | | |
| 4 | CO4 | | 2 | | | | | | | | | | | 3 | | 2 |
| 5 | CO5 | | 2 | | | | | | | | | | | 3 | | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction to restructuring of power industry<br>Introduction, Reasons for restructuring / deregulation of power industry, Understanding the restructuring process, Introduction to issues involved in deregulation, Reasons and objectives of deregulation of various power systems across the world. | 5L |
| Module II | Power System Operation<br>Introduction, need for operational reliability, value of reliability, cost of reliability, procuring reliability resources, operational issues, balancing resources, effect of generation from stochastic renewable sources, limits on power transfer, voltage control and reactive support, stability services, system restoration, co-optimization of energy and reserve in a centralized electricity market, allocation of transmission capacity between energy and reserve, allocating the costs, who should pay for reserve. | 8L |
| Module III | Transmission Congestion Management<br>Introduction, Classification of congestion management methods, Calculation of ATC, Non-market methods, Market based methods, Nodal pricing, Price area congestion management. | 7L |
| Module IV | Pricing of transmission network usage and loss allocation<br>Introduction to transmission pricing, Principles of transmission pricing, Classification of transmission pricing methods, Rolled-in transmission pricing methods, Marginal transmission pricing paradigm, Composite pricing paradigm, Merits and de-merits of different paradigms,Debated issues in transmission pricing, Introduction to loss allocation, Financial markets associated with electricity markets, Introduction to optimal bidding by a | 8L |

| | | |
|---|---|---|
| | generator company, Optimal bidding methods. | |
| Module V | Investing in Transmission<br>Nature of transmission business, cost based transmission expansion, allocating the cost of transmission, optimal transmission capacity, effect of load fluctuation, load duration curve, the transmission demand function, recovery of variable transmission investment cost, sharing reserve, sharing generating capacity margin. | 8L |
| | Total | 36L |

**Text Books:**

1 Daniel Kirschen and Goran Strbac, Fundamentals of Power System Economics, John Wiley & Sons Ltd, 2004.

**Reference Books:**

1 Sally Hunt, —Making competition work in electricity, John Wiley & Sons, Inc., 2002.

2 Kankar Bhattacharya, Jaap E. Daadler, Math H. J. Bollen, —Operation of Restructured Power Systems, Kluwer Academic Pub., 2001.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE703C | Computer Applications in Power System | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Numerical Methods, Power System – I and Power System – II. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE703C.1 | Apply | Explain Network Equations, Graph Theory, develop Network Matrices from Graph Theoretic Approach, Augment Cut-set Incidence Matrix Cut-set and Circuit Equations, build Algorithm for the Bus Impedance Matrix Modification of ZBUS matrix |
| EE703C.2 | Apply | Illustrate different techniques such as Gauss Saidal method, Newton Raphson method, De-Coupled method, Fast Decoupled method, Modified Fast Decoupled, explain the concept of Optimal Power Flow, solve optimal power flow by Gradient method, by Newton's method Linear Programming Methods, DC load flow, Continuation Power flow |
| EE703C.3 | Apply | Analysis General sensitivity, illustrate generation shift distribution, line outage distribution and compensated shift factors, sensitivity associated with VAR, load bus voltage changes, changes in reactive power generation |
| EE703C.4 | Apply | Define and explain factors Affecting Power System Security, explain Short Circuit Studies of a Large Power System Networks, perform Symmetrical Fault Analysis Using Bus Impedance Matrix, formulate Bus Impedance Matrix, explain Contingency Analysis, Overview of security analysis, select Contingency and define Concentric Relaxation and Bounding |
| EE703C.5 | Apply | Explain power system state estimation, Matrix Formulation, State Estimation of an AC network by Orthogonal Decomposition, detect and identify Bad measurements, illustrate Network Observability and Pseudo measurements of Power Systems State Estimation |
| EE703C.6 | Apply | Explain, formulate and solve problem using numerical integration techniques: One step methods, Taylor series based methods, Forward - Euler's method, Runge-Kutta methods, Trapezoidal method, backward-Euler's method, perform Accuracy and error analysis, numerical stability analysis, Transient stability analysis, elucidate triangular factorization |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 2 | | 3 | 3 | | | | 2 | | | 2 | 3 | 3 | 3 |
| 2 | CO2 | | 2 | | 3 | 3 | | | | 2 | | | 2 | 3 | 3 | 3 |
| 3 | CO3 | | 3 | | 3 | 3 | | | | 2 | | | | 3 | 3 | 3 |
| 4 | CO4 | 2 | 3 | | 3 | 3 | | | | 2 | | | | 3 | 2 | 3 |
| 5 | CO5 | | 3 | | 3 | 3 | | | | 2 | | 2 | 2 | 3 | 2 | 3 |
| 6 | CO6 | | 3 | 3 | 3 | 3 | | | | 2 | | 3 | 3 | 3 | 2 | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Network Formulation and Graph Theory<br>Introduction, Network Equations, Graph Theory, Development of Network Matrices from Graph Theoretic Approach, Augment Cut-set Incidence Matrix Cut-set and Circuit Equations, Building Algorithm for the Bus Impedance Matrix Modification of ZBUS matrix due to changes in the primitive network | 5L |
| Module II | Load Flow Studies<br>Introduction, Different techniques such as Gauss Saidal method, Newton Raphson method, De- Coupled method, Fast Decoupled method, Modified Fast Decoupled, Concept of Optimal Power Flow, Solution of Optimal power flow by Gradient method, Solution of Optimal power flow by Newton's method Linear Programming Methods, DC load flow, Continuation Power flow. | 4L |

| | | |
|---|---|---|
| Module III | Sensitivity Analysis<br>Sensitivity analysis- General sensitivity relations, generation shift distribution factors, line outage distribution factors, compensated shift factors, sensitivity associated with voltage-VAR, sensitivities relating load bus voltage changes in terms of PV bus voltage changes, sensitivity relating changes in reactive power generation for changes in PV Bus Voltage. | 6L |
| Module IV | Power System Security<br>Introduction, Factors Affecting Power System Security, Short Circuit Studies of a Large Power System Networks, Symmetrical Fault Analysis Using Bus Impedance Matrix, Algorithm for Formation of Bus Impedance Matrix, Contingency Analysis: Detection of Network Problems, Overview of security analysis, Linear Sensitivity Factors, Contingency Selection, Concentric Relaxation, Bounding | 7L |
| Module V | Introduction to State Estimation in Power Systems<br>Introduction, Power system state estimation, Maximum Likelihood Concept, Weighted Least Squares Estimation, Introduction, Matrix Formulation, State Estimation of an AC network, Development of Method, State Estimation by Orthogonal Decomposition, An Introduction to Advanced topics in state estimation, Detection and Identification of Bad measurements, Estimation of quantities not being measured, Network Observability and Pseudo measurements, Application of Power Systems State Estimation | 8L |
| Module VI | Numerical Integration Techniques<br>Numerical integration techniques: One step methods, Taylor series based methods, Forward - Euler's method, Runge-Kutta methods, Trapezoidal method, backward-Euler's method, Accuracy and error analysis, Numerical stability analysis, Stiff systems, Step-size selection, Differential algebraic systems, triangular factorization, Power system applications: Transient stability analysis. | 6L |
| | Total | 36L |

**Text Books:**


1 Computer Methods in Power System Analysis, Glenn Stagg and El-abiad, McGraw-Hill.
2 Power System Analysis, Stevenson and Grainger, TATA McgrawHill.
3 Computational Methods for Electric Power Systems, Mariesa Crow, CRC press.
4 Computer-Aided Power Systems Analysis, George Kusic, CRC Press – Indian Edition.


**Reference Books:**


1 Computer Modelling of Electrical Power System, J. Arrilaga and N. R. Wattson, Wiley 2001.
2 Computational Methods for Large Sparse Power System Analysis – An Object Oriented Approach, S. A. Soman, S. A. Khaparde, Kluwer Academic Publishers.
3 Power System Analysis, Hadi Saadat, Tata Mcgraw Hill, New Delhi.
4 Large Networks by Matrix Methods, H. E. Brown, John Wiley.
5 Power Generation Operation & Control, A. J. Wood and B. F. Wollenberg, John Wiley & Sons, Inc.
6 AC-DC Power System Analysis, Jos Arrillaga and Bruce Smith, IEE London UK.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE704A | Power System Dynamics and Control | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Numerical Methods, Electrical Machines, Power Systems and Control Systems. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE704A.1 | Apply | Apply their power system operations knowledge to study stability problems and recognize the impact of power system opertions and control. |
| EE704A.2 | Apply | Build the analysis capability in the framework of linear dynamical systems and issues in modelling. |
| EE704A.3 | Analyze | Possess advanced knowledge of modelling of synchronous machines for dynamic analysis (steady state and short circuit transient analysis). |
| EE704A.4 | Apply | Prepare and study the modelling of synchronous machines excitation systems including speed governors and voltage controllers. |
| EE704A.5 | Analyze | Possess advanced knowledge about methods for dynamic power system analysis, including angular stability, frequency stability, voltage stability and transient stability. |
| EE704A.6 | Apply | Apply the stability analysis knowledge to describe the various methods to enhance the stability of a power system including power system stabilizers and emergency controller. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 2 | | | | | | | | | | | 2 | 2 | |
| 2 | CO2 | | 3 | | | | | | | | 2 | | 2 | 3 | 2 | |
| 3 | CO3 | | 3 | | | | | | | | 2 | | 2 | 3 | 2 | |
| 4 | CO4 | | 3 | | | | | | | | 2 | | 2 | 3 | 2 | |
| 5 | CO5 | | 3 | | | | | | | | 2 | | 2 | 3 | 2 | |
| 6 | CO6 | | 3 | | | | | | | | 2 | | 2 | 3 | 2 | |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction to Power System Operations<br>Introduction to power system stability, Stability problems in Power System. Impact on Power System Operations and control. | 3L |
| Module II | Analysis of Linear Dynamical System and Numerical Methods<br>Analysis of dynamical System, Concept of Equilibrium, Small and Large Disturbance Stability. Modal Analysis of Linear System. Analysis using Numerical Integration Techniques. Issues in Modelling: Slow and Fast Transients, Stiff System. | 5L |
| Module III | Modelling of Synchronous Machines and Associated Controllers<br>Modelling of synchronous machine: Physical Characteristics. Rotor position dependent model. d-q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus. Modelling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors. | 12L |
| Module IV | Stability Analysis<br>Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multimachine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre of Inertia Motion. Load Sharing: Governor droop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs. | 11L |
| Module V | Enhancing System Stability<br>Planning Measures. Stabilizing Controllers (Power System Stabilizers). Operational MeasuresPreventive Control. Emergency Control. | 5L |
| | | Total 36L |

