# CURRICULA
# POST GRADUATE PROGRAMMES
# (M.Tech., M.Sc., MCA, MBA, M.A.)

## (2024 – 25)

**NATIONAL INSTITUTE OF TECHNOLOGY**
**TIRUCHIRAPPALLI - 620 015**
**TAMIL NADU, INDIA**

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## CREDIT DISTRIBUTION

| Sl. No. | Programme | Semester / Trimester (for MBA) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 1-4 | Total |
| **M.Tech.** | | | | | | | | | |
| 1. | Chemical Engineering | 24 | 24 | 14 | 12 | - | - | 6 | 80 |
| 2. | Process Control and Instrumentation | 24 | 24 | 14 | 12 | - | - | 6 | 80 |
| 3. | Transportation Engineering and Management | 25 | 23 | 14 | 12 | - | - | 6 | 80 |
| 4. | Structural Engineering | 25 | 23 | 14 | 12 | - | - | 6 | 80 |
| 5. | Environmental Engineering | 23 | 25 | 14 | 12 | - | - | 6 | 80 |
| 6. | Construction Technology and Management | 23 | 25 | 14 | 12 | - | - | 6 | 80 |
| 7. | Geotechnical Engineering | 23 | 25 | 14 | 12 | - | - | 6 | 80 |
| 8. | Data Analytics | 24 | 24 | 14 | 12 | - | - | 6 (1-3) | 80 |
| 9. | Computer Science and Engineering | 24 | 24 | 20 | 12 | - | - | - | 80 |
| 10. | Power Systems | 25 | 23 | 14 | 12 | - | - | 6 | 80 |
| 11. | Power Electronics | 25 | 23 | 14 | 12 | - | - | 6 | 80 |
| 12. | Communication Systems | 23 | 25 | 14 | 12 | - | - | 6 | 80 |
| 13. | VLSI System | 23 | 25 | 14 | 12 | - | - | 6 | 80 |
| 14. | Energy Engineering | 25 | 23 | 14 | 12 | - | - | 6 | 80 |
| 15. | Industrial Automation | 25 | 23 | 14 | 12 | - | - | 6 (1-3) | 80 |
| 16. | Industrial Safety Engineering | 24 | 24 | 14 | 12 | - | - | 6 | 80 |
| 17. | Thermal Power Engineering | 24 | 24 | 14 | 12 | - | - | 6 | 80 |
| 18. | Welding Engineering | 24 | 24 | 14 | 12 | - | - | 6 | 80 |
| 19. | Materials Science and Engineering | 24 | 24 | 14 | 12 | - | - | 6 | 80 |
| 20. | Industrial Metallurgy | 24 | 24 | 14 | 12 | - | - | 6 | 80 |
| 21. | Non - Destructive Testing | 23 | 25 | 14 | 12 | - | - | 6 | 80 |
| 22. | Manufacturing Technology | 23 | 25 | 14 | 12 | - | - | 6 | 80 |
| 23. | Industrial Engineering and Management | 25 | 23 | 14 | 12 | - | - | 6 | 80 |
| **M.Sc.** | | | | | | | | | |
| 24. | Chemistry | 20 | 19 | 23 | 18 | - | - | | 80 |
| 25. | Computer Science | 26 | 22 | 14 | 12 | - | - | 6 | 80 |
| 26. | Mathematics | 22 | 19 | 20 | 15 | - | - | 6 | 80 |
| 27. | Physics | 20 | 19 | 20 | 15 | - | - | 6 | 80 |
| **MCA** | | | | | | | | | |
| 28. | Master of Computer Applications | 20 | 21 | 23 | 20 | 21 | 12 | 3 | 120 |
| **MBA** | | | | | | | | | |
| 29. | Master of Business Administration | 15 | 14 | 14 | 15 | 12 | 10 | - | 80 |
| **MA** | | | | | | | | | |
| 30. | English | 20 | 19 | 20 | 18 | - | - | 3 | 80 |

## M.Tech. (CHEMICAL ENGINEERING)

The total minimum credits required for completing the M.Tech. Programme in Chemical Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL601 | Advanced Process Control | 4 |
| 2. | CL603 | Mathematical Methods for Chemical Engineers | 4 |
| 3. | CL605 | Advances in Fluidization Engineering | 4 |
| 4. | | Programme Elective I | 4 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III | 3 |
| 7. | CL607 | Chemical Process Modelling and Simulation Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL602 | Chemical Reactor Analysis and Design | 4 |
| 2. | CL604 | Chemical Process Design | 4 |
| 3. | CL606 | Advanced Separation Techniques | 4 |
| 4. | | Programme Elective IV | 4 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI | 3 |
| 7. | CL608 | Analytical Instrumentation Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CL609 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CL647 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| CL648 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | OPEN ELECTIVE I / Online Course | 3 |
| 2. | | OPEN ELECTIVE II / Online Course | 3 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL611 | Nano Technology | 3 |
| 2. | CL612 | Scale - up Methods | 3 |
| 3. | CL613 | Industrial Safety and Risk Management | 3 |
| 4. | CL614 | Bioprocess Engineering | 3 |
| 5. | CL615 | Polymer Dynamics | 3 |
| 6. | CL616 | Multiphase Flow | 3 |
| 7. | CL617 | Design and Analysis of Experiments | 3 |
| 8. | CL618 | Fuel Cell Technology | 3 |
| 9. | CL619 | Pinch Analysis and Heat Exchange Network Design | 4 |
| 10. | CL620 | Industrial Energy Systems | 3 |
| 11. | CL621 | Wastewater and Solid Waste Treatment | 3 |
| 12. | CL622 | Computational Fluid Dynamics | 3 |
| 13. | CL623 | Process Optimization | 4 |
| 14. | CL624 | Ecology for Engineers | 3 |
| 15. | CL625 | Advanced Food Process Engineering | 3 |
| 16. | CL626 | Bio-refinery Engineering | 3 |
| 17. | CL627 | Air Pollution Control Equipment Design | 3 |
| 18. | CL628 | Advanced Transport Phenomena | 4 |
| 19. | CL629 | Electrochemical Reaction Engineering | 3 |
| 20. | CL630 | Bio-energy | 3 |
| 21. | CL631 | Process Intensification | 3 |
| 22. | CL632 | Bio electrochemical Systems | 3 |
| 23. | HS611 | Technical Communication | 3 |
| 24. | MT667 | Surface Engineering | 3 |

## OPEN ELECTIVES (OE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL617 | Design and Analysis of Experiments | 3 |
| 2. | CL630 | Bio-energy | 3 |

## M. Tech. (PROCESS CONTROL AND INSTRUMENTATION)

The total minimum credits required for completing the M.Tech. Programme in Process Control and Instrumentation is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL651 A/B | Measurement Systems / Chemical Process Systems | 4 |
| 2. | CL653 | Modern Control Engineering | 4 |
| 3. | CL601 | Advanced Process Control | 4 |
| 4. | | Programme Elective I | 4 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III | 3 |
| 7. | CL655 | Process Control and Instrumentation Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL652 | Computational Techniques in Control Engineering | 4 |
| 2. | CL654 | Process Flow-Sheeting | 4 |
| 3. | CL656 | Industrial Instrumentation | 4 |
| 4. | | Programme Elective IV | 4 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI | 3 |
| 7. | CL658 | Process Simulation Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CL659 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CL697 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| CL698 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | OPEN ELECTIVE I / Online Course | 3 |
| 2. | | OPEN ELECTIVE II / Online Course | 3 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL661 | Signal Conditioning and Processing | 3 |
| 2. | CL662 | Computer Control of Processes | 3 |
| 3. | CL663 | Analytical Instrumentation | 3 |
| 4. | CL664 | Applied Soft Computing | 4 |
| 5. | CL665 | Multi Sensor Data Fusion | 3 |
| 6. | CL666 | System Identification and Adaptive Control | 4 |
| 7. | CL667 | Logic and Distributed Control Systems | 3 |
| 8. | CL668 | Industrial Data Communication Systems | 3 |
| 9. | CL669 | Micro Electro Mechanical Systems | 3 |
| 10. | CL670 | Optimal Control | 3 |
| 11. | CL671 | Real-Time and Embedded Systems | 3 |
| 12. | CL672 | Cyber Physical System | 3 |
| 13. | CL673 | Biomedical Instrumentation | 3 |
| 14. | CL674 | Machine Learning | 3 |
| 15. | CL675 | Optimization Techniques | 4 |
| 16. | CL676 | Controller Tuning | 3 |
| 17. | CL677 | Wireless Sensor Networks | 3 |
| 18. | CL678 | Mathematical Methods for Engineers | 3 |
| 19. | HS611 | Technical Communication | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CL674 | Machine Learning | 3 |
| 2. | CL675 | Optimization Techniques | 3 |

## M. Tech. (TRANSPORTATION ENGINEERING AND MANAGEMENT)

The total minimum credits required for completing the M.Tech. Programme in Transportation Engineering and Management is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA601 | Numerical Methods and Applied Statistics | 4 |
| 2. | CE601 | Highway Traffic Analysis and Design | 4 |
| 3. | CE603 | Pavement Analysis and Design | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | CE607 | Traffic Engineering and Transportation Planning Laboratory | 2 |
| 8. | CE609 | Pavement Engineering Laboratory | 2 |
| | | **Total** | **25** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE602 | Urban Transportation Systems | 4 |
| 2. | CE604 | Transportation Planning | 4 |
| 3. | CE606 | Pavement Construction and Maintenance | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | CE610 | Computer Aided Design in Transportation Engineering | 2 |
| | | **Total** | **23** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CE645 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CE647 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CE648 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) / ONLINE COURSE (OC)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | **# (To be completed between I to IV semester)** | 6 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE611 | Traffic Flow Theory | 3 |
| 2. | CE612 | Introduction to Computational Techniques in Transportation Engineering | 3 |
| 3. | CE613 | Transportation Network Analysis and Optimization | 3 |
| 4. | CE614 | Transportation Systems | 3 |
| 5. | CE615 | Transportation Economics | 3 |
| 6. | CE616 | Waterway Transportation | 3 |
| 7. | CE617 | Airport Planning and Design | 3 |
| 8. | CE618 | Advanced Highway Materials | 3 |
| 9. | CE619 | Intelligent Transportation Systems | 3 |
| 10. | CE620 | Advanced Surveying and Cartography | 3 |
| 11. | CE621 | Geospatial Techniques | 3 |
| 12. | CE622 | Statistical Methods for Civil Engineers | 3 |
| 13. | CE623 | Basics of Machine Learning and its Application in Civil Engineering | 3 |
| 14. | CE624 | Urban Planning Techniques and Practices | 3 |
| 15. | CE625 | Design and Construction of Low Volume Rural Roads | 3 |
| 16. | CE626 | Pavement Evaluation and Management | 3 |
| 17. | CE627 | Behavioral Travel Modeling | 3 |
| 18. | CE628 | Sustainable Transportation | 3 |
| 19. | CE629 | Logistics in Transportation Engineering | 3 |
| 20. | CE630 | Road Safety System | 3 |
| 21. | CE631 | Railways Infrastructure Planning and Design | 3 |

## OPEN ELECTIVES (OE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE619 | Intelligent Transportation Systems | 3 |
| 2. | CE621 | Geospatial Techniques | 3 |
| 3. | CE622 | Statistical Methods for Civil Engineers | 3 |
| 4. | CE623 | Basics of Machine Learning and its Application in CivilEngineering | 3 |
| 5. | CE624 | Urban Planning Techniques and Practices | 3 |

**MICROCREDITS (MC)** (Students can opt 3 courses of 1 credit (4-week duration) each as microcredits or 2 courses (2 credits (8-week duration) & 1 credit (4-week duration) instead of 1 OE/OC)

| Code | Course of Study | Credit |
|---|---|---|
| | Equivalent to OC (May be completed between Semester I to Semester IV) | 3 |

## ELECTIVE COMBINATIONS

### 1. Program Elective Courses

**Option 1:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 3 | 0 | 9 |

**Option 2:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 3 | 0 | 9 |

**Option 3:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 2 | 1 | 9 |

**Option 4:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 2 | 1 | 9 |

## 2. Online Courses (OC) / Open Elective (OE) Courses

**Option 1:**

| Semester | No. of Open Elective Courses | No. of Online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | - | 2 | - | - |
| | - | 1 | 1 | 1 |
| | - | 1 | - | 3 |

**Option 2:**

| Semester | No. of Open Elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | 1 | 1 | - | - |
| | 1 | - | 1 | 1 |
| | 1 | - | - | 3 |

**Option 3:**

| Semester | Open elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | 2 | - | - | - |

