## 13. Courses of Study and Scheme of Assessment

## BE ROBOTICS AND AUTOMATION

**(2015 REGULATIONS)**
**(Minimum credits to be earned: 180)**

| Code No. | Course | Hours / week | | | | Maximum marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total | CAT |
| **SEMESTER I** | | | | | | | | | |
| 15R101 | Calculus and its Applications | 3 | 2 | 0 | 4 | 50 | 50 | 100 | BS |
| 15R102 | Physics | 3 | 0 | 0 | 3 | 50 | 50 | 100 | BS |
| 15R103 | Chemistry | 3 | 0 | 0 | 3 | 50 | 50 | 100 | BS |
| 15R104 | Problem Solving and C Programming | 2 | 2 | 0 | 3 | 50 | 50 | 100 | ES |
| 15R105 | Introduction to Mechanical Systems | 4 | 0 | 0 | 4 | 50 | 50 | 100 | ES |
| 15Z104 | English Language Proficiency | 2 | 2 | 0 | 3 | 50 | 50 | 100 | HS |
| 15R110 | Engineering Practices | 0 | 0 | 2 | 1 | 100 | - | 100 | ES |
| 15R111 | Physics Laboratory I | 0 | 0 | 2 | 1 | 100 | - | 100 | BS |
| 15R112 | Chemistry Laboratory I | 0 | 0 | 2 | 1 | 100 | - | 100 | BS |
| 15R214 | Personality and Character Development | 0 | 0 | Refer sem 2 and footnote | | | | | MC |
| | **Total 29 hrs** | **17** | **6** | **6** | **23** | **600** | **300** | **900** | |
| **SEMESTER II** | | | | | | | | | |
| 15R201 | Complex Variables and Transforms | 3 | 2 | 0 | 4 | 50 | 50 | 100 | BS |
| 15R202 | Materials Science | 3 | 0 | 0 | 3 | 50 | 50 | 100 | BS |
| 15R203 | Applied Electrochemistry | 3 | 0 | 0 | 3 | 50 | 50 | 100 | BS |
| 15R204 | Electrical Circuit Theory | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| 15R205 | Strength of Materials | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| 15Z___ | Language Elective | 3 | 0 | 0 | 3 | 50 | 50 | 100 | HS |
| 15R210 | Engineering Graphics | 0 | 0 | 4 | 2 | 100 | - | 100 | ES |
| 15R211 | Physics Laboratory II | 0 | 0 | 2 | 1 | 100 | - | 100 | BS |
| 15R212 | Chemistry Laboratory II | 0 | 0 | 2 | 1 | 100 | - | 100 | BS |
| 15R213 | Electric Circuits and Networks Laboratory | 0 | 0 | 2 | 1 | 100 | - | 100 | ES |
| 15R214 | Personality and Character Development | 0 | 0 | ** | Grade | - | - | - | MC |
| | **Total 30 hrs** | **18** | **2** | **10** | **24** | **700** | **300** | **1000** | |

CA - Continuous Assessment
FE - Final Examination
** - Total 40 hrs in I & II semesters put together. Grade: Completed / Not Completed.

**CAT-Category; BS – Basic Science; HS – Humanities & Social Sciences; ES – Engineering Sciences; PC – Professional Core; PE – Professional Elective; OE – Open Elective; EEC – Employability Enhancement Course; MC – Mandatory Course.**

## BE ROBOTICS AND AUTOMATION (2015 REGULATIONS)

| Code No. | Course | Hours / week | | | | Maximum marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total | CAT |
| **SEMESTER II – Summer Term€** | | | | | | | | | |
| 15R215 | Professional Skills | 6 | 0 | 9 | 2 | 100 | - | 100 | EEC |
| 15R216 | In-Plant Training and Technical Seminar | 6 | 0 | 9 | 2 | 100 | - | 100 | EEC |
| | **Total 30 hrs** | **12** | **0** | **18** | **4** | **200** | **-** | **200** | |