**Text Books:**

1 K. R. Padiyar, —Power System Dynamics, Stability and Control, B. S. Publications, 2002.
2 Prabha Kundur, —Power System Stability and Control, McGraw Hill, 1995.
3 P. Sauer and M. A. Pai, —Power System Dynamics and Stability, Prentice Hall, 1997.

**Reference Books:**

1 A. J. Wood and B. F. Wollenberg, —Power Generation Operation & Control, John Wiley & Sons, Inc.
2 A. Chakrabarti and S. Halder, —Power System Analysis, Operation and Control, PHI.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| EE704B | Power Quality and Facts | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Power Electronics, Synchronous Machine, Power Systems and Control Systems. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE704B.1 | Apply | Study the importance of reactive power requirement & compensation in power system network, assess & evaluate various compensators and compare the shunt and series reactive compensation in ac transmission shunt and series reactive compensation. |
| EE704B.2 | Apply | Demonstrate the working principles and their operating characteristics of FACTS controllers and their role in improving power system performance |
| EE704B.3 | Analyze | Analyse role of SVC, TCSC, STATCOM, SSSC, UPFC in improving the power quality and system dynamics. |
| EE704B.4 | Apply | Study and analyze the effects of harmonics on various equipment's. |
| EE704B.5 | Apply | Demostrate the power quality problems in distribution systems and classification techniques |
| EE704B.6 | Apply | Illustrate the working principles of load compensation using DSTATECOM |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 3 | | | | | | | | | | | | 2 | | 3 |
| 2 | CO2 | 3 | | | | | | | | | 2 | | | 2 | | 3 |
| 3 | CO3 | | 3 | | 3 | 3 | | | | | | | 3 | 3 | | 3 |
| 4 | CO4 | | 3 | | 3 | | | | | | | | | 3 | | 3 |
| 5 | CO5 | 3 | 3 | | | | | | | | 2 | | | 3 | | 3 |
| 6 | CO6 | 3 | | | | 3 | | | | | | | 3 | 3 | | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Transmission Lines and Series/Shunt Reactive Power Compensation<br>Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation. | 4L |
| Module II | Thyristor-based Flexible AC Transmission Controllers (FACTS)<br>Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Harmonics and control of SVC and TCSC. Fault Current Limiter. | 6L |
| Module III | Voltage Source Converter based (FACTS) controllers<br>Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse- Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. | 9L |
| Module IV | Application of FACTS<br>Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM. | 4L |
| Module V | Power Quality Problems in Distribution Systems<br>Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMAcurve. | 4L |

| | | |
|---|---|---|
| Module VI | DSTATCOM<br>Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM. | 9L |
| | Total | 36L |

**Text Books:**


1. N. G. Hingorani and L. Gyugyi, —Understanding FACTS: Concepts and Technology of FACTS Systems, Wiley-IEEE Press, 1999.
2. K. R. Padiyar, —FACTS Controllers in Power Transmission and Distribution, New Age International (P) Ltd. 2007.
3. R. C. Dugan, —Electrical Power Systems Quality||, McGraw Hill Education, 2012.


**Reference Books:**


1. T. J. E. Miller, —Reactive Power Control in Electric Systems||, John Wiley and Sons, New York, 1983.
2. G. T. Heydt, —Electric Power Quality||, Stars in a Circle Publications, 1991.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE704C | HVDC Transmission Systems | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Power System and Power Electronics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE704C.1 | Apply | Find the applicability of HVDC converters in HVDC transmission |
| EE704C.2 | Analyze | Formulate and solve mathematical problems related to rectifier and inverter control methods and learn about different control schemes as well as starting and stopping of DC links. |
| EE704C.3 | Analyze | Analyze the different harmonics generated by the converters and their variation with the change in firing angles. |
| EE704C.4 | Apply | Analyze power system faults happening on both the AC and DC sides of the converters and formulate protection schemes for the same. |
| EE704C.5 | Apply | Illustrate the existing HVDC systems along with MTDC systems and modern transmission system. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | | | | | | | | | 2 | | 3 |
| 2 | CO2 | | 2 | 3 | 3 | | | | | | | | | 3 | 3 | 3 |
| 3 | CO3 | | 3 | | | | | | | | | | | 3 | 3 | 3 |
| 4 | CO4 | | 3 | 3 | | | | | | | | | | 3 | 3 | 3 |
| 5 | CO5 | 2 | 2 | | | | | | | | | | | 3 | | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction<br>Introduction of DC power transmission technology, comparison of AC and DC transmission, limitation of HVDC transmission, reliability of HVDC systems, application of DC transmission, description of DC transmission system, planning for HVDC transmission, modern trends in DC transmission. | 4L |
| Module II | Analysis of HDVC Converters<br>Choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, Characteristics of a twelve pulse converter, detailed analysis of converters. | 6L |
| Module III | Control of HVDC Converter and Systems<br>Necessity of control of a DC link, rectifier control, compounding of rectifiers, power reversal of DC link, voltage dependent current order limit(VDCOL) characteristics of the converter, inverter extinction angle control, pulse phase control, starting and stopping of DC link, constant power control, control scheme of HVDC converters. | 8L |
| Module IV | Harmonics and Filters<br>Generation of harmonics by converters, characteristics of harmonics on DC side, characteristics of current harmonics, characteristic variation of harmonic currents with variation of firing angle and overlap angle, effect of control mode on harmonics, non-characteristic harmonic. Harmonic model and equivalent circuit, use of filter, filter configuration, design of band-pass and high pass filter, protection of filters, DC filters, power line communication and RI noise, filters with voltage source converter HDVC schemes. | 10L |
| Module V | Fault and Protection Schemes in HVDC Systems<br>Nature and types of faults, faults on AC side of the converter stations, converter faults, fault on DC side of the systems, protection against over currents and over voltages, protection of filter units. | 4L |
| Module VI | Multiterminal HVDC Systems<br>Types of multiterminal (MTDC) systems, parallel operation aspect of MTDC Series and shunt devices and principle of operation and control, UPFC and IPFC, modelling of FACTS devices for power system studies. | 8L |
| | | Total 36L |

**Text Books:**

1 S. Kamakshaiah and V. Kamaraju, —HVDC Transmission, Tata McGraw Hill Education.
2 K. R. Padiyar, —HVDC Power Transmission System, Wiley Eastern Limited.
3 J. Arrillaga, —High Voltage Direct Current Transmission, The Institution of Electrical Engineers.

**Reference Books:**

1 Prabha Kundur, —Power System Stability and Control||, McGraw Hill.
2 Abhijit Chakrabarti and Sunita Halder, —Power System Analysis: Operation and Control, PHI Learning Pvt. Ltd.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| HU703 | Industrial & Financial Management | 2 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Basic Mathematics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| HU703.1 | Understand | Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work. |
| HU703.2 | Understand | Explain and describe various technology-based business models and the dynamics of value creation, value proposition, and value capture in industrial enterprises. |
| HU703.3 | Understand | Select, interpret and use different costing techniques as a basis for decisions in various business situations. |
| HU703.4 | Understand | Demonstrate the basic principles of financial accounting and construct reporting. |
| HU703.5 | Understand | Illistrate how the industrial company markets and price it's products considering GST. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | | | 2 | 3 | 3 | | | |
| 2 | CO2 | | | | | | | | | | | 3 | 3 | | | |
| 3 | CO3 | | | | | | | | 3 | | | 3 | 3 | | | |
| 4 | CO4 | | | | | | | | 3 | | 2 | 3 | 3 | | | |
| 5 | CO5 | | | | | | | | 3 | | 2 | 3 | 3 | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction to Accounting<br>Important Definitions, Basic concepts and conventions, Types of Accounts with Golden Rule of Accounting, Journal, Ledger and Trial Balance, Preparation of Trading Account, Profit & Loss A/C and Balance Sheet for business organizations. | 10L |
| Module II | Financial Management<br>Introduction to Financial Management:- Introduction, Definition and concept, scope, objective, functions of Finance Manager.<br>Ratio Analysis:- Definition, Objectives, Advantages & Disadvantages, Classification of Ratios: Liquidity ratios,Capital Structure ratios, Activity ratios & Profitability Ratios.<br>Capital Budgeting:- Nature of Investment Decision, Importance of Capital Budgeting, capital budgeting process,Investment criteria, payback period, Rate of return, cash flow, discounting cash flow NPV method and IRR method, Benefit cost ratio, ARR. | 8L |
| Module III | Cost Accounting and Budget<br>Cost Accounting:- Introduction to cost accounting cost sheet, Marginal cost & C-V-P analysis with BEC.Budget and Budgetary Control:- Concepts of Budget, Budgeting and budgetary control, Master Budget, Zero Based Budget ,Cashbudget, Flexible budget. | 4L |
| Module IV | Working capital management<br>Introduction-working capital concept-financing working capital-importance of working capital- | 2L |
| | Total | 36L |

**Text Books:**

1 Financial Management, Khan & Jain, S. Chand.
2 Management Accounting, Khan & Jain, S. Chand.
3 Modern Accountancy, Haniff & Mukherjee, TMH.