## M. Tech. (STRUCTURAL ENGINEERING)

The total minimum credits required for completing the M.Tech. Programme in Structural Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA624 | Applied Mathematics for Structural Engineering | 4 |
| 2. | CE651 | Theory of Elasticity and Plasticity | 4 |
| 3. | CE653 | Advanced Reinforced Concrete Design | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | CE655 | Structural Engineering Laboratory | 2 |
| 8. | CE657 | Computational Laboratory for Structural Engineers | 2 |
| | | **Total** | **25** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE652 | Structural Dynamics | 4 |
| 2. | CE654 | Finite Element Analysis of Structural Members | 4 |
| 3. | CE656 | Advanced Design of Metal Structures | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | CE658 | Structural Design Studio | 2 |
| | | **Total** | **23** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CE659 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CE697 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CE698 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) / ONLINE COURSE (OC)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| | | **# (To be completed between I to IV semester)** | 6 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE661 | Matrix Methods of Structural Analysis | 3 |
| 2. | CE662 | Non – Linear Analysis | 3 |
| 3. | CE663 | Reliability Analysis of Structures | 3 |
| 4. | CE664 | Stochastic Processes in Structural Mechanics | 3 |
| 5. | CE665 | Structural Optimization | 3 |
| 6. | CE666 | Failure Analysis of Structures | 3 |
| 7. | CE667 | Forensic Engineering and Rehabilitation of Structures | 3 |
| 8. | CE668 | Fracture Mechanics | 3 |
| 9. | CE669 | Advanced Steel and Concrete Composite Structures | 3 |
| 10. | CE670 | Design of Metal Structures II | 3 |
| 11. | CE671 | Design of Thin-walled Steel Structures | 3 |
| 12. | CE672 | Stability of Structures | 3 |
| 13. | CE673 | Theory of Plates and Shells | 3 |
| 14. | CE674 | Analysis and Design of Tall Buildings | 3 |
| 15. | CE675 | Design of Offshore Structures | 3 |
| 16. | CE676 | Seismic Design of Structures | 3 |
| 17. | CE677 | Wind Effects on Structures | 3 |
| 18. | CE678 | Advanced Concrete Technology | 3 |
| 19. | CE679 | Prefabricated Structures | 3 |
| 20. | CE680 | Prestressed Concrete Structures | 3 |
| 21. | CE681 | Smart Structures and Applications | 3 |
| 22. | CE682 | Special Concrete | 3 |

| | | | |
|---|---|---|---|
| 23. | CE683 | Structures in Disaster Prone Areas | 3 |
| 24. | CE684 | Design of Boiler Structures | 3 |
| 25. | CE685 | Design of Bridges | 3 |
| 26. | CE686 | Façade Design and Engineering | 3 |
| 27. | CE687 | Design of Structures for Accidental Loads | 3 |
| 28. | CE688 | Green Building Design | 3 |
| 29. | CE689 | Hydraulic Structures | 3 |
| 30. | CE690 | Structures for Power Plants | 3 |
| 31. | CE691 | Soil Structure Interaction | 3 |
| 32. | CE692 | Seismic Design of Steel Structures | 3 |
| 33. | CE693 | Introduction to 3D Printing Technology | 3 |
| 34. | CE694 | Modelling, Simulation and Computer Applications | 3 |
| 35. | CE695 | Random Vibrations | 3 |
| 36. | CE696 | Uncertainty Modeling, and Analysis | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE665 | Structural Optimization | 3 |
| 2. | CE678 | Advanced Concrete Technology | 3 |
| 3. | CE685 | Design of Bridges | 3 |
| 4. | CE688 | Green Building Design | 3 |
| 5. | CE691 | Soil Structure Interaction | 3 |
| 6. | CE693 | Introduction to 3D Printing Technology | 3 |
| 7. | CE694 | Modelling, Simulation and Computer Applications | 3 |
| 8. | CE696 | Uncertainty Modeling, and Analysis | 3 |

***(For OE courses refer the curriculum of other PG specializations)***

**MICROCREDITS (MC)** [Students can opt 3 courses of 1 credit (4-week duration) each as microcredits or 2 courses (2 credits (8-week duration) & 1 credit (4-week duration) instead of 1 OE/OC]

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Equivalent to Online Course (May be completed between Semester I to Semester IV) | 3 |

# Electives [Choices]

## 1. Program Elective (PE) Courses

### Option 1:

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 3 | 0 | 9 |

### Option 2:

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 3 | 0 | 9 |

### Option 3:

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 2 | 1 | 9 |

### Option 4:

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 2 | 1 | 9 |

## 2. Online Courses (OC) / Open Elective (OE) Courses

### Option 1:

| Semester | No. of Open Elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I – IV | - | 2 | - | - |
| | - | 1 | 1 | 1 |
| | - | 1 | - | 1+1+1 |

**Option 2:**

| Semester | No. of Open elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I – IV | 1 | 1 | - | - |
| | 1 | - | 1 | 1 |
| | 1 | - | - | 1+1+1 |

**Option 3:**

| Semester | Open elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | 2 | - | - | - |

## M. Tech. (ENVIRONMENTAL ENGINEERING)

The total credits required for completing the M.Tech. Programme in Environmental Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA601 | Numerical Methods and Applied Statistics | 4 |
| 2. | CE701 | Environmental Process Chemistry and Microbiology | 4 |
| 3. | CE703 | Physico-Chemical Processes for Water and Wastewater Treatment | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III | 3 |
| 7. | CE707 | Environmental Quality Measurements Laboratory | 2 |
| | | **Total** | **23** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE702 | Biological Process Design for Wastewater Treatment | 4 |
| 2. | CE704 | Solid and Hazardous Waste Management | 4 |
| 3. | CE706 | Air Pollution and Control Engineering | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI | 3 |
| 7. | CE708 | Environmental Engineering Processes Laboratory | 2 |
| 8. | CE710 | Environmental Computation Laboratory | 2 |
| | | **Total** | **25** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CE746 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CE747 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CE748 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) / ONLINE COURSE (OC)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| | | **# (To be completed between I to IV semester)** | 6 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE711 | Transport of Water and Wastewater | 3 |
| 2. | CE712 | Membrane Technologies for Water and Wastewater Treatment | 3 |
| 3. | CE713 | Industrial Wastewater Management | 3 |
| 4. | CE714 | Modeling of Natural Systems | 3 |
| 5. | CE715 | Groundwater Flow and Contaminant Transport Through Porous Media | 3 |
| 6. | CE716 | Indoor Environmental Quality | 3 |
| 7. | CE717 | Aerosol Science and Engineering | 3 |
| 8. | CE718 | Analytical Methods for Environmental Monitoring | 3 |
| 9. | CE719 | Landfill Design and Operation | 3 |
| 10. | CE720 | Environmental Impact Assessment | 3 |
| 11. | CE721 | Environmental Laws | 3 |
| 12. | CE722 | Environmental Nanotechnology | 3 |
| 13. | CE723 | Cleaner Production and Environmental Sustainable Management | 3 |
| 14. | CE724 | Environmental Biotechnology | 3 |
| 15. | CE725 | Remote Sensing and GIS for Environmental Applications | 3 |
| 16. | CE726 | Climate Variability, Mitigation and Adaptation | 3 |
| 17. | CE727 | Environmental Systems Analysis | 3 |
| 18. | CE728 | Environmental Social Governance | 3 |
| 19. | CE729 | Ecological and Ecosystem Engineering | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE711 | Transport of Water and Wastewater | 3 |
| 2. | CE712 | Membrane Technologies for Water and Wastewater Treatment | 3 |
| 3. | CE718 | Analytical Methods for Environmental Monitoring | 3 |
| 4. | CE720 | Environmental Impact Assessment | 3 |
| 5. | CE723 | Cleaner Production and Environmental Sustainable Management | 3 |

***(For OE courses refer the curriculum of other PG specializations)***

**MICROCREDITS (MC)** [Students can opt 3 courses of 1 credit (4-week duration) each as microcredits or 2 courses (2 credits (8-week duration) & 1 credit (4-week duration) instead of 1 OE/OC]

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Equivalent to OC (May be completed between Semester I to Semester IV) | 3 |

## Electives [Choices]

### 1. Program Elective (PE) Courses

**Option 1:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 3 | 0 | 9 |

**Option 2:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 3 | 0 | 9 |

**Option 3:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 2 | 1 | 9 |

**Option 4:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 2 | 1 | 9 |

## 2. Online Courses (OC) / Open Elective (OE) Courses

**Option 1:**

| Semester | No. of Open Elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 Credit courses | 2 credit courses | 1 credit course |
| I - IV | - | 2 | - | - |
| | - | 1 | 1 | 1 |
| | - | 1 | - | 1+1+1 |

**Option 2:**

| Semester | No. of Open elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | 1 | 1 | - | - |
| | 1 | - | 1 | 1 |
| | 1 | - | - | 1+1+1 |

**Option 3:**

| Semester | Open elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | 2 | - | - | - |

## M. Tech. (CONSTRUCTION TECHNOLOGY AND MANAGEMENT)

The total credits required for completing the M.Tech. Programme in Construction Technology and Management is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE751 | Construction Planning and Control | 4 |
| 2. | CE753 | Contracts and Specifications | 4 |
| 3. | CE755 | Lean Construction Concepts, Tools and Practices | 4 |
| 4. | CE757 | Construction Economics and Finance | 3 |
| 5. | | Programme Elective I | 3 to 4 |
| 6. | | Programme Elective II | 3 to 4 |
| 7. | CE759 | Construction Management Software Laboratory | 2 |
| | | **Total** | **23 to 25** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE752 | Construction Quality and Safety Management | 4 |
| 2. | CE754 | Organizational Behaviour | 4 |
| 3. | CE756 | Construction Methods and Equipment | 4 |
| 4. | | Programme Elective III | 3 to 4 |
| 5. | | Programme Elective IV | 3 to 4 |
| 6. | | Programme Elective V | 3 to 4 |
| 7. | CE758 | Construction Engineering and Information Laboratory | 2 |
| 8. | CE760 | Construction Materials Laboratory | 2 |
| | | **Total** | **25 to 28** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CE796 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CE797 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CE798 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC)/ MICROCREDITS (MC) (Students can opt 3 courses of 1 credit (4 weeks) each as microcredits instead of 1 OE/OC)**

| Code | Course of Study | Credit |
|---|---|---|
| | # (To be completed between I to IV semester) | 1 to 6 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE761 | Modern Construction Materials | 3 |
| 2. | CE762 | Functional Efficiency of Buildings | 3 |
| 3. | CE763 | Disaster Mitigation and Management | 3 |
| 4. | CE764 | Construction Supply Chain Management | 3 |
| 5. | CE765 | Planning of Prefabricated Structures | 3 |
| 6. | CE766 | Safety in Material Handling at Construction | 3 |
| 7. | CE767 | Non Destructive Evaluation | 3 |
| 8. | CE768 | Value Engineering | 3 |
| 9. | CE769 | Quantitative Methods in Construction Management | 3 |
| 10. | CE770 | Formwork Design | 3 |
| 11. | CE771 | Construction Personal Management | 3 |
| 12. | CE772 | Project Risk Analysis and Management Techniques | 3 |
| 13. | CE773 | Strategic Management in Construction | 3 |
| 14. | CE774 | Infrastructure Planning and Management | 3 |
| 15. | CE775 | Sustainable Construction | 3 |
| 16. | CE776 | Construction Project Modelling | 3 |
| 17. | CE777 | Smart Buildings | 3 |
| 18. | CE778 | Soft Computing Techniques in Civil Engineering | 3 |
| 19. | CE779 | Estimation and Quantity Surveying | 3 |
| 20. | CE780 | Urban Water Infrastructure | 3 |

## OPEN ELECTIVES (OE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE769 | Quantitative Methods in Construction Management | 3 |
| 2. | CE772 | Project Risk Analysis and Management Techniques | 3 |
| 3. | CE773 | Strategic Management in Construction | 3 |
| 4. | CE774 | Infrastructure Planning and Management | 3 |
| 5. | CE777 | Smart Buildings | 3 |
| 6. | CE778 | Soft Computing Techniques in Civil Engineering | 3 |
| 7. | CE779 | Estimation and Quantity Surveying | 3 |

## COURSES FROM OTHER SPECIALIZATION / DEPARTMENTS (To be offered as Program Elective)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **TRANSPORTATION ENGINEERING AND MANAGEMENT** | | | |
| 1. | CE601 | Highway Traffic Analysis and Design | 4 |
| 2. | CE603 | Pavement Analysis and Design | 4 |
| 3. | CE604 | Transportation Planning | 4 |
| 4. | CE606 | Pavement Construction and Maintenance | 4 |
| 5. | CE619 | Intelligent Transportation Systems | 3 |
| 6. | CE621 | Geospatial Techniques | 3 |
| 7. | CE624 | Urban Planning Techniques and Practices | 3 |
| **STRUCTURAL ENGINEERING** | | | |
| 1. | CE667 | Forensic Engineering and Rehabilitation of Structures | 3 |
| 2. | CE678 | Advanced Concrete Technology | 3 |
| 3. | CE689 | Hydraulic Structures | 3 |
| **ENVIRONMENTAL ENGINEERING** | | | |
| 1. | CE701 | Environmental Process Chemistry and Microbiology | 4 |
| 2. | CE702 | Biological Process Design for Wastewater Treatment | 4 |
| 3. | CE703 | Physico-Chemical Process for Water and Wastewater Treatment | 4 |
| 4. | CE711 | Transport of Water and Wastewater | 3 |
| 5. | CE712 | Membrane Technologies for Water and Wastewater Treatment | 3 |
| 6. | CE713 | Industrial Wastewater Management | 3 |

| | | | |
|---|---|---|---|
| **GEOTECHNICAL ENGINEERING** | | | |
| 1. | CE815 | Ground Improvement Techniques | 3 |
| 2. | CE816 | Analysis of Deep Foundation | 3 |
| 3. | CE818 | Marine Foundations Engineering | 3 |
| 4. | CE820 | Geotechnical Constitutive Modelling | 3 |
| 5. | CE826 | Geosynthetics Engineering | 3 |
| 6. | CE829 | Ports and Harbour Structures | 3 |
| **ENERGY AND ENVIRONMENT** | | | |
| 1. | EN620 | Energy Efficient Buildings | 3 |
| 2. | EN636 | Smart Grid Systems | |
| **ELECTRICAL AND ELECTRONICS ENGINEERING** | | | |
| 1. | EE662 | High Voltage DC Transmission | 3 |
| 2. | EE671 | Fuzzy Logic Control System | 3 |
| 3. | EE673 | Renewable Power Generation Technologies | 3 |
| 4. | EE680 | Smart Grid Technologies | 3 |
| 5. | EE684 | Distributed Generation and Micro-Grids | 3 |
| 6. | EE703 | E-Vehicle Technology and Mobility | 3 |