CA - Continuous Assessment
FE - Final Examination
€ - These courses will be conducted prior to the commencement of the third semester for a period of 4 weeks during summer term

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## BE ROBOTICS AND AUTOMATION (2015 REGULATIONS)

| Code No. | Course | Hours / week | | | | Maximum marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total | CAT |
| **SEMESTER III** | | | | | | | | | |
| 15R301 | Linear Algebra and Numerical Analysis | 3 | 2 | 0 | 4 | 50 | 50 | 100 | BS |
| 15R302 | Digital Electronics | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| 15R303 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R304 | Electrical Machines and Power systems | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R305 | Kinematics and Dynamics of Machinery | 3 | 2 | 0 | 4 | 50 | 50 | 100 | PC |
| 15Z070 | Economics for Engineers | 3 | 0 | 0 | 3 | 50 | 50 | 100 | HS |
| 15R310 | Electronic Circuits and Digital Laboratory | 0 | 0 | 2 | 1 | 100 | - | 100 | PC |
| 15R311 | Mechanics & Machines Laboratory | 0 | 0 | 2 | 1 | 100 | - | 100 | PC |
| | **Total 26 hrs** | **18** | **4** | **4** | **22** | **500** | **300** | **800** | |
| **SEMESTER IV** | | | | | | | | | |
| 15R401 | Probability and Statistics | 2 | 2 | 0 | 3 | 50 | 50 | 100 | BS |
| 15R402 | Automatic Control Systems | 3 | 2 | 0 | 4 | 50 | 50 | 100 | PC |
| 15R403 | Data Structures and Algorithms | 4 | 0 | 0 | 4 | 50 | 50 | 100 | ES |
| 15R404 | Linear Integrated Circuits | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R405 | Hydraulics and Pneumatics | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15____ | Open Elective I* | 3 | 0 | 0 | 3 | 50 | 50 | 100 | OE |
| 15R410 | LIC and Control Systems Laboratory | 0 | 0 | 4 | 2 | 100 | - | 100 | PC |
| 15R411 | Hydraulics and Pneumatics Laboratory | 0 | 0 | 2 | 1 | 100 | - | 100 | PC |
| | **Total 28 hrs** | **18** | **4** | **6** | **23** | **500** | **300** | **800** | |

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FE - Final Examination

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*** – LTPC for open electives can be either 3 0 0 3 or 2 2 0 3.**

## BE ROBOTICS AND AUTOMATION (2015 REGULATIONS)

| Code No. | Course | Hours / week | | | | Maximum marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total | CAT |
| **SEMESTER V** | | | | | | | | | |
| 15R501 | Programmable Logic Controllers | 2 | 2 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R502 | Robot Kinematics and Dynamics | 2 | 2 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R503 | Microprocessors and Microcontrollers | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R504 | Sensors and Transducers | 4 | 0 | 0 | 4 | 50 | 50 | 100 | PC |
| 15R___ | Professional Elective I | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PE |
| 15____ | Open Elective II* | 3 | 0 | 0 | 3 | 50 | 50 | 100 | OE |
| 15R510 | PLC and Robotics Laboratory | 0 | 0 | 4 | 2 | 100 | - | 100 | PC |
| 15R511 | Microprocessors and Microcontrollers Laboratory | 0 | 0 | 2 | 1 | 100 | - | 100 | PC |
| | **Total 27 hrs** | **17** | **4** | **6** | **22** | **500** | **300** | **800** | |
| **SEMESTER VI** | | | | | | | | | |
| 15R601 | Power Electronics and Drives | 2 | 2 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R602 | Design of Mechanical Transmission Systems | 2 | 2 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R603 | Vision Systems | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R604 | CNC Machines | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R605 | Environmental Science and Engineering | 3 | 0 | 0 | 3 | 50 | 50 | 100 | ES |
| 15____ | Open Elective III* | 3 | 0 | 0 | 3 | 50 | 50 | 100 | OE |
| 15R610 | Power Electronics and Drives Laboratory | 0 | 0 | 4 | 2 | 100 | - | 100 | PC |
| 15R611 | CNC and Engineering Design Laboratory | 0 | 0 | 4 | 2 | 100 | - | 100 | PC |
| 15R612 | Innovation Practices | 0 | 0 | 4 | 2 | 100 | - | 100 | EEC |
| | **Total 32 hrs** | **16** | **4** | **12** | **24** | **600** | **300** | **900** | |