**Reference Books:**

1 An Introduction to Accountancy, S. N. Maheswari, Vikas publication.
2 Cost Accounting: Theory and Practices, B. Banerjee, PHI.
3 Financial Management, IM Pandey, Vikas.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE791 | Electrical Drives Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE791.1 | Analyze | Conduct experiment to set up control strategies to synthesize the voltages in dc and ac motor drives. |
| EE791.2 | Analyze | Develop testing and experimental procedures in a group applying basic knowledge in electronics, electrical circuit analysis, electrical machines, microprocessors, and programmable logic controllers. |
| EE791.3 | Analyze | Use standard methods/modern tools to determine accurate modeling/simulation parameters for various general-purpose electrical machines and power electronics devices required for designing a system and solve drives related problems |
| EE791.4 | Analyze | Combine the use of computer-based simulation tools relevant to electrical drives with practical laboratory experimentation. |
| EE791.5 | Apply | Perform experiments on electrical drive in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE791.6 | Apply | Perform experiments on electrical drive, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 3 | | | | | | | | | 2 | 3 | 2 |
| 2 | CO2 | | | 3 | 3 | | | | | | | | | 3 | 3 | 2 |
| 3 | CO3 | | | 2 | 3 | | | | | | | | | | 3 | 2 |
| 4 | CO4 | | | 2 | 3 | | | | | | | | | | 3 | |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

**Experiment No** **List of Experiments**

Experiment – 1 Study of single-phase fully controlled DC Drive.
Experiment – 2 Study of Chopper fed DC Drive.
Experiment – 3 Study of AC Single phase motor-speed control using TRIAC.
Experiment – 4 PWM Inverter fed three-phase Induction Motor control.
Experiment – 5 VSI fed Induction motor Drive analysis.
Experiment – 6 CSI fed Induction motor Drive analysis.
Experiment – 7 Study of V/f control operation of three-phase induction motor drive.
Experiment – 8 Study of permanent magnet synchronous motor drive fed by PWM Inverter.
Experiment – 9 Regenerative or Dynamic braking operation for DC Motor.
Experiment – 10 Regenerative or Dynamic braking operation of AC motor.
Experiment – 11 AC and DC Drive Applications using PLC.
Experiment – 12 Introduction to Industrial Automation.

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|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE792A | Object Oriented Programming Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | 1. Computer Fundamentals.<br>2. Basic understanding of Computer Programming and related Programming Paradigms.<br>3. Problem Solving Techniques with proper logic Implementation. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE792A.1 | Remember | Execute simple Java programming using operators, control statements & loops, array, class, object, and method, access specifier, constructor, call by value & call by reference, static variables, inner classes |
| EE792A.2 | Understand | Analyze distinct features of different string handling functions with various I/O operations. |
| EE792A.3 | Apply | Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface. |
| EE792A.4 | Apply | Apply Exception handling, Multithreading and Applet (Web program in java) programming concept in Java. |
| EE792A.5 | Apply | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE792A.6 | Apply | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | 2 | | | | | | 2 | | | 2 | |
| 2 | CO2 | | | | 2 | 2 | | | | | | | | | 2 | |
| 3 | CO3 | | | | 2 | 2 | | | | | | | | | 2 | |
| 4 | CO4 | | | | 2 | 2 | | | | | | 2 | | | 2 | |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

| Module | List of Experiments |
|---|---|
| Module I | Java Basics<br>1. Simple Java programming using operators, control statements & loops, array.<br>2. Programming on class, object, and method, access specifier.<br>3. Programming on constructor, method/constructor overloading.<br>4. Programming on this keyword, call by value & call by reference, static variables &methods, inner classes. |
| Module II | Basic String handling & I/O<br>1. Programming to show the use of String class methods - charAt(), compareTo(), equals(),equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(),toString(), toUpperCase(), trim(), valueOf() methods.<br>2. Programming to show the use of StringBuffer class methods - append(), capacity(),charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(),length(), setCharAt(), setLength(), substring(), toString() methods.<br>3. Programming on Command line arguments.<br>4. Programming using keyboard input by implementing BufferedReader& Scanner classes. |
| Module III | Inheritance, Interface and Java Packages<br>1. Programming on Simple Inheritance, super and final keywords, super() method.<br>2. Programming on method overriding, dynamic method dispatch,abstract classes &methods, multiple inheritance by using interface.<br>3. Programming on importing system package, creating user-defined package, importinguser-defined package, using protected access specifier, subclassing an imported class of apackage, using same names for classes of different packages, adding multiple publicclasses to a package. |

Module IV Exception handling, Multithreading and Applet Programming

1. Programming on exception handling using try-catch block, implementing throw andthrows keywords, using finally block, creating user-defined exception.
2. Programming on creating child threads i) by extending thread class ii) byimplementing runnable interface, creating child threads by assigning thread priorities.
3. Programming on creating simple applet to display some message, creating applet two add 2integers, creating applet to do GUI based programming.

**Text Books:**

1 Herbert Schildt - "Java: The Complete Reference " - 9th Ed. - TMH
2 E. Balagurusamy - " Programming With Java: A Primer " - 3rd Ed. - TMH.

**Reference Books:**

1 R.K Das - " Core Java for Beginners " - VIKAS PUBLISHING.
2 Rambaugh, James Michael, Blaha - " Object Oriented Modelling and Design " - PrenticeHall, India.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE792B | Big Data Analysis Laboratory | - | - | 3 | - | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Familiarity and knowledge of Database Management Systems. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE792B.1 | Apply | Process big data using Hadoop framework. |
| EE792B.2 | Analyze | Build and apply linear and logistic regression models. |
| EE792B.3 | Apply | Perform data analysis with machine learning methods, graphical data analysis. |
| EE792B.4 | Apply | Implement clustering techniques. |
| EE792B.5 | Apply | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE792B.6 | Apply | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | 2 | | | | | | | | | | 2 | |
| 2 | CO2 | | | 2 | 2 | 2 | | | | | | 2 | | | 2 | |
| 3 | CO3 | | | | 3 | 2 | | | | | | 3 | | | 2 | |
| 4 | CO4 | | | | 3 | 3 | | | | | | 3 | | | 3 | |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

| Module | List of Experiments |
|---|---|
| Module I | Hadoop:<br>1. Install, configure and run Hadoop and HDFS<br>2. Implement word count / frequency programs using MapReduce<br>3. Implement an MR program that processes a weather dataset |
| Module II | R:<br>1. Implement Linear and logistic Regression<br>2. Implement SVM / Decision tree classification techniques<br>3. Implement clustering techniques<br>4. Visualize data using any plottingframework<br>5. Implement an application that stores and retrieves big data in Hbase / MongoDB / Pigusing Hadoop / R. |

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE792C | Digital Image Processing Laboratory | - | - | 3 | 3 | 1.5 | 40 | 60 | 100 |
| Pre-requisite | Knowledge in DSP, algorithm, MATLAB Programming. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE792C.1 | Analyze | Build knowledge on Digital Imaging fundamentals and Digital Image Transform. |
| EE792C.2 | Understand | Understanding Digital Image enhancement techniques in spatial and frequency domain. |
| EE792C.3 | Analyze | Explaining the requirements and types of Image Compression and its standards. |
| EE792C.4 | Apply | Demonstrate the Digital Image Restoration and Segmentation of Digital Images, build ideas on Edge detection techniques and concepts on Digital Image security. |
| EE792C.5 | Apply | Perform experiments in a group and interpret the observed test result and hence calculate unknown parameters individually. |
| EE792C.6 | Apply | Execute program, analysis debug, note the observation with ethics and write an effective report to represent the observation. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | 2 | 2 | | | | | | | | | | 2 | |
| 2 | CO2 | | | | 2 | 2 | | | | | | 2 | | | 2 | |
| 3 | CO3 | | | | 3 | 2 | | | | | | 3 | | | 2 | |
| 4 | CO4 | | | | 3 | 3 | | | | | | 3 | | | 3 | |
| 5 | CO5 | | | | | | | | | 3 | | | | | | |
| 6 | CO6 | | | | | | | | 2 | | 3 | | | | | |

| Experiment No | List of Experiments |
|---|---|
| Experiment - 1 | Convert RGB Digital Images into Grayscale Images and show result. |
| Experiment - 2 | Transform a grayscale image into frequency domain and show its magnitude and phaseangle. |
| Experiment - 3 | Display histogram of a digital image and equalized the image. |
| Experiment - 4 | Apply LPF and HPF in a Grayscale Digital Image and display result. |
| Experiment - 5 | Apply Mean and Median filtering in a Grayscale Digital Image and display result. |
| Experiment - 6 | Compress and reconstruct a Grayscale Digital Images in spatial domain. |
| Experiment - 7 | Compress and reconstruct a Grayscale Digital Image in frequency domain. |
| Experiment - 8 | Apply segmentation technique (any one) in a Digital Image and display result. |
| Experiment - 9 | Apply Edge detection technique in a Digital Image and display result. |
| Experiment - 10 | Apply any cryptography or watermarking technique for image encryption and displayresult. |
| Experiment - 11 | Innovative experiment. |