## M.Tech. (GEOTECHNICAL ENGINEERING)

The total minimum credits required for completing the M.Tech. Programme in Geotechnical Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA602 | Applied Mathematics | 4 |
| 2. | CE801 | Advanced Soil Mechanics | 4 |
| 3. | CE803 | Soil Exploration and Field Testing | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | CE807 | Advanced Geotechnical Engineering Laboratory | 2 |
| | | **Total** | **23** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE802 | Foundation Analysis and Design | 4 |
| 2. | CE804 | Earth Retaining Structures | 4 |
| 3. | CE806 | Dynamics of Soils and Foundations | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | CE808 | Geosynthetics and Field Testing Laboratory | 2 |
| 8. | CE810 | Geotechnical Design Studio | 2 |
| | | **Total** | **25** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CE845 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CE847 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CE848 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) / ONLINE COURSE (OC)

| Code | Course of Study | Credit |
|---|---|---|
| | # (To be completed between I to IV semester) | 6 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE811 | Geotextile from Design to Applications | 3 |
| 2. | CE812 | Geomechanics -Theory and Applications | 3 |
| 3. | CE813 | Finite Element Methods in Geotechnical Engineering | 3 |
| 4. | CE814 | Slope Stability and Earth Dams | 3 |
| 5. | CE815 | Ground Improvement Techniques | 3 |
| 6. | CE816 | Analysis of Deep Foundation | 3 |
| 7. | CE817 | Machine Foundations | 3 |
| 8. | CE818 | Marine Foundation Engineering | 3 |
| 9. | CE819 | Soil-Structure Interaction | 3 |
| 10. | CE820 | Geotechnical Constitutive Modelling | 3 |
| 11. | CE821 | Rock Mechanics | 3 |
| 12. | CE822 | Unsaturated Soil Mechanics | 3 |
| 13. | CE823 | Design of Underground Excavation | 3 |
| 14. | CE824 | Geotechnical Earthquake Engineering | 3 |
| 15. | CE825 | Geo-environmental Engineering | 3 |
| 16. | CE826 | Geosynthetics Engineering | 3 |
| 17. | CE827 | Forensic Geotechnical Engineering | 3 |
| 18. | CE828 | Geotechnics in Practice | 3 |
| 19. | CE829 | Ports and Harbour Structures | 3 |
| 20. | CE830 | Risk and Reliability in Geotechnical Engineering | 3 |
| 21. | CE831 | Geotechnology of Waste Disposal Facilities | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CE815 | Ground Improvement Techniques | 3 |
| 2. | CE816 | Analysis of Deep Foundation | 3 |
| 3. | CE819 | Soil-Structure Interaction | 3 |
| 4. | CE825 | Geo-environmental Engineering | 3 |
| 5. | CE829 | Ports and Harbour Structures | 3 |

***(For OE courses refer the curriculum of other PG specializations)***

**MICROCREDITS (MC) [Students can opt 3 courses of 1 credit (4-week duration) each as microcredits or 2 courses (2 credits (8-week duration) & 1 credit (4-week duration) instead of 1 OE/OC]**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| | | | 3 |

## Electives [Choices]

### 1. Program Elective (PE) Courses

**Option 1:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 3 | 0 | 9 |

**Option 2:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 3 | 0 | 9 |

**Option 3:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 3 | 0 | 9 |
| II | 2 | 1 | 9 |

**Option 4:**

| Semester | No. of Programme Electives | No. of Online Programme Electives | Credits for Programme Elective Courses |
|---|---|---|---|
| I | 2 | 1 | 9 |
| II | 2 | 1 | 9 |

## 2. Online Courses (OC) / Open Elective (OE) Courses

**Option 1:**

| Semester | No. of Open Elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 Credit courses | 2 credit courses | 1 credit course |
| I - IV | - | 2 | - | - |
| | - | 1 | 1 | 1 |
| | - | 1 | - | 1+1+1 |

**Option 2:**

| Semester | No. of Open elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | 1 | 1 | - | - |
| | 1 | - | 1 | 1 |
| | 1 | - | - | 1+1+1 |

**Option 3:**

| Semester | Open elective Courses | No. of online Courses | | |
|---|---|---|---|---|
| | | 3 credit courses | 2 credit courses | 1 credit course |
| I - IV | 2 | - | - | - |

## M.Tech. (DATA ANALYTICS)

The total minimum credits required for completing the M.Tech. Programme in Data Analytics is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA611 | Mathematical Foundations for Data Analytics | 4 |
| 2. | CA613 | Advanced Data Structures and Algorithms | 4 |
| 3. | CA615 | Machine Learning Techniques | 3 |
| 4. | CA617 | Big Data Analytics | 4 |
| 5. | CA6AX | Programme Elective I | 4 |
| 6. | CA6BX | Programme Elective II | 3 |
| 7. | CA601 | Machine Learning Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA610 | Deep Learning and its Applications | 3 |
| 2. | CA612 | Image and Video Analytics | 3 |
| 3. | CA6CX | Programme Elective III | 4 |
| 4. | CA6DX | Programme Elective IV | 4 |
| 5. | CA6EX | Programme Elective V | 3 |
| 6. | CA6FX | Programme Elective VI | 3 |
| 7. | CA602 | Deep Learning Laboratory | 2 |
| 8. | CA604 | Image and Video Analytics Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CA648 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CA649 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CA650 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | OPEN ELECTIVE I / Online Course | 3 |
| 2. | | OPEN ELECTIVE II / Online Course | 3 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **ELECTIVE - I** | | | |
| 1. | CA6A1 | Data Mining and Warehousing | 4 |
| 2. | CA6A2 | Soft Computing Techniques | 4 |
| 3. | CA6A3 | Next Generation Data Base Systems | 4 |
| **ELECTIVE - II** | | | |
| 4. | CA6B1 | Distributed and Cloud Computing | 3 |
| 5. | CA6B2 | Block Chain Technology | 3 |
| 6. | CA6B3 | Cognitive Sciences | 3 |
| **ELECTIVE - III** | | | |
| 7. | CA6C1 | DevOps | 4 |
| 8. | CA6C2 | Analytics for Strategic Market Planning | 4 |
| 9. | CA6C3 | Financial Risk Analytics and Management | 4 |
| **ELECTIVE - IV** | | | |
| 10. | CA6D1 | Data Visualization | 4 |
| 11. | CA6D2 | Pattern Recognition | 4 |
| 12. | CA6D3 | Natural Language Processing | 4 |
| **ELECTIVE - V** | | | |
| 13. | CA6E1 | Web Analytics | 3 |
| 14. | CA6E2 | Federated Learning | 3 |
| 15. | CA6E3 | Human Resource Analytics | 3 |
| **ELECTIVE - VI** | | | |
| 16. | CA6F1 | Intelligent Systems and Process Automation | 3 |
| 17. | CA6F2 | Social Network Analytics | 3 |
| 18. | CA6F3 | Supply Chain Analytics | 3 |

## OPEN ELECTIVES (OE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA615 | Machine Learning Techniques | 3 |

## M. Tech. (COMPUTER SCIENCE AND ENGINEERING)

The total minimum credits required for completing the M. Tech. Programme in Computer Science and Engineering Course is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CS601 | Mathematical Concepts of Computer Science | 4 |
| 2. | CS603 | Advanced Data Structures and Algorithms | 4 |
| 3. | CS605 | High Performance Computer Architecture | 3 |
| 4. | CS607 | Principles of Machine Learning and Deep Learning | 4 |
| 5. | E1 | Programme Elective I | 4 |
| 6. | E2 | Programme Elective II | 3 |
| 7. | CS609 | Computer System Design Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CS602 | Service Oriented Architecture and Web Security | 3 |
| 2. | CS604 | Advances in Operating Systems | 4 |
| 3. | E3 | Programme Elective III | 4 |
| 4. | E4 | Programme Elective IV | 3 |
| 5. | E5 | Programme Elective V | 3 |
| 6. | E6 | Programme Elective VI | 3 |
| 7. | CS606 | Data Science and AI Laboratory | 2 |
| 8. | CS608 | Web Development Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CS675 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

## SEMESTER III

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CS677 | Project Work (Phase I) | 12 |
| 2. | CS704 | Online Courses (NPTEL) | 6 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CS678 | Project Work (Phase II) | 12 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CS615 | Advanced Network Principles and Protocols | 4 |
| 2. | CS616 | Cloud Computing Principles | 4 |
| 3. | CS617 | Statistical Natural Language Processing | 4 |
| 4. | CS618 | Internet of Things | 4 |
| 5. | CS619 | Image and Video Analytics | 4 |
| 6. | CS620 | Fog and Edge Computing | 4 |
| 7. | CS621 | Immersive Technologies | 4 |
| 8. | CS622 | Quantum Computing | 4 |
| 9. | CS630 | Advanced Databases | 3 |
| 10. | CS631 | Advanced Cryptography | 3 |
| 11. | CS632 | Network Security | 3 |
| 12. | CS633 | Wireless Sensor Networks | 3 |
| 13. | CS634 | Software Design Architectures | 3 |
| 14. | CS635 | Mobile Network systems | 3 |
| 15. | CS636 | Cloud Security | 3 |
| 16. | CS637 | Design and Analysis of Parallel Algorithms | 3 |
| 17. | CS638 | Social Network Mining and Analysis | 3 |
| 18. | CS639 | Computational Geometry | 3 |
| 19. | CS640 | Database Tuning and Administration | |
| 20. | CS641 | Big Data Analytics and Mining | 3 |
| 21. | CS642 | Models of Computation | 3 |
| 22. | CS643 | Cognitive Science | 3 |

| | | | |
|---|---|---|---|
| 23. | CS644 | Information Visualization | 3 |
| 24. | CS645 | Knowledge Management | 3 |
| 25. | CS646 | Text Mining | 3 |
| 26. | CS647 | Digital and Cyber Forensics | 3 |
| 27. | CS648 | Multimedia Presentation and Coding Techniques | 3 |
| 28. | CS649 | Principles of Data Warehousing and Datamining | 3 |
| 29. | CS650 | Hardware Security | 3 |
| 30. | CS651 | Advanced Digital Design | 3 |
| 31. | CS652 | Real Time systems | 3 |
| 32. | CS653 | Smart Phone Computing | 3 |
| 33. | CS654 | Quantum-safe Cryptography | 3 |
| 34. | CS655 | Drone Technologies | 3 |
| 35. | CS656 | Reinforcement Learning | 3 |
| 36. | CS657 | Data Science | 3 |
| 37. | CS658 | AI Principles and Practices | 3 |
| 38. | CS659 | Advanced Compiler Design | 3 |
| 39. | CS660 | Algorithmic Graph Theory | 3 |
| 40. | CS661 | Soft Computing Techniques | 3 |
| 41. | CS662 | Algorithmic Game Theory | 3 |

**OPEN ELECTIVES (OE) (offered to other Departments)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CS700 | Machine Learning and Deep Learning Techniques | 3 |
| 2. | CS701 | Natural Language Processing Techniques | 3 |
| 3. | CS702 | Image and Video Analytic Fundamentals | 3 |
| 4. | CS703 | Reinforcement Learning Principles | 3 |

## M. Tech. (POWER SYSTEMS)

The total credits required for completing the M.Tech. Programme in Power Systems is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA603 | Advanced Engineering Mathematics | 4 |
| 2. | EE601 | Advanced Power System Analysis | 4 |
| 3. | EE603 | Power Conversion Techniques | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | EE607 | Power Conversion Laboratory | 2 |
| 8. | EE611 | Power System Computation Laboratory | 2 |
| | | **Total** | **25** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EE602 | Power System Operation and Control | 4 |
| 2. | EE604 | Advanced Power System Protection | 4 |
| 3. | EE606 | Power System Stability | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | EE608 | Power Systems Laboratory | 2 |
| | | **Total** | **23** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| EE613 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| EE609 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| EE610 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course | 3 |
| 2. | | Open Elective II / Online Course | 3 |

**LIST OF OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course Title | Credit |
|---|---|---|---|
| 1. | EE679 | Swarm Intelligent Techniques | 3 |
| 2. | EE686 | Energy Auditing and Management | 3 |

Note:

- Department will give the list of recommended online courses for PE and OE in every session.
- Students shall opt the online courses from the list of recommended courses by anydepartment of the institute as open elective.
- **MICROCREDITS (MC)** (Students can opt 3 courses of 1 credit (4 weeks) each asmicrocredits instead of 1 OE/OC)