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FE - Final Examination

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*** – LTPC for open electives can be either 3 0 0 3 or 2 2 0 3.**

## BE ROBOTICS AND AUTOMATION (2015 REGULATIONS)

| Code No. | Course | Hours / week | | | | Maximum marks | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Lecture | Tutorial | Practical | Credits | CA | FE | Total | CAT |
| **SEMESTER VII** | | | | | | | | | |
| 15R701 | Automation System Design | 2 | 2 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R702 | Field and Service Robotics | 2 | 2 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R703 | Totally Integrated Automation | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PC |
| 15R___ | Professional Elective II | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PE |
| 15R___ | Professional Elective III | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PE |
| 15R___ | Professional Elective IV | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PE |
| 15R710 | Totally Integrated Automation Laboratory | 0 | 0 | 4 | 2 | 100 | - | 100 | PC |
| 15R711 | Product Design Laboratory | 0 | 0 | 4 | 2 | 100 | - | 100 | EEC |
| 15R720 | Project Work I | 0 | 0 | 4 | 2 | 100 | - | 100 | EEC |
| | **Total 32 hrs** | **16** | **4** | **12** | **24** | **600** | **300** | **900** | |
| **SEMESTER VIII** | | | | | | | | | |
| 15R___ | Professional Elective V | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PE |
| 15R___ | Professional Elective VI | 3 | 0 | 0 | 3 | 50 | 50 | 100 | PE |
| 15R820 | Project Work II | 0 | 0 | 16 | 8 | 50 | 50 | 100 | EEC |
| | **Total 22 hrs** | **6** | **0** | **16** | **14** | **150** | **150** | **300** | |

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## LANGUAGE ELECTIVES

| | |
|---|---|
| 15Z080 | Communication Skills for Engineers |
| 15Z081 | Basic German |
| 15Z082 | Basic French |
| 15Z083 | Basic Japanese |

## OPEN ELECTIVES

**(Students can opt for all open electives from single stream or several streams)**

### MATHEMATICS

| | |
|---|---|
| 15OH01 | Advanced Linear Algebra |
| 15OH02 | Algebraic Structures |
| 15OH03 | Calculus of Variations and Tensor Analysis |
| 15OH04 | Graph Theory and its Applications |
| 15OH05 | Mathematical Finance |
| 15OH06 | Mathematical Modeling and Simulation |
| 15OH07 | Number Theory for Computing |
| 15OH08 | Operations Research |
| 15OH09 | Reliability and Quality Control |
| 15OH10 | Soft Computing |
| 15OH11 | Stochastic Models |

### PHYSICS

| | |
|---|---|
| 15OH20 | Analytical Techniques for Materials Characterization |
| 15OH21 | Laser Technology |
| 15OH22 | Micro Electromechanical Systems |
| 15OH23 | Nanomaterials and Applications |
| 15OH24 | Physics for Solar PV Systems and Solid-State Lighting Systems |
| 15OH25 | Sensors for Engineering Applications |
| 15OH26 | Thin Film Technology |
| 15OH27 | Nonlinear Science and Engineering Applications |
| 15OH28 | Nonlinear Fiber Optics |
| 15OH29 | Chaotronics |

### CHEMISTRY

| | |
|---|---|
| 15OH33 | Chemical Sensors and Biosensors |
| 15OH37 | Energy Storing Devices and Fuel Cells |
| 15OH39 | Modern Electronic Materials |