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE801A | Wind and Solar Energy Systems | 2 | - | - | - | 2 | 30 | 70 | 100 |
| Pre-requisite | Concept of Basic Physics, Power Electronics and Electrical Machines. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE801A.1 | Apply | Identify winds energy as alternate form of energy and explain the fundamental of wind power generation and associated terms. |
| EE801A.2 | Apply | Categorize different types wind generators and the associated issues. |
| EE801A.3 | Apply | Explain the geometry of solar radiation and associated terms. |
| EE801A.4 | Apply | Demonstrate solar photovoltaic theory, different characteristics and implementation process. |
| EE801A.5 | Apply | Insight in to the grid integration of wind and solar power |
| EE801A.6 | Apply | Describe the technologies involved in solar thermal generation, implementation of solar thermal power plant. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 2 | | | | | 3 | | | | | | 2 | | 2 |
| 2 | CO2 | | 2 | | | | | 3 | | | | | | 2 | | 2 |
| 3 | CO3 | | 2 | | | | | 3 | | | | | | 2 | | 2 |
| 4 | CO4 | 3 | | | | | | 3 | | | 2 | | | 2 | | 2 |
| 5 | CO5 | | 2 | | | 2 | | 3 | | | | | | 2 | | 2 |
| 6 | CO6 | 2 | | | | 3 | | 3 | | | 2 | 2 | | 2 | | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Introduction to Wind Power<br>History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stalland pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions. | 3L |
| Module II | Wind Generator Classifications<br>Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent-Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control. | 4L |
| Module III | Solar Radiation<br>The sun to earth transaction of solar energy, Study of wavelength Of solar radiation spectra, Solar Spectrum Electromagnetic Radiation, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability | 3L |
| Module IV | Solar Photovoltaic System<br>Technologies-Amorphous, mono crystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking(MPPT) algorithms, Converter Control. | 5L |
| Module V | Grid Integration of Wind and Solar Power<br>Constant- Voltage, Constant Frequency Generation, Single output system, Double Output Systemwith Current Converter and voltage source inverter, Variable-voltage, Variable frequency generation, Circuit Model of Self Excited Induction Generator, Effect of Wind Generator on a power network.<br>Solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems. | 7L |

| | | |
|---|---|---|
| Module VI | Solar Thermal Power Generation<br>Technologies involved in solar thermal generation, Analysis of Parabolic trough, central receivers, parabolic dish, Concept of solar pond. | 1L |
| | Total | 23L |

**Text Books:**


1 T. Ackermann, —Wind Power in Power Systems, John Wiley and Sons Ltd., 2005.

2 G. M. Masters, —Renewable and Efficient Electric Power Systems, John Wiley and Sons,2004.

S. P. Sukhatme, —Solar Energy: Principles of Thermal Collection and Storage, McGrawHill, 1984.


**Reference Books:**


1 H. Siegfried and R. Waddington, —Grid integration of wind energy conversion systems, John Wiley and Sons Ltd., 2006.

2 G. N. Tiwari and M. K. Ghosal, —Renewable Energy Applications, Narosa Publications,2004.

3 J. A. Duffie and W. A. Beckman, —Solar Engineering of Thermal Processes, John Wiley& Sons, 1991.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| EE801B | Utilization of Electric Power | L | T | P | S | C | IA | SEE | Total |
| | | 2 | - | - | - | 2 | 30 | 70 | 100 |
| Pre-requisite | Basic Electrical Engineering and Electrical Machines. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE801B.1 | Understand | Describe the working of traction system, train movement, mechanism of train movement. |
| EE801B.2 | Understand | Demonstrate the working of electric motor operation and uses in traction. |
| EE801B.3 | Understand | Illustrate the different control used in traction system. |
| EE801B.4 | Understand | Apply the knowledge of illumination engineering to calculate illumination level for a given application and then select the suitable specification ethically for installation. |
| EE801B.5 | Understand | Apply the knowledge of engineering and analyze the working of electric heating and welding processes. |
| EE801B.6 | Understand | Explain the process of electrolysis. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | | | | | | 2 | | | 2 | | 2 |
| 2 | CO2 | 3 | | | | | | | | | 2 | | | 2 | | 2 |
| 3 | CO3 | 3 | | | | | | | | | | | | 2 | | 2 |
| 4 | CO4 | | 2 | | | | | | 3 | | | 2 | | 2 | | 2 |
| 5 | CO5 | | 2 | | | | | | | | | 3 | | 2 | | 2 |
| 6 | CO6 | | 2 | | | | | | | | | | | 2 | | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Electric Traction<br>Requirement of an ideal traction system, Supply system for electric traction, Train movement(speed time curve, simplified speed time curve, average speed and schedulespeed), Mechanism oftrain movement (energy consumption, tractive effort during acceleration, tractive effort on agradient, tractive effort for resistance, power and energy output for the driving axles, factorsaffecting specific energy consumption, coefficient of adhesion).<br>Electric traction motor & their control:Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort andhorse power. Use of AC series motor and Induction motor for traction.<br>Traction motor control:DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by currentthrough earth, current collection in traction system, Power electronic controllers in traction system. | 9L |
| Module II | Illumination<br>The nature of radiation, Polar curve, Law of illumination, Photometry (Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement).<br>Types of Lamps:Conventional and energy efficient, Basic principle of light control, Different lighting scheme andtheir design methods, Flood and Street lighting. | 6L |
| Module III | Electric Heating and Welding<br>Types of heating, Resistance heating, Induction heating, Arc furnace, Dielectric heating, Microwaveheating. | 4L |
| Module IV | Electrolytic Processes<br>Basic principles, Faraday ‘s law of Electrolysis, Electro deposition, Extraction and refining ofMetals, Power supply of Electrolytic processes. | 3L |
| | | Total 22L |

**Text Books:**

1 T. Starr, —Generation, Transmission and Utilization of Electrical Power, Pitman.
2 J. B. Gupta, —Utilization of Electric Power & Electric Traction, S. K. Kataria & Sons.
3 C. L. Wadhawa, —Generation Distribution and Utilization of Electrical Energy, New Age International Publishers.

**Reference Books:**

1 H. Partab, —Art and Science of Utilization of Electrical Energy, Dhanpat Rai & Sons.
2 E. Openahaw Taylor, Orient Longman, —Utilisation of Electric Energy.

# JIS COLLEGE OF ENGINEERING

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE801C | Line Commutated and Active Rectifiers | 2 | - | - | - | 2 | 30 | 70 | 100 |
| Pre-requisite | Concept of Transformers and Power Electronic Converters. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE801C.1 | Understand | Studey and analyse different controlled rectifier circuits. |
| EE801C.2 | Understand | Describe the operation of line-commutated rectifiers – 6 pulse and 12-pulse configurations. |
| EE801C.3 | Understand | Demonstrate the principle of operation and steady state analysis of DC-DC boost converter and power circuit of single-switch AC-DC converter and their . |
| EE801C.4 | Understand | Demonstrate the principle of operation and steady state analysis of 1-phase and 3-phase ac-dc boost converter. |
| EE801C.5 | Understand | Demonstrate the principle of operation and steady state analysis of DC-DC and AC-DC flyback converter. |
| EE801C.6 | Understand | Choose appropriate device for a particular converter topology |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 3 | | | | | | | | 2 | | | 2 | | 2 |
| 2 | CO2 | 3 | | | | | | | | | 2 | | | 2 | | 2 |
| 3 | CO3 | 3 | | | | | | | | | 2 | | | 2 | | 2 |
| 4 | CO4 | 3 | | | | | | | | | 2 | | | 2 | | 2 |
| 5 | CO5 | 3 | | | | | | | | | 2 | | | 2 | | 2 |
| 6 | CO6 | | 2 | | | | | | 2 | | 2 | | | 2 | | 2 |

| Module | Content | Hour |
|---|---|---|
| Module I | Diode and Phase-Controlled Rectifiers with passive filtering<br>Single-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C andLC filter; continuous and discontinuous conduction, input current waveshape. single-phase thyristor rectifier with L and LC filter; 3-phase thyristor rectifier with L and LC filter; continuous and discontinuous conduction, input current waveshape. | 7L |
| Module II | Multi-Pulse converter<br>Review of transformer phase shifting, generation of 6-phase AC voltage from 3-phase AC, 6-pulseconverter and 12-pulse converters with inductive loads, steady state analysis, commutation overlap, notches during commutation. | 4L |
| Module III | Single-phase AC-DC single-switch boost converter<br>Review of DC-DC boost converter, power circuit of single-switch AC-DC converter, steady state analysis, unity power factor operation, closed-loop control structure. | 3L |
| Module IV | AC-DC bidirectional boost converter<br>Review of 1-phase inverter and 3-phase inverter, power circuits of 1-phase and 3-phase ac-dc boost converter, steady state analysis, operation at leading, lagging and unity power factors. Rectification and regenerating modes. | 4L |
| Module V | Isolated single-phase AC-DC flyback converter<br>DC-DC flyback converter, output voltage as a function of duty ratio and transformer turns ratio. Power circuit of AC-DC flyback converter, steady state analysis, unity power factor operation. | 6L |
| | Total | 24L |

**Text Books:**

1 G. De, —Principles of Thyristorised Converters, Oxford & IBH Publishing Co, 1988.
2 J. G. Kassakian, M. F. Schlecht and G. C. Verghese, —Principles of Power Electronics,Addison-Wesley, 1991.
3 L. Umanand, —Power Electronics: Essentials and Applications, Wiley India, 2009.