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EE661 | Flexible AC Transmission System | 3 |
| 2. | EE662 | High Voltage DC Transmission | 3 |
| 3. | EE663 | Microcontroller Applications in Power Converters | 3 |
| 4. | EE664 | Advanced Digital Signal Processing | 3 |
| 5. | EE665 | Advanced Digital System Design | 3 |
| 6. | EE667 | Neural Networks and Deep Learning | 3 |

| | | | |
|---|---|---|---|
| 7. | EE668 | Digital Controllers in Power Electronics Applications | 3 |
| 8. | EE669 | Computer Networking | 3 |
| 9. | EE670 | Electrical Distribution Systems | 3 |
| 10. | EE671 | Fuzzy Logic Control Systems | 3 |
| 11. | EE672 | Transient over Voltages in Power Systems | 3 |
| 12. | EE673 | Renewable Power Generation Technologies | 3 |
| 13. | EE674 | Power System Planning and Reliability | 3 |
| 14. | EE675 | Modeling And Analysis of Electrical Machines | 3 |
| 15. | EE676 | Power Quality | 3 |
| 16. | EE677 | Power System Restructuring and Pricing | 3 |
| 17. | EE678 | Computer Relaying and Wide Area Measurement Systems | 3 |
| 18. | EE680 | Smart Grid Technologies | 3 |
| 19. | EE681 | Electrical Systems in Wind Energy | 3 |
| 20. | EE683 | Embedded Processors and Controllers | 3 |
| 21. | EE684 | Distributed Generation and Micro-Grids | 3 |
| 22. | EE685 | Control Design Techniques for Power Electronic Systems | 3 |
| 23. | EE688 | Principles of VLSI Design | 3 |
| 24. | EE695 | Digital Control Systems | 3 |
| 25. | EE696 | Power System Automation | 3 |
| 26. | EE703 | E-Vehicle Technology and Mobility | 3 |
| 27. | EE705 | Design of Magnetics for Power Electronic Applications | 3 |
| 28. | EE706 | Power Management Integrated Circuits | 3 |
| 29. | EE707 | Electric Power Market | 3 |
| 30. | EE711 | Cybersecurity of Smart Grids | 3 |

## M. Tech. (POWER ELECTRONICS)

The total credits required for completing the M.Tech. Programme in Power Electronics is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA603 | Advanced Engineering Mathematics | 4 |
| 2. | EE651 | Power Converters | 4 |
| 3. | EE653 | Linear and Non-Linear System Theory | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | EE657 | Design and Simulation of Power Electronic Circuit Laboratory | 2 |
| 8. | EE659 | Power Electronics Systems Laboratory | 2 |
| | | **Total** | **25** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EE652 | Switched Mode Power Conversion | 4 |
| 2. | EE654 | Power Electronic Drives | 4 |
| 3. | EE656 | Industrial Control Electronics | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | EE658 | Power Converters and Drives Laboratory | 2 |
| | | **Total** | **23** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| EE713 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| EE709 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| EE710 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I | 3 |
| 2. | | Open Elective II | 3 |

**LIST OF OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EE687 | Electric and Hybrid Vehicles | 3 |
| 2. | EE712 | Home Energy Management System | 3 |

Note:

- Department will give the list of recommended online courses for PE and OE in every session.
- Students shall opt the online courses from the list of recommended courses by any department of the institute as open elective.
- **MICROCREDITS (MC)** (Students can opt 3 courses of 1 credit (4 weeks) each as microcredits instead of 1 OE/OC)

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EE661 | Flexible AC Transmission System | 3 |
| 2. | EE662 | High Voltage DC Transmission | 3 |
| 3. | EE664 | Advanced Digital Signal Processing | 3 |
| 4. | EE665 | Advanced Digital System Design | 3 |
| 5. | EE667 | Neural Networks and Deep Learning | 3 |
| 6. | EE668 | Digital Controllers in Power Electronics Applications | 3 |
| 7. | EE669 | Computer Networking | 3 |

| | | | |
|---|---|---|---|
| 8. | EE670 | Electrical Distribution Systems | 3 |
| 9. | EE671 | Fuzzy Logic Control Systems | 3 |
| 10. | EE672 | Transient over Voltages in Power Systems | 3 |
| 11. | EE673 | Renewable Power Generation Technologies | 3 |
| 12. | EE674 | Power System Planning and Reliability | 3 |
| 13. | EE675 | Modeling and Analysis of Electrical Machines | 3 |
| 14. | EE676 | Power Quality | 3 |
| 15. | EE677 | Power System Restructuring and Pricing | 3 |
| 16. | EE678 | Computer Relaying and Wide Area Measurement Systems | 3 |
| 17. | EE680 | Smart Grid Technologies | 3 |
| 18. | EE681 | Electrical Systems in Wind Energy | 3 |
| 19. | EE684 | Distributed Generation and Micro-Grids | 3 |
| 20. | EE685 | Control Design Techniques for Power Electronic Systems | 3 |
| 21. | EE688 | Principles of VLSI Design | 3 |
| 22. | EE689 | Advanced Topics in Power Electronics Applications | 3 |
| 23. | EE690 | Design Techniques for SMPS | 3 |
| 24. | EE691 | Energy Storage Systems | 3 |
| 25. | EE692 | Digital Simulation of Power Electronic Systems | 3 |
| 26. | EE693 | PWM Converters and Applications | 3 |
| 27. | EE695 | Digital Control Systems | 3 |
| 28. | EE696 | Power System Automation | 3 |
| 29. | EE698 | Grid Converters for Renewable Energy Applications | 3 |
| 30. | EE699 | Topics in Power Electronics and Distributed Generation | 3 |
| 31. | EE700 | Wireless Sensor Networks and Applications | 3 |
| 32. | EE701 | Soft Switching Power Converters | 3 |
| 33. | EE702 | Solar PV System | 3 |
| 34. | EE703 | E-Vehicle Technology and Mobility | 3 |
| 35. | EE704 | Design of Embedded Controllers for Smart Micro-Grid | 3 |
| 36. | EE705 | Design of Magnetics for Power Electronic Applications | 3 |
| 37. | EE706 | Power Management Integrated Circuits | 3 |
| 38. | EE708 | Electric Vehicle Charging Systems | 3 |

## M. Tech. (COMMUNICATION SYSTEMS)

The total minimum credits required for completing the M.Tech. Programme in Communication Systems is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC601 | Linear Algebra and Stochastic Processes | 4 |
| 2. | EC603 | Advanced Digital Signal Processing | 4 |
| 3. | EC605 | Microwave Circuits | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III | 3 |
| 7. | EC607 | Microwave and MIC Laboratory | 2 |
| | | **Total** | **23** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC602 | Advanced Digital Communication | 4 |
| 2. | EC604 | Broadband Wireless Technologies | 4 |
| 3. | EC606 | Optical Communication Systems | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI | 3 |
| 7. | EC608 | Fiber Optics and Communication Laboratory | 2 |
| 8. | EC610 | Digital Signal and Image Processing Laboratory | 2 |
| | | **Total** | **25** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| EC649 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| EC647 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| EC648 | Project Work (Phase II) | 12 |

In addition to the Programme electives, students have to do 2 Open Electives offered by the institute or PG-level Online Courses from NPTEL (Can be completed from Semester I-IV) as given in the list in the next page. If students opt to do open electives from institute, they can choose open electives offered by VLSI or other departments.

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course | 3 |
| 2. | | Open Elective II / Online Course | 3 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC611 | Detection and Estimation | 3 |
| 2. | EC612 | DSP Architecture | 3 |
| 3. | EC613 | High Speed Communication Networks | 3 |
| 4. | EC614 | Spectral Analysis of Signal | 3 |
| 5. | EC615 | Digital Image Processing | 3 |
| 6. | EC616 | RF MEMS | 3 |
| 7. | EC617 | Smart Antennas | 3 |
| 8. | EC618 | Ad Hoc Networks | 3 |
| 9. | EC619 | Wavelet Signal Processing | 3 |
| 10. | EC620 | WDM Optical Networks | 3 |
| 11. | EC621 | Advanced Techniques for Wireless Reception | 3 |
| 12. | EC622 | Error Control Coding | 3 |
| 13. | EC623 | Digital Communication Receivers | 3 |
| 14. | EC624 | Analysis Methods for Passive MIC | 3 |
| 15. | EC625 | Electromagnetic Metamaterials | 3 |
| 16. | EC626 | Bio MEMS | 3 |
| 17. | EC627 | Substrate Integrated Waveguide Technology: Design and Analysis | 3 |
| 18. | EC628 | Pattern Recognition and Computational Intelligence | 3 |
| 19. | EC629 | Photonic Integrated Circuits and Systems | 3 |
| 20. | EC630 | Fiber-Optic Sensors | 3 |
| 21. | EC631 | Optical Wireless Communications | 3 |
| 22. | EC632 | Foundations of Artificial Intelligence | 3 |
| 23. | EC633 | Introduction to Soft Computing and Machine Learning | 3 |
| 24. | EC634 | Next Generation WLAN | 3 |
| 25. | EC635 | Electromagnetic Interference and Compatibility | 3 |
| 26. | EC636 | Computer Vision | 3 |
| 27. | EC637 | Natural Language Processing | 3 |
| 28. | EC638 | Optimization Methods in Machine Learning | 3 |

| | | | |
|---|---|---|---|
| 29. | EC639 | Hardware for Deep Learning | 3 |
| 30. | EC640 | Image and Video Processing | 3 |
| 31. | EC641 | Automated Test Engineering for Electronics | 3 |
| 32. | EC642 | Radiating Systems | 3 |
| 33. | EC643 | Advanced Topics in 5G/B5G Wireless Communication | 3 |
| 34. | EC646 | Verilog HDL: Digital Design and Modeling | 3 |
| 35. | EC654 | Electronic Design Automation Tools | 3 |
| 36. | EC656 | Design of ASICs | 3 |
| 37. | EC663 | Optimization of Digital Signal Processing Structures for VLSI | 3 |
| 38. | EC664 | Cognitive Radio | 3 |

## LIST OF OPEN ELECTIVES (Offered to VLSI and other Departments)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC703 | Pattern Recognition and Computational Intelligence Techniques | 3 |
| 2. | EC704 | High Speed Networks and Internet | 3 |
| 3. | EC705 | Design for Electromagnetic Compatibility | 3 |

## LIST OF NPTEL ONLINE COURSES

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC801 | Fundamentals of MIMO Wireless Communications | 3 |
| 2. | EC802 | Evolution of Air Interface Towards 5G | 3 |
| 3. | EC803 | Introduction to Industry 4.0 and Industrial Internet of Things | 3 |
| 4. | EC804 | VLSI Data Conversion Circuits | 3 |
| 5. | EC805 | Introduction to Time-Varying Electrical Networks | 3 |
| 6. | EC806 | Power Management Integrated Circuits | 3 |
| 7. | EC807 | Optical Wireless Communications beyond 5G Networks and IOT | 3 |
| 8. | EC808 | 5G Wireless Standard Design | 3 |

## M. Tech. (VLSI SYSTEM)

The total minimum credits required for completing the M.Tech. Programme in VLSI System is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC651 | Analog VLSI | 4 |
| 2. | EC653 | Basics of VLSI | 4 |
| 3. | EC661 | Digital System Design | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III | 3 |
| 7. | EC655 | HDL Programming Laboratory | 2 |
| | | **Total** | **23** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC652 | VLSI System Testing | 4 |
| 2. | EC654 | Electronic Design Automation Tools | 4 |
| 3. | EC656 | Design of ASICs | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI | 3 |
| 7. | EC658 | Analog IC Design Laboratory | 2 |
| 8. | EC660 | ASIC – CAD Laboratory | 2 |
| | | **Total** | **25** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| EC699 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| EC697 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| EC698 | Project Work (Phase II) | 12 |

In addition to the Programme electives, students have to do 2 Open Electives offered by the institute or PG-level Online Courses from NPTEL (Can be completed from Semester I-IV) as given in the list. If students opt to do open electives from institute, they can choose open electives offered by M.Tech.- Communication Systems or other departments.

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course | 3 |
| 2. | | Open Elective II / Online Course | 3 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA617 | Graph Theory and Discrete Optimization | 3 |
| 2. | EC612 | DSP Architecture | 3 |
| 3. | EC613 | High Speed Communication Networks | 3 |
| 4. | EC615 | Digital Image Processing | 3 |
| 5. | EC616 | RF MEMS | 3 |
| 6. | EC626 | Bio MEMS | 3 |
| 7. | EC628 | Pattern Recognition and Computational Intelligence | 3 |
| 8. | EC632 | Foundations of Artificial Intelligence | 3 |
| 9. | EC635 | Electromagnetic Interference and Compatibility | 3 |
| 10. | EC636 | Computer Vision | 3 |
| 11. | EC637 | Natural Language Processing | 3 |
| 12. | EC638 | Optimization Methods in Machine Learning | 3 |
| 13. | EC639 | Hardware for Deep Learning | 3 |
| 14. | EC640 | Image and Video Processing | 3 |
| 15. | EC641 | Automated Test Engineering for Electronics | 3 |
| 16. | EC662 | Modelling and Synthesis with Verilog HDL | 3 |
| 17. | EC663 | Optimizations of Digital Signal Processing Structures for VLSI | 3 |
| 18. | EC664 | Cognitive Radio | 3 |
| 19. | EC665 | VLSI Process Technology | 3 |
| 20. | EC666 | Analysis and Design of Digital Systems using VHDL | 3 |
| 21. | EC667 | Advanced Computer Architecture | 3 |
| 22. | EC668 | Low Power VLSI Systems | 3 |
| 23. | EC669 | VLSI Digital Signal Processing Systems | 3 |
| 24. | EC670 | Asynchronous System Design | 3 |
| 25. | EC671 | Advanced Digital Design | 3 |
| 26. | EC672 | Physical Design Automation | 3 |
| 27. | EC673 | Mixed - Signal Circuit Design | 3 |

| | | | |
|---|---|---|---|
| 28. | EC674 | Integrated Circuits for Wireless Communication | 3 |
| 29. | EC675 | Functional Verification using Hardware Verification Languages | 3 |
| 30. | EC676 | Testability of Analog / Mixed-Signal Circuits and High Speed Circuit Design | 3 |
| 31. | EC677 | High Speed System Design | 3 |
| 32. | EC678 | Modelling of Solid-State Devices | 3 |
| 33. | EC679 | Nano-Scale Devices: Modelling and circuits | 3 |
| 34. | EC680 | Embedded System Design | 3 |
| 35. | EC681 | Internet of Things | 3 |
| 36. | EC682 | Design and Testing of Advanced Semiconductor Memories | 3 |
| 37. | EC683 | FPGA Based System Design | 3 |
| 38. | EC684 | Bio-Medical CMOS ICs | 3 |
| 39. | EC685 | On-chip Antenna Design | 3 |
| 40. | EC687 | VLSI SoC Design and Verification | 3 |
| 41. | EC688 | VLSI Broadband Communication Circuits | 3 |
| 42. | EC689 | High Performance Frequency Synthesizers | 3 |
| 43. | EC690 | Analog Power Integrated Circuit Design | 3 |