### COMPUTER APPLICATIONS

| | |
|---|---|
| 15OH46 | Computer Graphics and Virtual Reality |
| 15OH47 | Data and File Structures |
| 15OH48 | Database Management System |
| 15OH49 | High Performance Computing |
| 15OH50 | Mainframe Systems |
| 15OH51 | Mobile Application Development |
| 15OH52 | Multicore Programming |
| 15OH53 | Object Oriented Programming |
| 15OH54 | Programming in Python |
| 15OH55 | Responsive Web Design |
| 15OH56 | Social Web Mining |
| 15OH57 | Software Engineering |
| 15OH58 | Java Programming |
| 15OH59 | Geographic Information System |
| 15OH60 | Programming for Robotics |

**HUMANITIES**

| | |
|---|---|
| 15OH61 | An Introduction to Indian Constitution |
| 15OH62 | Entrepreneurship |
| 15OH63 | Human Resource Management |
| 15OH64 | Industrial Psychology |
| 15OH65 | Principles of Management |
| 15OH66 | Business Statistics |
| 15OH67 | Disaster Management |
| 15OH68 | Financial and Managerial Accounting |
| 15OH69 | Marketing Management |
| 15OH70 | Defence Practices and Disaster Management |

**ENGLISH**

| | |
|---|---|
| 15OH75 | English and Soft Skills for Employability |
| 15OH76 | English for Competitive Examinations |
| 15OH77 | German Language – International Level A1.1 |
| 15OH78 | German Language – International Level A1.2 |

**APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCES**

| | |
|---|---|
| 15OH82 | Optimization Techniques |
| 15OH83 | Data Science |
| 15OH84 | Data Visualization |
| 15OH85 | Artificial Intelligence |
| 15OH86 | Pervasive Computing |
| 15OH87 | Parallel and Distributed Computing |
| 15OH88 | Cyber Security |
| 15OH89 | Randomized Algorithms |
| 15OH90 | Approximation Algorithms |
| 15OH91 | Network Science |
| 15OH92 | Applied Stochastic Processes |
| 15OH93 | Modelling and Simulation |
| 15OH94 | Graph Algorithms |

**OPEN ELECTIVES OFFERED BY ENGINEERING DEPARTMENTS**

| | | |
|---|---|---|
| 15AH01 | Automotive Infotronics | (Dept. of Automobile Engineering) |
| 15AH03 | Electric and Hybrid Vehicles | (Dept. of Automobile Engineering) |
| 15MH03 | Industrial Engineering and Management | (Dept. of Mechanical Engineering) |
| 15ZH01 | Multimedia Systems and Applications | (Dept. of Computer Science and Engineering) |
| 15IH03 | Graphics and Multimedia | (Dept. of Information Technology) |
| 15PH07 | Virtual Reality Systems and Applications | (Dept. of Production Engineering) |
| 15PH08 | Foundation Skills in Integrated Product Development | (Dept. of Production Engineering) |

**PROFESSIONAL ELECTIVES**

**ROBOTICS**

| | |
|---|---|
| 15R001 | Artificial Intelligence for Robotics |
| 15R002 | Robotic Control Systems |
| 15R003 | Industrial Robotics and Material Handling Systems |
| 15R004 | Microrobotics |
| 15R005 | Cognitive Robotics |
| 15R006 | Cloud Robotics |
| 15R007 | Medical Robotics |

**AUTOMATION AND NETWORKING**

| | |
|---|---|
| 15R010 | Electrical Machines for Automation |
| 15R011 | Industrial Networking |

| | |
|---|---|
| 15R012 | Virtual Instrumentation Systems |
| 15R013 | Sensor Networks |
| 15R014 | Computer Integrated Manufacturing |
| 15R015 | Digital Control Systems |
| 15R016 | Automobile Engineering |
| 15R017 | Renewable Energy Systems |

**SIGNAL PROCESSING**

| | |
|---|---|
| 15R020 | Image Analytics |
| 15R021 | Speech Signal Processing |
| 15R022 | Signal Processing |
| 15R023 | Embedded Processors |
| 15R024 | Advanced Microprocessors and Microcontrollers |