**Reference Books:**

1 N. Mohan and T. M. Undeland, —Power Electronics: Converters, Applications andDesign, John Wiley & Sons, 2007.
2 R. W. Erickson and D. Maksimovic, —Fundamentals of Power Electronics, SpringerScience & Business Media, 2001.

# JIS COLLEGE OF ENGINEERING

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Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE802A | Advanced Electric Drives | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Electrical Machines and Power Electronics. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE802A.1 | Understand | Study and demonstrate the operation of power electronic converters and their control strategies for AC drive. |
| EE802A.2 | Understand | Describe the modelling and speed control of DC drive. |
| EE802A.3 | Understand | Describe the basics of reference frame theory, illustrate the modelling of induction machine and their speed control. |
| EE802A.4 | Understand | Demonstrate the operation of permanent magnet motor drives and their speed control. |
| EE802A.5 | Understand | Demonstrate the operation of switch reluctance motor drives and their speed control. |
| EE802A.6 | Understand | Acquire the knowledge of selection of drives as per practical operational industrial requirement. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | 3 | | | | | | | | | | | 2 | | |
| 2 | CO2 | 3 | | | | | | | | | | | | 2 | | |
| 3 | CO3 | 3 | | | | | | | | | | | | 2 | | |
| 4 | CO4 | 3 | | | | | | | | | | | | 2 | | |
| 5 | CO5 | 3 | | | | | | | | | | | | 2 | | |
| 6 | CO6 | 2 | | | | | | | | | 3 | | | | 2 | |

| Module | Content | Hour |
|---|---|---|
| Module I | Power Electronic Converters for AC Drives<br>Review of Three-Phase Inverter with square-wave switching, Pulse Width Modulation Techniques–Sinusoidal PWM, Selected Harmonic Elimination, Space Vector Modulation, current control of VSI with PWM, three-level inverter and its different topologies, SVM for three-level inverter, Hbridgeas a four-quadrant drive. | 10L |
| Module II | Modelling and Control of DC Machines<br>Electromechanical modelling, state-space modelling, Block diagram and transfer function, Control of separately excited dc motor drives for Inner current loop and speed control design. | 5L |
| Module III | Induction Motor Drives<br>Different transformations and reference frame theory, modelling of induction machines, voltage fed inverter control, open loop Volt/Hz control, vector control, direct torque and flux control, Introduction to three-phase traction drives with parallel machines. | 7L |
| Module IV | Permanent Magnet Motor Drives<br>Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM. | 4L |
| Module V | Switched Reluctance Motor Drives<br>Evolution of switched reluctance motors, various topologies for SRM drives, comparison, closed loop speed and torque control of SRM. | 4L |
| | Total | 30L |

**Text Books:**

1 B. K. Bose, —Modern Power Electronics and AC Drives, Pearson Education, Asia, 2003.
2 R. Krishnan, —Permanent Magnet Synchronous and Brushless DC motor Drives, CRCPress, 2009.

**Reference Books:**

1 P. C. Krause, O. Wasynczuk and S. D. Sudhoff, —Analysis of Electric Machinery and DriveSystems, John Wiley & Sons, 2013.
2 Bin-Wu, —High-power Converters and AC Drives, IEEE Press, John Wiley & Sons, 2006.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE802B | Control Systems Design | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Control System – I, Control Systems – II. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE802B.1 | Understand | Deonstrate the various design philosophy of control system. |
| EE802B.2 | Understand | Design, analysis and investigate the performance of the classical compensator (Lag, lead, lag-lead, feedback and feed forward) in control system. |
| EE802B.3 | Understand | Design, analysis and investigate the performance of PID controller |
| EE802B.4 | Understand | Design, analysis and investigate the performance of robust controllers. |
| EE802B.5 | Understand | Design, analysis and investigate the performance of optimal and non-linear controllers. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | 3 | 3 | | | | | | | | | | 2 | | |
| 2 | CO2 | | 3 | 3 | | 3 | | | | | 2 | | | 3 | 3 | |
| 3 | CO3 | | 3 | 3 | | 3 | | | | | 2 | | | 3 | 3 | |
| 4 | CO4 | | 3 | 3 | | 3 | | | | | 2 | | | 3 | 3 | |
| 5 | CO5 | | 3 | 3 | | 3 | | | | | 2 | | | 3 | 3 | |

| Module | Content | Hour |
|---|---|---|
| Module I | Design Specifications<br>Introduction to design problem and philosophy, Introduction to time domain and frequency domain design specification and its physical relevance, Effect of gain on transient and steady state response, Effect of addition of pole on system performance, Effect of addition of zero on system response. | 6L |
| Module II | Design of Classical Control System<br>Introduction to compensator, Design of Lag, lead lag-lead compensator, Feedback and Feed forward compensator design, Feedback compensation, Realization of compensators. | 5L |
| Module III | Design of PID controllers<br>Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second andthird order systems. Control loop with auxiliary feedback – Feed forward control. | 6L |
| Module IV | Introduction to Robust Control<br>Robust control system and system sensitivities to parameter, perturbations, analysis of robustness, systems with uncertain parameters, considerations in design of robust control system, robust PID controller. | 9L |
| Module V | Lyapunov's stability and optimal control<br>Positive/negative definite, positive/negative semi-definite functions, Lyapunav stability criteria, introduction to optimal control, Riccatti Equation, Linear Quadratic Regulator, Design Examples. | 10L |
| | Total | 36L |

**Text Books:**

1 N. Nise, —Control system Engineering, John Wiley, 2000.
2 I. J. Nagrath and M. Gopal, —Control system engineering, Wiley, 2000.
3 M. Gopal, —Digital Control Engineering, Wiley Eastern, 1988.

**Reference Books:**

1 K. Ogata, —Modern Control Engineering, Prentice Hall, 2010.
2 B. C. Kuo, —Automatic Control system, Prentice Hall, 1995.
3 J. J. D ‘Azzo and C. H. Houpis, —Linear control system analysis and design (conventionaland modern), McGraw Hill, 1995.
4 R.T. Stefani and G.H. Hostetter, —Design of feedback Control Systems, Saunders CollegePub, 1994.
5 G. C. Goodwin, S. F. Graebe, M. E. Salgado, —Control System Design.

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| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | | R18 |
|---|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | | |
| | | L | T | P | S | C | IA | SEE | Total |
| EE802C | Industrial Electrical System | 3 | - | - | - | 3 | 30 | 70 | 100 |
| Pre-requisite | Concept of Electrical Machines and Power Systems. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| EE802C.1 | Understand | Demonstrate the role of different component used in electrical system. |
| EE802C.2 | Understand | Demonstrate the role of different component used in residential and commercial electrical system. |
| EE802C.3 | Understand | Demonstrate the role of different component used in industrial electrical system. |
| EE802C.4 | Understand | Describe the role of automation and their operation process used in industrial electrical system. |
| EE802C.5 | Analysis | Analyze real world queries to summarized industrial, societal and environmental need and design solution plan |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | 2 | | | | | 3 | | 3 | | 2 | | | 3 | | 2 |
| 2 | CO2 | 2 | | | | | 3 | | 3 | | 2 | | | 3 | | 2 |
| 3 | CO3 | 2 | | | | | 3 | | 3 | | 2 | | | 3 | | 2 |
| 4 | CO4 | 2 | | | | | 3 | | 3 | | 2 | 2 | | 3 | | 2 |
| 5 | CO5 | | | 3 | | | 3 | 3 | 3 | 2 | | 3 | | 3 | | 3 |

| Module | Content | Hour |
|---|---|---|
| Module I | Electrical System Components<br>LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices. | 7L |
| Module II | Residential and Commercial Electrical Systems<br>General rules and guidelines for installation, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components. | 12L |
| Module III | Industrial Electrical Systems<br>HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components. | 9L |
| Module IV | Industrial Electrical System Automation<br>Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation. | 8L |
| | Total | 36L |

**Text Books:**

1 K. B. Raina, —Electrical Design, Estimating & Costing, New age International, 2007.
2 S. Singh and R. D. Singh, —Electrical estimating and costing, Dhanpat Rai and Co., 1997.
3 Paul Gill, —Electrical Power Equipment, Maintenance and Testing, CRC Press.
4 R. G. Jamkar, —Industrial Automation using PLC, SCADA & DCS, Global Education.