**LIST OF NPTEL ONLINE COURSES**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC801 | Fundamentals of MIMO Wireless Communications | 3 |
| 2. | EC802 | Evolution of Air Interface Towards 5G | 3 |
| 3. | EC803 | Introduction to Industry 4.0 and Industrial Internet of Things | 3 |
| 4. | EC804 | VLSI Data Conversion Circuits | 3 |
| 5. | EC805 | Introduction to Time-Varying Electrical Networks | 3 |
| 6. | EC806 | Power Management Integrated Circuits | 3 |
| 7. | EC807 | Optical Wireless Communications beyond 5G Networks and IOT | 3 |
| 8. | EC808 | 5G Wireless Standard Design | 3 |

**LIST OF OPEN ELECTIVES (Offered to M.Tech. Communication Systems and Other Branches)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EC701 | Frequency Synthesizer Circuits | 3 |
| 2. | EC702 | Power Management Circuits | 3 |

## M.Tech. (ENERGY ENGINEERING)

The total credits required for completing the M.Tech. Programme in Energy Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EN601 | Renewable Energy Technologies-I | 4 |
| 2. | EN603 | Energy Data Analytics | 4 |
| 3. | EN605 | Smart Energy Systems | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | EN607 | Energy and Material-Characterization Laboratory | 2 |
| 8. | EN609 | Smart Energy Systems Laboratory | 2 |
| | | **Total** | **25** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EN602 | Renewable Energy Technologies-II | 4 |
| 2. | EN604 | Artificial Intelligence (AI) in Energy Systems | 4 |
| 3. | EN606 | Energy Audit and Management | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | EN608 | Energy Modelling, Simulation and Data Analytics Laboratory | 2 |
| | | **Total** | **23** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| EN671 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| EN673 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| EN674 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course | 3 |
| 2. | | Open Elective II / Online Course | 3 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EN610 | Direct Energy Conversion | 3 |
| 2. | EN611 | Environmental Engineering and PollutionControl | 3 |
| 3. | EN612 | Energy Storage Systems | 3 |
| 4. | EN613 | Advanced Fuel Technologies | 3 |
| 5. | EN614 | Hydrogen Energy | 3 |
| 6. | EN615 | Professional Skill Development | 3 |
| 7. | EN616 | Computational Fluid Dynamics | 3 |
| 8. | EN617 | Foundation for Energy Engineering | 3 |
| 9. | EN618 | Energy Systems Modeling and Analysis | 3 |
| 10. | EN619 | Air Conditioning and Refrigeration | 3 |
| 11. | EN620 | Energy Efficient Buildings | 3 |
| 12. | EN621 | Thermal Engineering | 3 |
| 13. | EN622 | Optimum Utilization of Heat and Power | 3 |
| 14. | EN623 | Power Plant Technology | 3 |
| 15. | EN624 | Power Generation and Systems Planning | 3 |
| 16. | EN625 | Electrical Energy Technology | 3 |
| 17. | EN626 | Applied Thermodynamics | 3 |
| 18. | EN627 | Power Generation, Transmission and Distribution | 3 |

| | | | |
|---|---|---|---|
| 19. | EN628 | Advanced Heat Transfer | 3 |
| 20. | EN629 | Power Systems Planning and Operation | 3 |
| 21. | EN630 | Advanced Thermodynamics | 3 |
| 22. | EN631 | Instrumentation and Control in Energy Systems | 3 |
| 23. | EN632 | Advanced Reaction Engineering | 3 |
| 24. | EN633 | Computational Heat Transfer | 3 |
| 25. | EN634 | Batteries and Fuel Cells | 3 |
| 26. | EN635 | Environmental Impact Assessment | 3 |
| 27. | EN636 | Smart Grid Systems | 3 |
| 28. | EN637 | Nuclear Reactor Theory | 3 |
| 29. | EN638 | Optimization Techniques | 3 |
| 30. | EN639 | Power Sources for Electric Vehicles | 3 |
| 31. | EN640 | IPR, Startup and Entrepreneurship | 3 |
| 32. | EN641 | Carbon Sequestration Techniques | 3 |
| 33. | EN642 | Design of Heat Transfers Equipments | 3 |
| 34. | EN643 | Waste Management and Energy Generation Technology | 3 |
| 35. | EN644 | Blockchain Technologies | 3 |
| 36. | EN645 | Heat and Mass Transfer | 3 |

**OPEN ELECTIVE (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EN610 | Direct Energy Conversion | 3 |
| 2. | EN611 | Environmental Engineering and PollutionControl | 3 |
| 3. | EN612 | Energy Storage Systems | 3 |
| 4. | EN613 | Advanced Fuel Technologies | 3 |
| 5. | EN614 | Hydrogen Energy | 3 |
| 6. | EN615 | Professional Skill Development | 3 |
| 7. | EN616 | Computational Fluid Dynamics | 3 |
| 8. | EN617 | Foundation for Energy Engineering | 3 |
| 9. | EN618 | Energy Systems Modeling and Analysis | 3 |
| 10. | EN619 | Air Conditioning and Refrigeration | 3 |

| | | | |
|---|---|---|---|
| 11. | EN620 | Energy Efficient Buildings | 3 |
| 12. | EN621 | Thermal Engineering | 3 |
| 13. | EN622 | Optimum Utilization of Heat and Power | 3 |
| 14. | EN623 | Power Plant Technology | 3 |
| 15. | EN624 | Power Generation and Systems Planning | 3 |
| 16. | EN625 | Electrical Energy Technology | 3 |
| 17. | EN626 | Applied Thermodynamics | 3 |
| 18. | EN627 | Power Generation, Transmission and Distribution | 3 |
| 19. | EN628 | Advanced Heat Transfer | 3 |
| 20. | EN629 | Power Systems Planning and Operation | 3 |
| 21. | EN630 | Advanced Thermodynamics | 3 |
| 22. | EN631 | Instrumentation and Control in Energy Systems | 3 |
| 23. | EN632 | Advanced Reaction Engineering | 3 |
| 24. | EN633 | Computational Heat Transfer | 3 |
| 25. | EN634 | Batteries and Fuel Cells | 3 |
| 26. | EN635 | Environmental Impact Assessment | 3 |
| 27. | EN636 | Smart Grid Systems | 3 |
| 28. | EN637 | Nuclear Reactor Theory | 3 |
| 29. | EN638 | Optimization Techniques | 3 |
| 30. | EN639 | Power Sources for Electric Vehicles | 3 |
| 31. | EN640 | IPR, Startup and Entrepreneurship | 3 |
| 32. | EN641 | Carbon Sequestration Techniques | 3 |
| 33. | EN642 | Design of Heat Transfers Equipments | 3 |
| 34. | EN643 | Waste Management and Energy Generation Technology | 3 |
| 35. | EN644 | Blockchain Technologies | 3 |
| 36. | EN645 | Heat and Mass Transfer | 3 |

**MICROCREDITS (MC) (Students can opt 3 courses of 1 credit (4 weeks) each as Microcredits instead of one OE /OC)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | EN680 | Building Energy Management Using IoT | 1 |
| 2. | EN681 | Carbon Markets | 1 |
| 3. | EN682 | Carbon Capture and Utilization, Sequestration | 1 |
| 4. | EN683 | Life Cycle Assessment | 1 |
| 5. | EN684 | Decarbonasation of Industry | 1 |
| 6. | EN685 | Safety Management in Electrical Vehicles | 1 |
| 7. | EN686 | Introduction to Block Chain Technologies | 1 |
| 8. | EN687 | Digital Twinning | 1 |

## M. Tech. (INDUSTRIAL AUTOMATION)

The total minimum credits required for completing the M. Tech. Programme in Industrial Automation is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA623 | Applied Mathematics | 4 |
| 2. | IC601 | Measurements in Manufacturing and Process Industries | 4 |
| 3. | IC603 | Industrial Automation Systems | 4 |
| 4. | IC6XX | Programme Elective I | 3 |
| 5. | IC6XX | Programme Elective II | 3 |
| 6. | IC6XX / OC6XX | Programme Elective III / Online (NPTEL) | 3 |
| 7. | IC605 | Instrumentation and Measurement Laboratory | 2 |
| 8. | IC607 | Process Control and Automation Laboratory | 2 |
| | | **Total** | **25** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | IC602 | Industrial and Data Communications | 4 |
| 2. | IC604 | Electric Drives and Control | 4 |
| 3. | IC606 | Robotics in Industrial Automation | 4 |
| 4. | IC6XX | Programme Elective IV | 3 |
| 5. | IC6XX | Programme Elective V | 3 |
| 6. | IC6XX / OC6XX | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | IC608 | AI and Robotics Laboratory | 2 |
| | | **Total** | **23** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| IC611 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| IC609 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| IC610 | Project Work (Phase II) | 12 |

## ONLINE COURSE (OC) / MICRO CREDIT COURSE (MC) (To be completed between I to III semester)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | OC6XX / MC6XX | ONLINE COURSE (OC) (1/2/3 credit)<br>MICRO CREDIT COURSE (MC) (1 credit) | 6 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | IC612 | Artificial Intelligence in Industrial Automation | 3 |
| 2. | IC613 | Modeling, Simulation and Analysis of Manufacturing Systems | 3 |
| 3. | IC614 | Industrial Internet of Things | 3 |
| 4. | IC615 | Embedded Systems | 3 |
| 5. | IC616 | Computer Vision and Image Processing | 3 |
| 6. | IC617 | Intelligent Transportation Systems | 3 |
| 7. | IC618 | Wireless Sensor Networks | 3 |
| 8. | IC619 | Fluid Power Systems | 3 |
| 9. | IC620 | Augmented Reality | 3 |
| 10. | IC621 | Advanced Control Systems | 3 |
| 11. | IC622 | Network Control Systems | 3 |
| 12. | IC623 | System Identification | 3 |
| 13. | IC624 | Cyber Security in Industrial Automation | 3 |
| 14. | IC625 | Building and Infrastructure Systems and Automation | 3 |
| 15. | IC626 | Rapid Prototyping | 3 |
| 16. | IC627 | Predictive Analytics | 3 |
| 17. | IC628 | Optimization Techniques | 3 |
| 18. | IC629 | Advanced Sensor Interfacing Circuits | 3 |
| 19. | IC630 | Automation in Financial Technology | 3 |
| 20. | IC631 | Nonlinear Control | 3 |
| 21. | IC632 | Robot Dynamics and Control | 3 |

| | | | |
|---|---|---|---|
| 22. | IC633 | Condition Monitoring: Industrial Practices | 3 |
| 23. | IC634 | Modern Optimization Techniques and Algorithms | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | OE612 | Artificial Intelligence in Industrial Automation | 3 |
| 2. | OE613 | Modeling, Simulation and Analysis of Manufacturing Systems | 3 |
| 3. | OE614 | Industrial Internet of Things | 3 |
| 4. | OE615 | Embedded Systems | 3 |
| 5. | OE616 | Computer Vision and Image Processing | 3 |
| 6. | OE617 | Intelligent Transportation Systems | 3 |
| 7. | OE618 | Wireless Sensor Networks | 3 |
| 8. | OE619 | Fluid Power Systems | 3 |
| 9. | OE620 | Augmented Reality | 3 |
| 10. | OE621 | Advanced Control Systems | 3 |
| 11. | OE622 | Network Control Systems | 3 |
| 12. | OE623 | System Identification | 3 |
| 13. | OE624 | Cyber Security in Industrial Automation | 3 |
| 14. | OE625 | Building and Infrastructure Systems and Automation | 3 |
| 15. | OE626 | Rapid Prototyping | 3 |
| 16. | OE627 | Predictive Analytics | 3 |
| 17. | OE628 | Optimization Techniques | 3 |
| 18. | OE629 | Advanced Sensor Interfacing Circuits | 3 |
| 19. | OE630 | Automation in Financial Technology | 3 |
| 20. | OE631 | Nonlinear Control | 3 |
| 21. | OE632 | Robot Dynamics and Control | 3 |
| 22. | OE633 | Condition Monitoring: Industrial Practices | 3 |
| 23. | OE634 | Modern Optimization Techniques and Algorithms | 3 |

**ONLINE COURSE (OC)**
**(to be completed within 1st to 3rd semesters)**

**All the courses (eligible for M.Tech Programme) offered online in SWAYAM portal during the respective session can be considered for the list of online courses (OC) Students can also opt for online courses of 2 credit (8 weeks / 24 hours)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | OC6XX | Fundamentals of Micro and Nanofabrication | 3 |
| 2. | OC6XX | Distributed Optimization and Machine Learning | 3 |
| 3. | OC6XX | Practical Cyber Security for Cyber Security Practitioners | 3 |
| 4. | OC6XX | Social Innovation in Industry 4.0 | 3 |
| 5. | OC6XX | Industrial Robotics: Theories for Implementation | 3 |
| 6. | OC6XX | Automation in Manufacturing | 3 |
| 7. | OC6XX | Fundamentals of Artificial Intelligence | 3 |