**COMPUTER SCIENCE**

| | |
|---|---|
| 15R030 | Internet of Things |
| 15R031 | Computer Architecture |
| 15R032 | Embedded and Real-time Systems |
| 15R033 | System Software |
| 15R034 | Software Project Management and Quality Assurance |
| 15R035 | Neural Networks and Fuzzy Systems |
| 15R036 | Internet Tools and Java Programming |
| 15R037 | Machine Learning for Robotics |

**INDUSTRIAL ENGINEERING**

| | |
|---|---|
| 15R040 | Lean Manufacturing |
| 15R041 | Supply Chain Management |
| 15R042 | Process Planning and Cost Estimation |
| 15R043 | Maintenance and Safety Engineering |
| 15R044 | Industrial Design and Applied Ergonomics |
| 15R045 | Product Design and Development |
| 15R046 | Manufacturing Technology |

## ONE CREDIT COURSES

**OFFERED BY THE DEPARTMENT**

| | |
|---|---|
| 15RF01 | CAD Tools for Industrial Automation |
| 15RF02 | Design Concepts and Realization |
| 15RF03 | Dynamic Modeling Simulations and Control of Robots |
| 15RF04 | Modeling and Simulation of Dynamic Systems Using Adams |
| 15RF05 | Robot Operating Systems |
| 15RF06 | Computer Vision with OpenCV |
| 15RF07 | Underwater Robotics |
| 15RF08 | Industrial Drives for Automation |
| 15RF09 | PC Based Industrial Automation |

**OFFERED BY HUMANITIES**

| | |
|---|---|
| 15OF01 | Export – Import Management |
| 15OF02 | Insurance & Risk Management |
| 15OF03 | Values and Ethics at Work Place |
| 15OF04 | Development of Industrialisation |
| 15OF05 | Creativity and Social Enterprise |
| 15OF06 | Social and Psychological Well Being |
| 15OF13 | Security Analysis and Portfolio Management |
| 15OF14 | Implementation of Quality Management System |
| 15OF15 | Financial Management |
| 15OF16 | Personality Development Through Transactional Analysis |

**OFFERED BY THE DEPARTMENT OF ENGLISH**

| | |
|---|---|
| 15OF10 | Corporate Communication |
| 15OF11 | Interpersonal and Organizational Communication |
| 15OF12 | Human Values Through Literature |

**OFFERED BY THE DEPARTMENT OF MATHEMATICS**

| | |
|---|---|
| 15OF21 | Principles of Business Analytics |

## SUMMARY OF CREDIT DISTRIBUTION

| B.E. ROBOTICS AND AUTOMATION | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **S. No** | **Course Work subject Area** | **Credits Per Semester** | | | | | | | | **Total Credit** | **Credit Range** | |
| | | **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | | Min | Max |
| 1 | **HS** | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 9 | 9 | 18 |
| 2 | **BS** | 12 | 12 | 4 | 3 | 0 | 0 | 0 | 0 | 31 | 27 | 36 |
| 3 | **ES** | 8 | 9 | 3 | 4 | 0 | 3 | 0 | 0 | 27 | 27 | 36 |
| 4 | **PC** | 0 | 0 | 12 | 13 | 16 | 16 | 11 | 0 | 68 | 54 | 72 |
| 5 | **PE** | 0 | 0 | 0 | 0 | 3 | 0 | 9 | 6 | 18 | 18 | 27 |
| 6 | **OE** | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 0 | 9 | 9 | 18 |
| 7 | **EEC** | 0 | 0 +**4*** | 0 | 0 | 0 | 2 | 4 | 8 | 18 | 18 | 27 |
| | **Total** | **23** | **24+4*** | **22** | **23** | **22** | **24** | **24** | **14** | **180** | **175** | **185** |

*** Summer Term**

**CAT-Category; BS – Basic Sciences; HS – Humanities and Social Sciences; ES – Engineering Sciences; Arts & Science; PC – Professional Core; PE – Professional Electives; OE – Open Electives; EEC – Employability Enhancement Courses.**