**Reference Books:**

1 S.L. Uppal and G.C. Garg, —Electrical Wiring, Estimating & Costing||, Khanna Publishers, 2008
2 Web site for IS Standards.
3 H. Joshi, —Residential Commercial and Industrial Systems||, McGraw Hill Education, 2008.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| HU801 | Principles of Management | L | T | P | S | C | IA | SEE | Total |
| | | 2 | - | - | - | 2 | 30 | 70 | 100 |
| Pre-requisite | NA. | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| HU801.1 | Understand | Recall and recognize the relevance of management concepts. |
| HU801.2 | Apply | Apply management techniques for meeting current and future management challenges faced by the organization |
| HU801.3 | Apply | Compare the management theories and models ethically to solve real life problems in an organization. |
| HU801.4 | Apply | Apply principles of management in order to execute the role as a manager in an organization. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | | | | 3 | 3 | | | |
| 2 | CO2 | | | | | | | | | | | 3 | 3 | | | |
| 3 | CO3 | | | | | | | | 3 | | | 3 | 3 | | | |
| 4 | CO4 | | | | | | | | 3 | | | 3 | 3 | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Management Concepts<br>Definition, roles, functions and importance of Management, Evolution of Management thought contribution made by Taylor, Fayol, Gilbreth, Elton Mayo, McGregor, Maslow. | 4L |
| Module II | Planning and Control<br>Planning: Nature and importance of planning, types of planning, Levels of planning, The Planning Process - MBO, SWOT analysis, McKinsey's 7S Approach. Organising for decision making: Nature of organizing, span of control, Organisational structure –line and staff authority.<br>Control: Basic control process: Control as a feedback system, Feed Forward Control, Requirements for effective control. | 4L |
| Module III | Group dynamics<br>Types of groups, characteristics, objectives of Group Dynamics.<br>Leadership: Definition, styles & functions of leadership, qualities for good leadership, Theories of leadership . | 4L |
| Module IV | Work Study and Work Measurement<br>Definition of work study, Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim and Objectives,, Use of stopwatch procedure in making Time Study. Performance rating, allowances and its types. Calculation of Standard Time. Work sampling. | 4L |
| Module V | Marketing Management<br>Functions of Marketing, Product Planning and development, Promotional Strategy . | 2L |
| Module VI | Quality Management<br>Quality definition, Statistical quality control, acceptance sampling, Control Charts –Mean chart, range chart, c chart, p chart, np chart, Zero Defects, Quality circles, Kaizen and Six Sigma, ISO - 9000 Implementation steps, Total quality management. | 6L |
| | Total | 24L |

**Text Books:**

1 Essentials of Management, by Harold Kooritz & Heinz Weihrich Tata McGraw Hill.
2 Production and Operations Management, K.Aswathapa, K .Shridhara Bhat, Himalayan Publishing House.

**Reference Books:**

1 Organizational Behavior, by Stephen Robbins Pearson Education, New Delhi.
2 New Era Management, Daft, 11th Edition, Cengage Learning.
3 Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearson Publication.

# JIS COLLEGE OF ENGINEERING

(An Autonomous Institute)
Affiliated to MAKAUT, WB & Approved by AICTE, New Delhi
Block A, Phase III, Kalyani, Nadia-741235

| Program | B.Tech. in Electrical Engineering | | | | | | Regulation | R18 |
|---|---|---|---|---|---|---|---|---|
| Department | Department of Electrical Engineering | | | | | | Semester | VIII |
| Course Code | Course Name | Credit Structure | | | | | Marks Distribution | |
| MC804 | Essence of Indian Knowledge Tradition | L | T | P | S | C | IA | SEE | Total |
| | | 3 | - | - | - | - | 100 | - | 100 |
| Pre-requisite | | | | | | | | | |

| Course Outcomes | | |
|---|---|---|
| MC804.1 | Understand | Identify the concept of Indian traditional knowledge and its importance. |
| MC804.2 | Understand | Explain the need and importance of protecting traditional knowledge. |
| MC804.3 | Understand | IIllustrate the various enactments related to the protection of traditional knowledge. |
| MC804.4 | Understand | Interpret the concepts of Intellectual property to protect the traditional knowledge. |
| MC804.5 | Understand | Explain the importance of Traditional knowledge in Electrical Engineering. |

| | | Mapping with POs | | | | | | | | | | | | Mapping with PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | | | | | | | | 2 | | 3 | | | | | |
| 2 | CO2 | | | | | | | | 2 | | 3 | | | | | |
| 3 | CO3 | | | | | | | | 2 | | 3 | | | | | |
| 4 | CO4 | | | | | | | | 2 | | 3 | | | | | |
| 5 | CO5 | | | | | | | | 2 | | 3 | | | | | |

| Module | Content | Hour |
|---|---|---|
| Module I | Basic structure of Indian Knowledge System<br>Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs western knowledge traditional knowledge. | |
| Module II | Modern Science and Indian Knowledge System<br>Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge. | |
| Module III | Yoga and Holistic Health care<br>Yoga for positive health, prevention of stress related health problems and rehabilitation, Integral approach of Yoga Therapy to common ailments. | |
| Module IV | Traditional Knowledge and Environment<br>Traditional knowledge and engineering, Traditional medicine system, Importance of conservation and sustainable development of environment, Management of biodiversity. | |
| | | Total |

**Reference Books:**


1. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.
3. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
4. Fritzof Capra, The Wave of life.
5. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam.
6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.
7. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016 RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi 2016.

# Appendix – A

# MOOCs Courses
# For B.Tech Students for AY 2018-19
## (1st Semester to 8th Semester)

Total Credit for MOOCs Subjects will be 20.

**List of websites which offers online certification Courses**

| Sl. No. | Online Cerification Courses | Website |
|---|---|---|
| 1. | Swayam | https://swayam.gov.in/ |
| 2. | NPTEL | https://onlinecourses.nptel.ac.in/ |
| 3. | MOOC | http://mooc.org/ |
| 4. | Edx | https://www.edx.org/ |
| 5. | Coursera | https://www.coursera.org/ |
| 6. | Udacity | https://in.udacity.com/ |
| 7. | Udemy | https://www.udemy.com/ |
| 8. | Khan Academy | https://www.khanacademy.org/ |
| 9. | Skillsahre | https://www.skillshare.com/ |
| 10. | Harvard University | https://online-learning.harvard.edu/ |
| 11. | Ted | https://ed.ted.com/ |
| 12. | Alison | https://alison.com/ |
| 13. | Futurelearn | https://www.futurelearn.com/ |
| 14. | Web Development | https://digitaldefynd.com/best-free-web-development-courses-tutorials-certification/ |
| 15. | Digital Marketing | https://digitaldefynd.com/best-free-digital-marketing-certifications/ |
| 16. | ios app development | https://digitaldefynd.com/best-ios-app-development-course-tutorial/ |
| 17. | Open Learn | http://www.open.edu/openlearn/ |
| 18. | Future Learn | https://www.futurelearn.com/ |
| 19. | Tuts Plus | https://tutsplus.com/ |
| 20. | Open Culture | http://www.openculture.com/ |

***For Honors additional 20 Credit Point is to be earned (1st Sem to 8th Sem) through MOOCs courses. All the Certificates received by the students across all semester for MOOCs Courses from approved organization, should be submitted to CoE office prior to 8th Semester Examination.***

Distribution of the credit with respect to weeks are as follows:
4 to 6 weeks: 2 Credit
8 to 10 weeks: 3 Credits
12 to 14 weeks: 4 Credits
16 or more than that: 6 Credits

***20 credit for Honors, should be earned by the students from the MOOC Basket and any other subjects related to the specific program of the respective departments.***

# MOOCs Basket for Electrical Engineering

| Sl. No. | MOOC Courses | Applicable Students (Semester wise) |
|---|---|---|
| 1 | Environmental Science & Studies | I/II |
| 2 | Introduction to Environmental Science | I/II |
| 3 | Computer Fundamentals | II/III |
| 4 | Fundamental Concepts of Electricity | II/III |
| 5 | Basic Electrical Engineering | II/III |
| 6 | Basic Electric Circuits | II/III |
| 7 | Fundamentals of Electrical Engineering | II/III |
| 8 | Engineering Mechanics | II/III |
| 9 | Basic Electronics Engineering | II/III/IV |
| 10 | Engineering Calculus and Differential Equations | II/III/IV |
| 11 | C Programming | II/III/IV |
| 12 | C Programming: Getting Started | II/III/IV |
| 13 | C Programming: Language Foundations | II/III/IV |
| 14 | C Programming: Modular Programming and Memory Management | II/III/IV |
| 15 | C Programming: Pointers and Memory Management | II/III/IV |
| 16 | C Programming: Advanced Data Types | II/III/IV |
| 17 | Fundamentals of Semiconductor Devices | II/III/IV |
| 18 | Programming of C++ | III/IV |
| 19 | Numerical Methods | III/IV |
| 20 | Circuit Theory & Network | III/IV |
| 21 | Network Analysis | III/IV |
| 22 | Electrotechnical I | III/IV |
| 23 | Measurement and Instrumentation | III/IV |
| 24 | Electrical Measurement and Electronic Instruments | III/IV |
| 25 | Analog Electronics | III/IV |
| 26 | Analog Electronic Circuits | III/IV |
| 27 | Analog Circuits | III/IV |
| 28 | Analog Circuits and Systems through SPICE Simulation | III/IV |
| 29 | Op-Amp Practical Applications: Design, Simulation and Implementation | III/IV |
| 30 | MATLAB Programming and Simulink | III/IV |
| 31 | Circuits and Electronics 1: Basic Circuit Analysis | III/IV |
| 32 | Circuits and Electronics 2: Amplification, Speed, and Delay | III/IV |
| 33 | Circuits and Electronics 3: Applications | III/IV |
| 34 | Introduction to Engineering and Design | III/IV |
| 35 | Introduction to Design Thinking | III/IV |
| 36 | Design Thinking Fundamentals | III/IV |
| 37 | Design Thinking: Empathizing to Understand the Problem | III/IV |
| 38 | Design Thinking: Ideation, Iteration and Communication | III/IV |
| 39 | Design Thinking: Prototyping and User Testing | III/IV |
| 40 | Structure of Materials | III/IV |