**MICROCREDITS (MC)**
**Students can opt 3 courses of {1 credit (4 weeks / 12 hours); 2 credit (8 weeks / 24 hours)} each as microcredits instead of one OE/OC (3 - credit)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MC6XX | Equipment Design: Mechanical Aspects | 1 |
| 2. | MC6XX | Product Design and Development | 1 |
| 3. | MC6XX | Drone Technology | 1 |
| 4. | MC6XX | Automobile Technology | 1 |
| 5. | MC6XX | Python Programming | 1 |

## M. Tech. (INDUSTRIAL SAFETY ENGINEERING)

The total minimum credits required for completing the M. Tech. Programme in Industrial Safety Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA611 | Probability and Statistics | 4 |
| 2. | ME651 | Safety Management | 4 |
| 3. | ME652 | Occupational Health and Hygiene | 4 |
| 4. | MEXXX | Program Elective I | 4 |
| 5. | MEXXX | Program Elective II | 3 |
| 6. | MEXXX | Program Elective III | 3 |
| 7. | ME661 | Industrial Hygiene and Ergonomics Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME653 | Computer Aided Risk Analysis | 4 |
| 2. | ME654 | Safety in Process Industries | 4 |
| 3. | ME655 | Fire and Explosion: Prevention and Control | 4 |
| 4. | MEXXX | Program Elective IV | 4 |
| 5. | MEXXX | Program Elective V | 3 |
| 6. | MEXXX | Program Elective VI | 3 |
| 7. | ME662 | Industrial Safety Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| ME663 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| ME797 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| ME798 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) (To be completed between I to IV semester)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I | 3 |
| 2. | | Open Elective II | 3 |

## PROGRAMME ELECTIVES (PE)

### PEs with 4 credits

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME671 | Regulation for Health, Safety and Environment | 4 |
| 2. | ME672 | Safety in Construction and Material Handling | 4 |
| 3. | ME673 | Design of Air Pollution Control Systems | 4 |
| 4. | ME674 | Transport Safety | 4 |
| 5. | ME675 | Safety in Mines | 4 |
| 6. | ME676 | Dock Safety | 4 |

### PEs with 3 credits

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME677 | Safety in Engineering Industry | 3 |
| 2. | ME678 | Environmental Pollution Control | 3 |
| 3. | ME679 | Electrical Safety | 3 |
| 4. | ME680 | Human Factors and Ergonomics | 3 |
| 5. | ME681 | Industrial Noise and Vibration Control | 3 |
| 6. | ME682 | Work Study and Ergonomics | 3 |
| 7. | ME683 | Safety in Textile Industry | 3 |
| 8. | ME684 | Sensitivity Measurements and Evaluation of Energetic Material | 3 |
| 9. | ME685 | Safety in Powder Handling | 3 |
| 10. | ME686 | Nuclear Engineering and Safety | 3 |
| 11. | ME687 | Disaster Management | 3 |
| 12. | ME688 | ISO 45001 and ISO 14001 | 3 |
| 13. | ME689 | Safety in Refrigeration and Cryogenics | 3 |
| 14. | ME690 | Biomechanics and Human body vibration | 3 |
| 15. | ME691 | Safety in On and Off Shore Drilling | 3 |

## OPEN ELECTIVES (OE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME689 | Safety in Refrigeration and Cryogenics | 3 |
| 2. | ME690 | Biomechanics and Human body vibration | 3 |
| 3. | ME691 | Safety in On and Off Shore Drilling | 3 |

## M. Tech. (THERMAL POWER ENGINEERING)

The total minimum credits required for completing the M.Tech. Programme inThermal Power Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME601 | Mathematical Methods | 4 |
| 2. | ME602 | Advanced Fluid Mechanics | 4 |
| 3. | ME603 | Advanced Heat Transfer | 4 |
| 4. | | Programme Elective I | 4 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | ME607 | Advanced Thermal Engineering Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME604 | Fuels Combustion and Emission Control | 4 |
| 2. | ME605 | Heat Transfer Equipment Design | 4 |
| 3. | ME606 | Analysis and Design of Pressure Vessels | 4 |
| 4. | | Programme Elective IV | 4 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | ME608 | Advanced Engineering Simulation Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| ME609 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| ME747 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| ME748 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I | 3 |
| 2. | | Open Elective II | 3 |

**PROGRAMME ELECTIVES (PE)**

**Program Elective Course with 4 credits**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME611 | Fluid Mechanics of Turbomachines | 4 |
| 2. | ME612 | Computational Fluid Dynamics | 4 |
| 3. | ME613 | Finite Element Method in Heat Transfer Analysis | 4 |
| 4. | ME614 | Mechanical Shock and Vibration | 4 |
| 5. | ME615 | Thermal Piping Analysis and Design | 4 |

**Program Elective Course with 3 credits**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME621 | Energy Conservation, Management, and Audit | 3 |
| 2. | ME622 | Boiler Auxiliaries and Performance Evaluation | 3 |
| 3. | ME623 | Safety in Thermal and Nuclear Power Plants | 3 |
| 4. | ME624 | Boiler Production Technology | 3 |
| 5. | ME625 | Installation, Testing and Operation of Boilers | 3 |
| 6. | ME626 | Cogeneration and Waste Heat Recovery Systems | 3 |
| 7. | ME627 | Advanced IC Engines | 3 |
| 8. | ME628 | Power Plant Instrumentation | 3 |
| 9. | ME629 | Refrigeration and Cryogenics | 3 |
| 10. | ME630 | Analysis of Thermal Power Cycles | 3 |
| 11. | ME631 | Design and Optimization of Thermal Energy Systems | 3 |
| 12. | ME632 | Hydrogen Production, Handling and Storage | 3 |
| 13. | ME633 | Industrial Ventilation and Air-conditioning Systems | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | ME631 | Design and Optimization of Thermal Energy Systems | 3 |
| 2. | ME632 | Hydrogen Production, Handling and Storage | 3 |
| 3. | ME633 | Industrial Ventilation and Air-conditioning Systems | 3 |

## M.Tech. (WELDING ENGINEERING)

The total minimum credits required for completing the M.Tech. Programme in Welding Engineering is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA613 | Engineering Mathematics | 4 |
| 2. | MT601 | Design of Weldments | 4 |
| 3. | MT603 | Joining of Materials – I | 4 |
| 4. | | Programme Elective I | 4 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III | 3 |
| 7. | MT609 | Metallography, Materials Testing and Characterization Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MT602 | Welding Metallurgy | 4 |
| 2. | MT604 | Welding Codes and Standards | 4 |
| 3. | MT606 | Joining of Materials – II | 4 |
| 4. | | Programme Elective IV | 4 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI | 3 |
| 7. | MT610 | Welding Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| MT612 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| MT613 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| MT614 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MTXXX | Open Elective I / Online Course | 3 |
| 2. | MTXXX | Open Elective II / Online Course | 3 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MT661 | Physical Metallurgy | 4 |
| 2. | MT662 | Testing, Inspection and Characterization | 4 |
| 3. | MT663 | Mechanical Behaviour of Materials | 3 |
| 4. | MT664 | Corrosion Engineering | 3 |
| 5. | MT665 | Computational Techniques | 3 |
| 6. | MT666 | Metallurgical Failure Analyses | 3 |
| 7. | MT667 | Surface Engineering | 3 |
| 8. | MT668 | Modelling in Materials Processing | 3 |
| 9. | MT669 | Automaotive Materials | 3 |
| 10. | MT670 | Nanomaterials and Technology | 3 |
| 11. | MT671 | Advanced Electrochemical Techniques | 3 |
| 12. | MT672 | Developments in Iron Making and Steel Making | 3 |
| 13. | MT673 | Additive Manufacturing | 3 |
| 14. | MT674 | Phase Transformations | 3 |
| 15. | MT675 | Crystallography | 3 |
| 16. | MT676 | Particulate Technology | 3 |
| 17. | MT677 | Process Modeling | 3 |
| 18. | MT678 | Advanced Material Characterization Techniques | 3 |
| 19. | MT679 | Non-Destructive Testing | 3 |
| **PROGRAMME SPECIFIC ELECTIVES** | | | |
| 20. | MT701 | Electrical Aspects of Welding | 3 |
| 21. | MT702 | Welding Application Technology | 3 |
| 22. | MT703 | Repair Welding and Reclamation | 3 |
| 23. | MT704 | Life Assessment of Welded Structure | 3 |
| 24. | MT705 | Welding Economics and Management | 3 |
| **OPEN ELECTIVES** | | | |
| 25. | MT761 | Design and Selection of Materials | 3 |
| 26. | MT762 | Statistical Quality Control and Management | 3 |
| 27. | MT763 | Intellectual Property Rights | 3 |
| 28. | MT764 | Innovation and Product Development | 3 |
| 29. | MT765 | Energy Storage Systems | 3 |
| 30. | MT766 | Artificial Intelligence in Materials Engineering | 3 |
| 31. | MT767 | Molecular Modelling of Materials | 3 |

## M.Tech. (MATERIALS SCIENCE AND ENGINEERING)

The total minimum credits required for completing the M.Tech. Programme in Materials Science and Engineering is 80**.**

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA613 | Engineering Mathematics | 4 |
| 2. | MT621 | Thermodynamics and Kinetics | 4 |
| 3. | MT623 | Electrical, Magnetic and Optical Materials | 4 |
| 4. | | Programme Elective I | 4 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III /Online (NPTEL) | 3 |
| 7. | MT629 | Materials Characterisation Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MT622 | Ceramic Science and Technology | 4 |
| 2. | MT624 | Polymers and Composites | 4 |
| 3. | MT626 | Metallic Materials | 4 |
| 4. | | Programme Elective IV | 4 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI /Online (NPTEL) | 3 |
| 7. | MT630 | Functional Materials Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| MT631 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| MT639 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| MT640 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MTXXX | Open Elective I / Online Course | 3 |
| 2. | MTXXX | Open Elective II / Online Course | 3 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **PE courses for all MME M.Tech. specializations** | | | |
| 1. | MT661 | Physical Metallurgy | 4 |
| 2. | MT662 | Testing, Inspection and Characterisation | 4 |
| 3. | MT663 | Mechanical Behaviour of Materials | 3 |
| 4. | MT664 | Corrosion Engineering | 3 |
| 5. | MT665 | Computational Techniques | 3 |
| 6. | MT666 | Metallurgical Failure Analyses | 3 |
| 7. | MT667 | Surface Engineering | 3 |
| 8. | MT668 | Modelling in Materials Processing | 3 |
| 9. | MT669 | Automotive Materials | 3 |
| 10. | MT670 | Nanomaterials and Technology | 3 |
| 11. | MT671 | Advanced Electrochemical Techniques | 3 |
| 12. | MT672 | Developments in Iron-Making and Steel-Making | 3 |
| 13. | MT673 | Additive Manufacturing | 3 |
| 14. | MT674 | Phase Transformations | 3 |
| 15. | MT675 | Crystallography | 3 |
| 16. | MT676 | Particulate Technology | 3 |
| 17. | MT677 | Process Modelling | 3 |
| 18. | MT678 | Advanced Material Characterisation Techniques | 3 |
| 19. | MT679 | Non-Destructive Testing | 3 |
| **PE courses for MSE specialization** | | | |
| 20. | MT721 | High-Temperature Materials | 3 |
| 21. | MT722 | Biomaterials | 3 |
| 22. | MT723 | Severe Plastic Deformation | 3 |
| 23. | MT724 | Nuclear Materials | 3 |
| 24. | MT725 | Manufacturing Processes | 3 |
| 25. | MT726 | Structure-Property Relations in Nonferrous Metals | 3 |
| 26. | MT727 | Polymer Processing | 3 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MT761 | Design and Selection of Materials | 3 |
| 2. | MT762 | Statistical Quality Control and Management | 3 |
| 3. | MT763 | Intellectual Property Rights | 3 |
| 4. | MT764 | Innovation and Product Development | 3 |
| 5. | MT765 | Energy Storage Systems | 3 |
| 6. | MT766 | Artificial Intelligence in Materials Engineering | 3 |
| 7. | MT767 | Molecular Modelling of Materials | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **OE for Specializations other than MSE** | | | |
| 1. | MT721 | High-Temperature Materials | 3 |
| 2. | MT722 | Biomaterials | 3 |
| 3. | MT723 | Severe Plastic Deformation | 3 |
| 4. | MT724 | Nuclear Materials | 3 |
| 5. | MT726 | Structure-Property Relations in Nonferrous Metals | 3 |
| 6. | MT727 | Polymer Processing | 3 |

**MICROCREDITS (MC)** (Students can opt 3 courses of 1 credit (4 weeks) each as microcredits instead of 1 OE/OC)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | | |

## M.Tech. (INDUSTRIAL METALLURGY)

The total minimum credits required for completing the M.Tech. Programme in Industrial Metallurgy is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA613 | Engineering Mathematics | 4 |
| 2. | MT641 | Foundry Technology | 4 |
| 3. | MT643 | Welding Technology | 4 |
| 4. | | Programme Elective I | 4 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III /Online (NPTEL) | 3 |
| 7. | MT649 | Microstructure Characterization and Material Testing Laboratory | 2 |
| | | **Total** | **24** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MT642 | Industrial Heat Treatment | 4 |
| 2. | MT644 | Foundry Metallurgy | 4 |
| 3. | MT646 | Metal Forming | 4 |
| 4. | | Programme Elective IV | 4 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI /Online (NPTEL) | 3 |
| 7. | MT650 | Advanced Materials Processing Laboratory | 2 |
| | | **Total** | **24** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| MT656 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| MT657 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| MT658 | Project Work (Phase II) | 12 |