| | | |
|---|---|---|
| 41 | Digital Electronics | IV/V |
| 42 | Digital Electronic Circuits | IV/V |
| 43 | Digital Circuits | IV/V |
| 44 | xMinor in Materials for Electronic, Optical, and Magnetic Devices | IV/V |
| 45 | Circuits and Electronics | IV/V |
| 46 | Electromagnetic Field Theory | IV/V |
| 47 | Computational Electromagnetics | IV/V |
| 48 | Fourier Analysis and Its Applications | IV/V |
| 49 | Integrated Circuits: MOSFETs, Op-Amp and their Applications | IV/V |
| 50 | Electrical Machines – I | IV/V |
| 51 | Electrical Machines | IV/V/VI |
| 52 | Power Electronics | V/VI |
| 53 | Data Structure | V/VI |
| 54 | Data Structures and Software Design | V/VI |
| 55 | Computer Network | V/VI |
| 56 | Internet of Things | V/VI |
| 57 | Energy Conservation and Auditing | V/VI |
| 58 | Electromagnetic Waves | V/VI |
| 59 | Illumination Engineering | V/VI |
| 60 | Power Plant Engineering | V/VI |
| 61 | Microprocessors and Microcontrollers | V/VI |
| 62 | Microprocessors and Interfacing | V/VI |
| 63 | Architectural Design of Digital Integrated Circuits | V/VI |
| 64 | Linear and/or Non-linear System Theory | V/VI |
| 65 | Analog IC Design | V/VI |
| 66 | Digital IC Design | V/VI |
| 67 | Photonic Integrated Circuits 1 | V/VI |
| 68 | Stochastic Processes: Data Analysis and Computer Simulation | V/VI |
| 69 | Introduction to Computer Numerical Control | V/VI |
| 70 | Software Development Fundamentals | V/VI |
| 71 | Formal Software Verification | V/VI |
| 72 | Software Testing Fundamentals | V/VI |
| 73 | Linux Basics: The Command Line Interface | V/VI |
| 74 | C Programming: Using Linux Tools and Libraries | V/VI |
| 75 | A Hands-on Introduction to Engineering Simulations | V/VI |
| 76 | Introduction to Analytics Modeling | V/VI |
| 77 | Innovation Strategies for Electric Mobility: The StreetScooter Case | V/VI/VII |
| 78 | Autonomous Mobile Robots | V/VI/VII |
| 79 | Real-Time Bluetooth Networks – Shape the World | V/VI/VII |
| 80 | Power System | V/VI/VII |
| 81 | Power System Engineering | V/VI/VII |
| 82 | Power System Analysis | V/VI/VII |
| 83 | Recent Advances in Transmission Insulators | V/VI/VII |
| 84 | Control System | V/VI/VII |

| | | |
|---|---|---|
| 85 | Control Engineering | V/VI/VII |
| 86 | Linear Dynamical Systems | V/VI/VII |
| 87 | Linear System Theory | V/VI/VII |
| 88 | Non Linear Adaptive Control | VI/VII |
| 89 | Non Linear System Analysis | VI/VII |
| 90 | Zero-Energy Design: an approach to make your building sustainable | VI/VII |
| 91 | Inclusive Energy Systems – Exploring Sustainable Energy for All | VI/VII |
| 92 | Energy Systems Integration: A Trend or a Revolution? | VI/VII |
| 93 | Data Base Management System | VI/VII |
| 94 | Embedded Systems | VI/VII |
| 95 | Embedded Systems – Shape The World: Microcontroller Input/Output | VI/VII |
| 96 | Embedded Systems – Shape The World: Multi-Threaded Interfacing | VI/VII |
| 97 | Algorithm Design and Analysis | VI/VII |
| 98 | Hands-on training on Solar Study Lamp Assembly | VI/VII |
| 99 | Software Engineering | VI/VII |
| 100 | Digital Signal Processing | VI/VII |
| 101 | Signals and Systems | VI/VII |
| 102 | Principles of Signals and Systems | VI/VII |
| 103 | Discrete Time Signal Processing | VI/VII |
| 104 | Mathematical Methods and Techniques in Signal Processing | VI/VII |
| 105 | Statistical Signal Processing | VI/VII |
| 106 | VLSI Signal Processing | VI/VII |
| 107 | High Voltage Engineering | VI/VII |
| 108 | Computer Architecture | VI/VII |
| 109 | Components and Applications of Internet of Things | VI/VII |
| 110 | Analog Communication | VI/VII |
| 111 | Digital Communication Systems | VI/VII |
| 112 | Optical Engineering | VI/VII |
| 113 | Fiber-Optic Communication | VI/VII |
| 114 | Fiber-Optic Communication Systems and Techniques | VI/VII |
| 115 | Principles of Communication Systems | VI/VII |
| 116 | Principles of Communication Systems Part – II | VI/VII |
| 117 | Principles of Digital Communication | VI/VII |
| 118 | A System View of Communications: From Signals to Packets (Part 1) | VI/VII |
| 119 | A System View of Communications: From Signals to Packets (Part 2) | VI/VII |
| 120 | A System View of Communications: From Signals to Packets (Part 3) | VI/VII |
| 121 | CDMA / MIMO / OFDM Wireless Communications | VI/VII |
| 122 | Fundamentals of MIMO Wireless Communications | VI/VII |
| 123 | Introduction to Wireless and Cellular Communications | VI/VII |
| 124 | Microwave Engineering | VI/VII |
| 125 | Design and Simulation of Power Conversion using Open Source Tools | VI/VII |
| 126 | Digital Switching | VI/VII |
| 127 | Microelectronics: Devices to Circuits | VI/VII |
| 128 | Robotics | VI/VII |

| | | |
|---|---|---|
| 129 | Robotics: Kinematics and Mathematical Foundations | VI/VII |
| 130 | Robotics: Vision Intelligence and Machine Learning | VI/VII |
| 131 | Robotics: Dynamics and Control | VI/VII |
| 132 | Robotics: Locomotion Engineering | VI/VII |
| 133 | Model-based Systems Engineering: Foundations | VI/VII |
| 134 | Model-based Systems Engineering: Advanced Approaches with OPM | VI/VII |
| 135 | Electrical Drives | VII/VIII |
| 136 | Drones for Agriculture: Prepare and Design Your Drone (UAV) Mission | VII/VIII |
| 137 | Object Oriented Programming | VII/VIII |
| 138 | Programming for the Web with Java Script | VII/VIII |
| 139 | Big Data Analysis | VII/VIII |
| 140 | Visualizing Data with Python | VII/VIII |
| 141 | Python Basics for Data Science | VII/VIII |
| 142 | Analyzing Data with Python | VII/VIII |
| 143 | Analyzing Data with Python | VII/VIII |
| 144 | 4G Network Essentials | VII/VIII |
| 145 | Digital Image Processing | VII/VIII |
| 146 | Cyber Security Basics: A Hands-on Approach | VII/VIII |
| 147 | Advanced Electrical Power System | VII/VIII |
| 148 | Restructured Electrical Power System | VII/VIII |
| 149 | Computer Applications in Power System | VII/VIII |
| 150 | Transmission Lines and Electromagnetic Waves | VII/VIII |
| 151 | Power System Dynamics and Control | VII/VIII |
| 152 | Power Quality and FACTS | VII/VIII |
| 153 | HVDC Transmission Systems | VII/VIII |
| 154 | DC Power Transmission Systems | VII/VIII |
| 155 | Renewable and Non-Conventional Energy | VII/VIII |
| 156 | Solar Energy | VII/VIII |
| 157 | Solar Energy: Photovoltaic (PV) Systems | VII/VIII |
| 158 | Solar Energy: Photovoltaic (PV) Energy Conversion | VII/VIII |
| 159 | Solar Energy: Photovoltaic (PV) Technologies | VII/VIII |
| 160 | Solar Energy: Integration of Photovoltaic Systems in Microgrids | VII/VIII |
| 161 | Sustainable Energy: Design a Renewable Future | VII/VIII |
| 162 | Why Move Towards Cleaner Power | VII/VIII |
| 163 | Creating a Pro-Renewables Environment | VII/VIII |
| 164 | Incorporating Renewable Energy in Electricity Grids | VII/VIII |
| 165 | Using Photovoltaic (PV) Technology in Desert Climates | VII/VIII |
| 166 | Solar Resource Assessment in Desert Climates | VII/VIII |
| 167 | Solar Energy Engineering: Comprehensive Exams | VII/VIII |
| 168 | Nuclear Energy: Science, Systems and Society | VII/VIII |
| 169 | Utilization of Electric Power | VII/VIII |
| 170 | Line Commutated and Active Rectifiers | VII/VIII |
| 171 | Advanced Power Electronics | VII/VIII |
| 172 | Power Management Integrated Circuits | VII/VIII |

| | | |
|---|---|---|
| 173 | High Power Multilevel Converters – Analysis, Design and Operational Issues | VII/VIII |
| 174 | Advanced Electric Drives | VII/VIII |
| 175 | Mapping Signal Processing Algorithms to Architectures | VII/VIII |
| 176 | Neural Networks for Signal Processing – I | VII/VIII |
| 177 | Control Systems Design | VII/VIII |
| 178 | Advance Power Electronics and Control | VII/VIII |
| 179 | Principles and Techniques of Modern Radar Systems | VII/VIII |
| 180 | Industrial Electrical System | VII/VIII |
| 181 | Manufacturing Process Control II | VII/VIII |
| 182 | Sensors and Actuators | VII/VIII |
| 183 | Electronic Systems for Sensor Applications | VII/VIII |
| 184 | Fabrication Techniques for MEMs based Sensors: Clinical Perspective | VII/VIII |
| 185 | Micro and Nanofabrication (MEMS) | VII/VIII |
| 186 | Industrial Process Control | VII/VIII |
| 187 | PLC and SCADA | VII/VIII |
| 188 | Optimization Techniques | VII/VIII |
| 189 | Sensing Planet Earth – From Core to Outer Space | VII/VIII |
| 190 | Sensing Planet Earth – Water and Ice | VII/VIII |
| 191 | Research Methods: An Engineering Approach | VII/VIII |
| 192 | Smart Grid / Micro Grid | VII/VIII |
| 193 | Power Quality Improvement Technique | VII/VIII |
| 194 | Big Data Analytics for Smart Grid | VII/VIII |
| 195 | Electric Vehicles | VII/VIII |
| 196 | Electric and Conventional Vehicles | VII/VIII |
| 197 | Electric Cars: Introduction | VII/VIII |
| 198 | Electric Cars: Technology | VII/VIII |
| 199 | Electric Cars: Business | VII/VIII |
| 200 | Electric Cars: Policy | VII/VIII |

# Appendix – B

**Mandatory Additional Requirement (MAR):**

**Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that to be earned by the students during the entire B.Tech duration.**

| Sl. No. | Name of the Activity | Points | Maximum Points Allowed |
|---|---|---|---|
| 1. | MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course) | 20 | 40 |
| 2. | Tech Fest/Teachers Day/Freshers Welcome | | |
| | Organizer | 5 | 10 |
| | Participants | 3 | 6 |
| 5. | Rural Reporting | 5 | 10 |
| 6. | Tree Plantation (per tree) | 1 | 10 |
| 7. | Participation in Relief Camps | 20 | 40 |
| 8. | Participation in Debate/Group Discussion/ Tech quiz | 10 | 20 |
| 9. | Publication of Wall magazine in institutional level (magazine/article/internet) | 10 | 20 |
| 10. | Publication in News Paper, Magazine & Blogs | 10 | 20 |
| 11. | Research Publication (per publication) | 15 | 30 |
| 12. | Innovative Projects (other than course curriculum) | 30 | 60 |
| 13. | Blood donation | 8 | 16 |
| | Blood donation camp Organization | 10 | 20 |
| 15. | Participation in Sports/Games | | |
| | College level | 5 | 10 |
| | University Level | 10 | 20 |
| | District Level | 12 | 24 |
| | State Level | 15 | 30 |
| | National/International Level | 20 | 20 |
| 21. | Cultural Programme (Dance, Drama, Elocution, Music etc.) | 10 | 20 |
| 22. | Member of Professional Society | 10 | 20 |
| 23. | Student Chapter | 10 | 20 |
| 24. | Relevant Industry Visit & Report | 10 | 20 |
| 25. | Photography activities in different Club( Photography club, Cine Club, Gitisansad) | 5 | 10 |
| 26. | Participation in Yoga Camp (Certificate to be submitted) | 5 | 10 |
| 27. | Self-Entrepreneurship Programme | 20 | 20 |
| 28. | Adventure Sports with Certification | 10 | 20 |
| 29. | Training to under privileged/Physically challenged | 15 | 30 |
| 30. | Community Service & Allied Activities | 10 | 20 |

**Department: Electrical Engineering**

LIST OF MOOCS COURSES FOR MAR

| MOOCs Equivalent (Theory) | Minimum Duration | Suggested MAR Point |
|---|---|---|
| Ethics in Engineering Practice | 8weeks | 16 |
| Environmental Studies: A Global Perspective | 6weeks | 12 |
| Introduction To Biology: The Secret of Life | 12weeks | 20 |
| Engineering Econometrics | 12weeks | 20 |
| Management in Engineering | 8weeks | 16 |
| Human Resource Development | 12 weeks | 20 |
| Organizational Behavior | 7 weeks | 16 |
| Project Management for Managers | 12weeks | 20 |
| International Cyber Conflicts | 5weeks | 10 |
| FundamentalsofDigitalMarketing, SocialMedia,and E-Commerce | 6weeks | 12 |
| Developing Soft Skills and Personality | 8 weeks | 16 |
| History of English Language and Literature | 12 weeks | 20 |
| Interpersonal Skills | 8 weeks | 16 |
| Soft skills | 12 weeks | 20 |
| Technical English for engineers | 8 weeks | 16 |
| Better Spoken English | 12 weeks | 20 |
| Business English Communication | 4 weeks | 8 |
| Calculus of One Real Variable | 8 weeks | 16 |
| Educational leadership | 8 weeks | 16 |
| Economics of IPR | 4 weeks | 8 |
| Enhancing Soft Skills and Personality | 8 weeks | 16 |
| Human Resource Development | 12 weeks | 20 |
| Indian Philosophy | 12 weeks | 20 |
| Intellectual Property | 12 weeks | 20 |
| Introduction on Intellectual Property to Engineers and Technologists | 8 weeks | 16 |
| Literature, Culture and Media | 12 weeks | 20 |
| Science, Technology and Society | 12 weeks | 20 |
| Soft Skill Development | 8 weeks | 16 |
| Speaking Effectively | 8 weeks | 16 |
| Strategic Performance Management | 8 weeks | 16 |
| Water, Society and Sustainability | 4 weeks | 8 |
| Calculus of Several Real Variables | 8 weeks | 16 |
| Higher Engineering Mathematics | 12 weeks | 20 |
| Introduction to Abstract and Linear Algebra | 8 weeks | 16 |
| Enhancing Soft Skills and Personality | 8 weeks | 16 |

# Record of Activities for Mandatory Additional Requirement

| **College Name (College Code):** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Department:** | | | | | | | | | | | | |
| **Student Name:** | | **University Roll No:** | | | | | **Registration No:** | | | | | |
| **Sl No** | **Activity** | **Points** | **Max. Points Allowed** | **Points Earned** | | | | | | | | |
| | | | | **Sem1** | **Sem2** | **Sem3** | **Sem4** | **Sem5** | **Sem6** | **Sem7** | **Sem8** | **Total** |
| 1 | *MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course* | | | | | | | | | | | |
| | For 12 weeks duration | **20** | **40** | | | | | | | | | |
| | For 8 weeks duration | **16** | | | | | | | | | | |
| 2 | *Tech Fest/Teachers Day/Freshers Welcome* | | | | | | | | | | | |
| | Organizer | **5** | **10** | | | | | | | | | |
| | Participants | **3** | **6** | | | | | | | | | |
| 3 | Rural Reporting | **5** | **10** | | | | | | | | | |
| 4 | Tree Plantation and up keeping (per tree) | **1** | **10** | | | | | | | | | |
| 5 | Participation in Relief Camps | **20** | **40** | | | | | | | | | |
| 6 | Participation in Debate/Group Discussion/ Tech quiz | **10** | **20** | | | | | | | | | |
| 7 | *Publication of Wall magazine in institutional level (magazine/article/internet)* | | | | | | | | | | | |
| | Editor | **10** | **20** | | | | | | | | | |
| | Writer | **6** | **12** | | | | | | | | | |
| 8 | Publication in News Paper, Magazine & Blogs | **10** | **20** | | | | | | | | | |
| 9 | Research Publication (per publication) | **15** | **30** | | | | | | | | | |
| 10 | Innovative Projects (other than course curriculum) | **30** | **60** | | | | | | | | | |
| 11 | Blood donation | **8** | **16** | | | | | | | | | |
| | Blood donation camp Organization | **10** | **20** | | | | | | | | | |

# Record of Activities for Mandatory Additional Requirement (Contd.)

| Sl No | Activity | Points | Max. Points Allowed | Points Earned | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sem1 | Sem2 | Sem3 | Sem4 | Sem5 | Sem6 | Sem7 | Sem8 | Total |
| 12 | *Participation in Sports/Games* | | | | | | | | | | | |
| | College level | **5** | **10** | | | | | | | | | |
| | University Level | **10** | **20** | | | | | | | | | |
| | District Level | **12** | **24** | | | | | | | | | |
| | State Level | **15** | **30** | | | | | | | | | |
| | National/International Level | **20** | **20** | | | | | | | | | |
| 13 | Cultural Programme (Dance, Drama, Elocution, Music etc.) | **10** | **20** | | | | | | | | | |
| 14 | Member of Professional Society | **10** | **20** | | | | | | | | | |
| 15 | Student Chapter | **10** | **20** | | | | | | | | | |
| 16 | Relevant Industry Visit & Report | **10** | **20** | | | | | | | | | |
| 17 | Photography activities in different Club(Photography club, Cine Club, Gitisansad) | **5** | **10** | | | | | | | | | |
| 18 | Participation in Yoga Camp (Certificate to be submitted) | **5** | **10** | | | | | | | | | |
| 19 | Self-Entrepreneurship Programme | **20** | **20** | | | | | | | | | |
| 20 | Adventure Sports with Certification | **10** | **20** | | | | | | | | | |
| 21 | Training to under privileged / Differently abled | **15** | **30** | | | | | | | | | |
| 22 | Community Service & Allied Activities | **10** | **20** | | | | | | | | | |
| **Total Points** | | | | | | | | | | | | |
| **Signature of Mentor** | | | | | | | | | | | | |
| **Signature of HoD** | | | | | | | | | | | | |