## OPEN ELECTIVES (OE) (To be completed between I to IV semester)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I | 3 |
| 2. | | Open Elective II | 3 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **PE courses for all three specializations** | | | |
| 1. | MT661 | Physical Metallurgy | 4 |
| 2. | MT662 | Testing, Inspection and Characterization | 4 |
| 3. | MT663 | Mechanical Behavior of Materials | 3 |
| 4. | MT664 | Corrosion Engineering | 3 |
| 5. | MT665 | Computational Techniques | 3 |
| 6. | MT666 | Metallurgical Failure Analyses | 3 |
| 7. | MT667 | Surface Engineering | 3 |
| 8. | MT668 | Modelling in Materials Processing | 3 |
| 9. | MT669 | Automotive Materials | 3 |
| 10. | MT670 | Nanomaterials and Technology | 3 |
| 11. | MT671 | Advanced Electrochemical Techniques | 3 |
| 12. | MT672 | Developments in Iron-Making and Steel-Making | 3 |
| 13. | MT673 | Additive Manufacturing | 3 |
| 14. | MT674 | Phase Transformations | 3 |
| 15. | MT675 | Crystallography | 3 |
| 16. | MT676 | Particulate Technology | 3 |
| 17. | MT677 | Process Modeling | 3 |
| 18. | MT678 | Advanced Material Characterization Techniques | 3 |
| 19. | MT679 | Non-Destructive Testing | 3 |
| **PE courses for IM specialization** | | | |
| 1. | MT741 | Stainless Steel Technology | 3 |
| 2. | MT742 | Design of Castings and Weldments | 3 |
| 3. | MT743 | Advanced Materials Processing | 3 |
| 4. | MT744 | Special Casting Processes | 3 |
| 5. | MT745 | Special Topics in Metal Forming | 3 |

| | | | |
|---|---|---|---|
| 6. | MT746 | Thermodynamics of Solidification | 3 |
| 7. | MT747 | Modelling and Simulation for Metal Processing | 3 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MT761 | Design and Selection of Materials | 3 |
| 2. | MT762 | Statistical Quality Control and Management | 3 |
| 3. | MT763 | Intellectual Property Rights | 3 |
| 4. | MT764 | Innovation and Product Development | 3 |
| 5. | MT765 | Energy Storage Systems | 3 |
| 6. | MT766 | Artificial Intelligence in Materials Engineering | 3 |
| 7. | MT767 | Molecular Modeling of Materials | 3 |
| **OE for MSE and /or WE** | | | |
| 1. | MT741 | Stainless Steel Technology | 3 |
| 2. | MT742 | Design of Castings and Weldments | 3 |
| 3. | MT743 | Advanced Materials Processing | 3 |
| 4. | MT744 | Special Casting Processes | 3 |
| 5. | MT745 | Special Topics in Metal Forming | 3 |
| 6. | MT746 | Thermodynamics of Solidification | 3 |
| 7. | MT747 | Modelling and Simulation for Metal Processing | 3 |

## M.Tech. (NON-DESTRUCTIVE TESTING)

The total minimum credits required for completing the M.Tech. Programme in Non-Destructive Testing is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH601 | Surface NDE Methods | 4 |
| 2. | PH603 | Ultrasonic Testing | 4 |
| 3. | PH606 | Fabrication Technology | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III | 3 |
| 7. | PH607 | Conventional NDE Laboratory | 2 |
| | | **Total** | **23** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH602 | Advanced NDE Techniques | 4 |
| 2. | PH604 | Advanced Ultrasonic Techniques | 4 |
| 3. | PH605 | Radiographic Testing and Radiation Safety | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI | 3 |
| 7. | PH608 | Advanced NDE Laboratory and Fieldwork | 2 |
| 8. | PH622 | Radiography and Computational Laboratory | 2 |
| | | **Total** | **25** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| PH621 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| PH609 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| PH610 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course # | 3 |
| 2. | | Open Elective II / Online Course *, # | 3 |

* A Student may register for one 2-credit course and one 1-credit course instead of one 3 credit course.

# Every semester, a list of **approved** online courses will be made available to the students to register.

**PROGRAMME ELECTIVES (PE) ***

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH611 | Digital Signal and Image Processing | 3 |
| 2. | PH613 | Basics of Engineering Materials | 3 |
| 3. | PH615 | Material Characterization Techniques | 3 |
| 4. | PH617 | Composite Technology | 3 |
| 5. | PH619 | Electrical, Magnetic and Optoelectronic Materials | 3 |
| 6. | PH612 | Digital Radiography and Computed Tomography | 3 |
| 7. | PH614 | Fracture Mechanics and Failures of Materials | 3 |
| 8. | PH616 | Probability, Statistics, Quality and Reliability | 3 |
| 9. | PH618 | Introduction to Data Analytics | 3 |
| 10. | PH620 | Neutron Radiography | 3 |
| 11. | PH680 | Computational Techniques | 3 |
| 12. | PH685 | Sensors And Transducers | 3 |
| 13. | PH687 | Physics and Technology of Thin Films | 3 |

* Electives are not limited to the given list. Courses from other PG Programmes can also be chosen as subjects of study. The courses will be offered based on the availability of the faculty concerned.

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH613 | Basics of Engineering Materials | 3 |
| 2. | PH618 | Introduction to Data Analytics | 3 |
| 3. | PH680 | Computational Technique | 3 |

## M.Tech. (MANUFACTURING TECHNOLOGY)

The total minimum credits required for completing the M.Tech. Programme in Manufacturing Technology is 80.

### CURRICULUM

### SEMESTER I

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PR601 | Machining Science and Technology | 4 |
| 2. | PR603 | Advanced Forming Technology | 4 |
| 3. | PR605 | Manufacturing Management | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | PR607 | Advanced Material Processing Laboratory | 2 |
| | | **Total** | **23** |

### SEMESTER II

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PR602 | Welding and Additive Manufacturing | 4 |
| 2. | PR604 | Advanced Tooling and Automated Inspection | 4 |
| 3. | PR606 | Production Automation and CNC Technology | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | PR608 | Automation and CIM Laboratory | 2 |
| 8. | PR610 | Process Modelling and Additive Manufacturing Laboratory | 2 |
| | | **Total** | **25** |

### SUMMER TERM (Evaluation in the III Semester)

| Code | Course of Study | Credit |
|---|---|---|
| PR644 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| PR645 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| PR646 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course | 3 |
| 2. | | Open Elective II / Online Course | 3 |
| Online courses shall be dynamically updated based on student request and due approval through circulation. | | | |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PR611 | Modeling of Manufacturing Processes | 3 |
| 2. | PR612 | Advances in Polymer Matrix Composites | 3 |
| 3. | PR613 | Heat Treatment Processes | 3 |
| 4. | PR614 | Industrial Welding Applications | 3 |
| 5. | PR615 | Laser Material Processing | 3 |
| 6. | PR616 | Machine Tool Technology | 3 |
| 7. | PR617 | Manufacturing of Non-metallic Products | 3 |
| 8. | PR618 | Mechanical Behaviour of Materials | 3 |
| 9. | PR619 | Mechanics of Composite Materials | 3 |
| 10. | PR620 | Non-Destructive Testing | 3 |
| 11. | PR621 | Smart Materials and MEMS | 3 |
| 12. | PR622 | Surface Engineering | 3 |
| 13. | PR623 | Tribology | 3 |
| 14. | PR624 | Friction Materials | 3 |
| 15. | PR625 | Advanced Casting Processes | 3 |
| 16. | PR626 | Computational Methods in Manufacturing | 3 |
| 17. | PR627 | Additive Manufacturing | 3 |

| | | | |
|---|---|---|---|
| 18. | PR628 | Micro/Nano Manufacturing | 3 |
| 19. | PR629 | Design for Additive Manufacturing | 3 |
| 20. | PR630 | Computer Aided Design and Manufacturing | 3 |
| 21. | PR631 | Control of Manufacturing Processes | 3 |
| 22. | PR632 | Design for Manufacture | 3 |
| 23. | PR633 | Manufacturing Automation and Mechatronics | 3 |
| 24. | PR634 | Product Design and Development | 3 |
| 25. | PR635 | Robotics | 3 |
| 26. | PR636 | Terotechnology | 3 |
| 27. | PR637 | Tolerance Technology | 3 |
| 28. | PR638 | Modeling, Simulation and Analysis | 3 |
| 29. | PR639 | Supply Chain Management | 3 |
| 30. | PR640 | Automation and Control | 3 |
| 31. | PR641 | Data Science for Manufacturing | 3 |
| 32. | PR642 | Condition Monitoring of Machine | 3 |
| 33. | PR643 | Human Machine Interaction for Manufacturing | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PR628 | Micro/Nano Manufacturing | 3 |
| 2. | PR634 | Product Design and Development | 3 |
| 3. | PR635 | Robotics | 3 |
| 4. | PR641 | Data Science for Manufacturing | 3 |
| 5. | PR642 | Condition Monitoring of Machine | 3 |
| 6. | PR643 | Human Machine Interaction for Manufacturing | 3 |
| 7. | PR675 | Financial Management | 3 |

**MICROCREDITS (MC) (**Students can opt 3 courses of 1 credit (4 weeks) each as microcredits instead of 1 OE/OC)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Microcredit courses shall be dynamically updated based on student request and due approval through circulation | |

## M.Tech. (INDUSTRIAL ENGINEERING AND MANAGEMENT)

The total minimum credits required for completing the M.Tech. Programme in Industrial Engineering and Management is 80.

## CURRICULUM

### SEMESTER I

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PR651 | Data Analytics | 4 |
| 2. | PR652 | Modeling, Simulation and Analysis | 4 |
| 3. | PR653 | Analysis and Control of Manufacturing Systems | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | | Programme Elective III / Online (NPTEL) | 3 |
| 7. | PR657 | Data Analytics Laboratory | 2 |
| 8. | PR658 | Simulation Laboratory | 2 |
| | | **Total** | **25** |

### SEMESTER II

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PR654 | Advanced Operations Research | 4 |
| 2. | PR655 | Project Management | 4 |
| 3. | PR656 | Supply Chain Management | 4 |
| 4. | | Programme Elective IV | 3 |
| 5. | | Programme Elective V | 3 |
| 6. | | Programme Elective VI / Online (NPTEL) | 3 |
| 7. | PR659 | Supply Chain Management Laboratory | 2 |
| | | **Total** | **23** |

### SUMMER TERM (Evaluation in the III Semester)

| Code | Course of Study | Credit |
|---|---|---|
| PR660 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| PR690 | Project Work (Phase I) | 12 |

**SEMESTER IV**

| Code | Course of Study | Credit |
|---|---|---|
| PR691 | Project Work (Phase II) | 12 |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course | 3 |
| 2. | | Open Elective II / Online Course | 3 |

*Online courses shall be dynamically updated based on the students request and due approvalthrough circulation.

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **INDUSTRIAL ENGINEERING STREAM** | | | |
| 1. | PR661 | Industrial Engineering Economic Analysis | 3 |
| 2. | PR662 | Intelligent Manufacturing Systems | 3 |
| 3. | PR663 | Research Methodology | 3 |
| 4. | PR664 | Design and Analysis of Experiments | 3 |
| 5. | PR665 | Lean and Agile Manufacturing | 3 |
| 6. | PR666 | Facilities Planning and Design | 3 |
| 7. | PR667 | Production Management Systems | 3 |
| 8. | PR668 | Industry 4.0 and Cloud Manufacturing | 3 |
| 9. | PR669 | Work Design and Ergonomics | 3 |
| 10. | PR670 | Sustainable Manufacturing | 3 |
| 11. | PR671 | Quality and Reliability Engineering | 3 |
| 12. | PR672 | Value Engineering | 3 |
| 13. | PR673 | Cost Measurement and Productivity Measurement | 3 |
| **MANAGEMENT STREAM** | | | |
| 1. | PR674 | Industrial Engineering and Productivity Management | 3 |

| | | | |
|---|---|---|---|
| 2. | PR675 | Financial Management | 3 |
| 3. | PR676 | Marketing Management | 3 |
| 4. | PR677 | Total Quality Management and Six Sigma | 3 |
| 5. | PR678 | Human Resource Management | 3 |
| 6. | PR679 | Product Life Cycle Management | 3 |
| 7. | PR680 | Technology Management | 3 |
| 8. | PR681 | Advanced Optimization Techniques | 3 |
| 9. | PR682 | Product Design and Development | 3 |
| 10. | PR683 | E-waste Assessment and Management | 3 |
| **INDUSTRIAL INFORMATION SYSTEM STREAM** | | | |
| 1. | PR684 | Enterprise Resource Planning | 3 |
| 2. | PR685 | Decision Support Systems | 3 |
| 3. | PR686 | Knowledge Management | 3 |
| 4. | PR687 | Multi-Criteria Decision Making Techniques | 3 |
| 5. | PR688 | Intelligent Industrial Systems | 3 |
| 6. | PR689 | Human Machine Interaction for Manufacturing | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PR669 | Work Design and Ergonomics | 3 |
| 2. | PR670 | Sustainable Manufacturing | 3 |
| 3. | PR675 | Financial Management | 3 |
| 4. | PR680 | Technology Management | 3 |
| 5. | PR682 | Product Design and Development | 3 |
| 6. | PR684 | Enterprise Resource Planning | 3 |

**MICROCREDITS (MC)** (Students can opt 3 courses of 1 credit (4 weeks) each as microcredits instead of 1 OE/OC)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | Microcredits courses shall be dynamically updated based on the students request and due approval through circulation. | | |

## M.Sc. (CHEMISTRY)

The total minimum credits required for completing the M.Sc. Programme in Chemistry is 80.

## CURRICULUM

### SEMESTER I

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CHPC601 | Organic Reaction Mechanisms and Aromaticity | 3 |
| 2. | CHPC603 | Coordination Chemistry | 3 |
| 3. | CHPC605 | Quantum Chemistry and Group Theory | 3 |
| 4. | CHPC607 | Analytical Chemistry | 3 |
| 5. | CHPC609 | Theory of Spectroscopy and Molecular Excitons | 3 |
| 6. | | Program Elective I / *Online courses | 3 |
| 7. | CHLR601 | Inorganic and Analytical Chemistry Laboratory | 2 |
| | | **Total** | **20** |

### SEMESTER II

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CHPC602 | Stereochemistry, Photochemistry, Pericyclic and Rearrangement Reactions | 3 |
| 2. | CHPC604 | Organometallic Chemistry and Inorganic Spectroscopy | 3 |
| 3. | CHPC606 | Rates and Energetics of Chemical Reactions | 3 |
| 4. | CHPC608 | Spectroscopy-Applications in Organic Chemistry | 3 |
| 5. | | Program Elective II / *Online courses | 3 |
| 6. | CHLR602 | Organic Chemistry Laboratory | 2 |
| 7. | CHLR604 | Physical Chemistry and Spectroscopy Laboratory | 2 |
| | | **Total** | **19** |

### SUMMER TERM (Evaluation in the III Semester)

| Code | Course of Study | Credit |
|---|---|---|
| *CHPC611 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

* Evaluation methodology as per senate decision

### SEMESTER III

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CHPC613 | Synthetic Organic Chemistry | 3 |
| 2. | CHPC615 | Main Group, Bioinorganic and Nuclear Chemistry | 3 |

| | | | |
|---|---|---|---|
| 3. | CHPC617 | Statistical Thermodynamics, Photochemistry, and Surfaces | 3 |
| 4. | CHPC619 | Project Work (Phase I) | 12 |
| | | **Total** | **21** |

**SEMESTER IV**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CHPC610 | Project Work (Phase II) | 12 |
| 2. | | Program Elective III / *Online courses | 3 |
| 3. | | Program Elective IV / *Online courses | 3 |
| | | **Total** | **18** |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CHPE601 | Catalysis | 3 |
| 2. | CHPE602 | Polymer Chemistry | 3 |
| 3. | CHPE603 | Principles and Applications of Fluorescence Spectroscopy | 3 |
| 4. | CHPE604 | Computational Methods in Chemistry | 3 |
| 5. | CHPE605 | Medicinal Chemistry | 3 |
| 6. | CHPE606 | Interfacial Chemistry and Sonochemistry | 3 |
| 7. | CHPE607 | Nano Science and Technology | 3 |
| 8. | CHPE608 | Lanthanide and Actinide Chemistry | 3 |
| 9. | CHPE609 | Electronic Structure Methods and Modelling | 3 |
| 10. | CHPE610 | Fuel Cells for Stationary and Automotive Applications | 3 |
| 11. | CHPE611 | Natural Products Chemistry | 3 |
| 12. | CHPE612 | Inorganic Rings, Cages and Clusters | 3 |
| 13. | CHPE613 | Advanced Heterocyclic Chemistry | 3 |
| 14. | CHPE614 | Advanced Bioinorganic Chemistry | 3 |
| 15. | CHPE616 | Organometallic Chemistry for Organic Synthesis | 3 |
| 16. | CHPE618 | Environmental Chemistry | 3 |
| 17. | CHPE620 | Biocatalytic Processes in Chemical Industries | 3 |
| 18. | CHPE622 | Photoredox and Electro-Catalysis | 3 |
| 19. | CHPE624 | Multiscale Simulation Methods | 3 |
| 20. | | NPTEL, SWAYAM, Coursera, edX Online courses | 3 |

## M.Sc. (COMPUTER SCIENCE)

The total minimum credits required for completing the M.Sc. Programme in Computer Science is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CAS711 | Mathematical Foundations of Computer Sciences | 4 |
| 2. | CAS713 | Computer Organization and Architecture | 4 |
| 3. | CAS715 | Data Structures and Algorithms | 3 |
| 4. | CAS717 | Database Management Systems | 3 |
| 5. | CAS719 | Operating Systems Fundamentals | 4 |
| 6. | CAS7AX | Programme Elective I | 4 |
| 7. | CAS701 | Data Structures and Algorithms Laboratory using C/C++ | 2 |
| 8. | CAS703 | Database Management Systems Laboratory | 2 |
| | | **Total** | **26** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CAS712 | Networking Technologies | 3 |
| 2. | CAS7BX | Programme Elective II | 4 |
| 3. | CAS7CX | Programme Elective III | 4 |
| 4. | CAS7DX | Programme Elective IV | 3 |
| 5. | CAS7EX | Open Elective I | 3 |
| 6. | CAS7FX | Programme Elective V | 3 |
| 7. | CAS702 | Internet Programming Laboratory | 2 |
| | | **Total** | **22** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CAS748 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Code | Course of Study | Credit |
|---|---|---|
| CAS749 | Project Work (Phase I) | 12 |

## SEMESTER IV

| Code | Course of Study | Credit |
|---|---|---|
| CAS750 | Project Work (Phase II) | 12 |

## ONLINE COURSE (OC) (To be completed between I to IV semester)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Online Course I | 3 |
| 2. | | Online Course II | 3 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **ELECTIVE I** | | | |
| 1. | CAS7A1 | Artificial Intelligence | 4 |
| 2. | CAS7A2 | Cryptography | 4 |
| 3. | CAS7A3 | Distributed Computing | 4 |
| 4. | CAS7A4 | Soft Computing Techniques | 4 |
| **ELECTIVE II** | | | |
| 5. | CAS7B1 | Digital Image Processing | 4 |
| 6. | CAS7B2 | Theory of Computation | 4 |
| 7. | CAS7B3 | Fault Tolerance Systems and Techniques | 4 |
| 8. | CAS7B4 | Mobile Computing | 4 |
| **ELECTIVE III** | | | |
| 9. | CAS7C1 | GPGPU Programming | 4 |
| 10. | CAS7C2 | Software Engineering | 4 |
| 11. | CAS7C3 | Computer Vision and Pattern Recognition | 4 |
| 12. | CAS7C4 | Web Applications Development | 4 |
| **ELECTIVE IV** | | | |
| 13. | CAS7D1 | Defensive and Secure Software Development | 3 |
| 14. | CAS7D2 | Software Verification and Validation | 3 |
| 15. | CAS7D3 | Machine Learning and Deep Learning Techniques | 3 |
| 16. | CAS7D4 | Compiler Design | 3 |
| **ELECTIVE V** | | | |
| 17. | CAS7E1 | Big Data Analytics | 3 |

| | | | |
|---|---|---|---|
| 18. | CAS7E2 | Quantum Computing | 3 |
| 19. | CAS7E3 | Mobile Applications Development | 3 |
| 20. | CAS7E4 | Augmented Reality and Virtual Reality | 3 |
| **ELECTIVE VI** | | | |
| 21. | CAS7F1 | Blockchain Technologies | 3 |
| 22. | CAS7F2 | Design Patterns | 3 |
| 23. | CAS7F3 | Internet of Things | 3 |
| 24. | CAS7F4 | Real Time Systems | 3 |

**OPEN ELECTIVE (OE) offered by the Department**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CAS7E1 | Big Data Analytics | 3 |

## M.Sc. (MATHEMATICS)

The total minimum credits required for completing the M.Sc. Programme in Mathematics is 80.

## CURRICULUM

### SEMESTER I

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA701 | Real Analysis | 4 |
| 2. | MA702 | Linear Algebra | 4 |
| 3. | MA703 | Ordinary Differential Equations | 4 |
| 4. | MA704 | Numerical Analysis | 4 |
| 5. | MA705 | Probability and Statistics | 4 |
| 6. | MA706 | R-Language | 2 |
| | | **Total** | **22** |

### SEMESTER II

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA707 | Abstract Algebra | 4 |
| 2. | MA708 | Complex Analysis | 4 |
| 3. | MA709 | Topology | 4 |
| 4. | MA710 | Partial Differential Equations | 4 |
| 5. | MA7** | Program Elective I | 3 |
| 6. | MA711 | Scientific Computing using Python | 2 |
| | | **Total** | **21** |

### SUMMER TERM (Evaluation in the III Semester)

| Code | Course of Study | Credit |
|---|---|---|
| MA716 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

### SEMESTER III

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA712 | Functional Analysis | 4 |
| 2. | MA713 | Operations Research | 4 |
| 3. | MA7** | Program Elective II | 3 |
| 4. | MA7** | Program Elective III | 3 |

| | | | |
|---|---|---|---|
| 5. | MA714 | Mathematical Software Laboratory | 2 |
| 6. | MA715 | Project Work (Phase I) | 2 |
| | | **Total** | **18** |

**SEMESTER IV**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA7** | Program Elective IV | 3 |
| 2. | MA717 | Project Work (Phase II) | 8 |
| | | **Total** | **11** |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC)/Program Elective (PE)**
**(To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course/ Program Elective (PE) | 6 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MA718 | Integral Transforms | 3 |
| 2. | MA719 | Graph Theory | 3 |
| 3. | MA720 | Mathematics of Machine Learning | 3 |
| 4. | MA721 | Fluid Dynamics | 3 |
| 5. | MA722 | Integral Equations and Calculus of Variations | 3 |
| 6. | MA723 | Measure Theory | 3 |
| 7. | MA724 | Optimization Techniques | 3 |
| 8. | MA725 | Stochastic Processes | 3 |
| 9. | MA726 | Numerical Solution of Differential Equations | 3 |
| 10. | MA727 | Operator Theory | 3 |
| 11. | MA728 | Introduction of Fuzzy Mathematics and its applications | 3 |
| 12. | MA729 | Introduction to Singularly Perturbed Differential Equations | 3 |
| 13. | MA730 | Matrix Analysis | 3 |
| 14. | MA731 | Advanced Partial Differential Equations | 3 |
| 15. | MA732 | Nonlinear Programming | 3 |
| 16. | MA733 | Advanced Fuzzy Mathematics and its Applications | 3 |

| | | | |
|---|---|---|---|
| 17. | MA734 | Matrix Theory and Stochastic Programming | 3 |
| 18. | MA735 | Advanced Numerical Analysis for Singularly Perturbed Differential Equations | 3 |
| 19. | MA736 | Bio-rheology | 3 |
| 20. | MA737 | Advanced Complex Analysis | 3 |
| 21. | MA738 | Geometric Function Theory | 3 |
| 22. | MA739 | Approximation Theory | 3 |
| 23. | MA740 | Convex Analysis | 3 |
| 24. | MA741 | Graphs and Matrices | 3 |
| 25. | MA742 | Fitted Mesh and Fitted Operator Methods for Singular Perturbation problems | 3 |
| 26. | MA743 | Queueing Theory | 3 |
| 27. | MA744 | Finite Element Methods | 3 |
| 28. | MA745 | Particulate Processes: Theory and Modelling | 3 |
| 29. | MA746 | Introduction to Hydrodynamics Stability | 3 |
| 30. | MA747 | Fixed Point Theory and its Applications | 3 |
| 31. | MA748 | Advanced Functional Analysis | 3 |
| 32. | MA749 | Theory and Geometry of Banach Spaces | 3 |
| 33. | MA750 | Applied Functional Analysis | 3 |
| 34. | MA700 | Advanced Mathematics | 3 |

## M.Sc. (PHYSICS)

The total minimum credits required for completing the M.Sc. Programme in Physics is 80.

### CURRICULUM

**SEMESTER I**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH651 | Mathematical Physics | 4 |
| 2. | PH653 | Classical Mechanics | 4 |
| 3. | PH655 | Quantum Mechanics | 4 |
| 4. | | Programme Elective I | 3 |
| 5. | | Programme Elective II | 3 |
| 6. | PH657 | General Physics Laboratory | 2 |
| | | **Total** | **20** |

**SEMESTER II**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH652 | Electromagnetic Theory | 4 |
| 2. | PH654 | Statistical Mechanics | 4 |
| 3. | PH656 | Solid State Physics | 4 |
| 4. | | Programme Elective III | 3 |
| 5. | PH658 | Computational Laboratory | 2 |
| 6. | PH662 | Electronics Laboratory | 2 |
| | | **Total** | **19** |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| PH697 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**SEMESTER III**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH661 | Project Work (Phase I) | 10 |
| 2. | PH659 | Nuclear And Particle Physics | 4 |
| 3. | PH675 | Atomic And Molecular Spectroscopy | 4 |
| | | **Total** | **18** |

**SEMESTER IV**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH660 | Project Work (Phase II) | 12 |
| 2. | | Programme Elective IV | 3 |
| | | **Total** | **15** |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I / Online Course # | 3 |
| 2. | | Open Elective II / Online Course * # | 3 |

* A student may register for one 2 credit course and one 1 credit course instead of one 3 credit course**.**

# Every semester, a list of approved online courses will be made available for students to register.

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | PH611 | Digital Signal and Image Processing | 3 |
| 2. | PH613 | Basics of Engineering Materials | 3 |
| 3. | PH618 | Introduction to Data Analytics | 3 |
| 4. | PH671 | Electronics | 3 |
| 5. | PH672 | Instrumentation | 3 |
| 6. | PH673 | Numerical Methods | 3 |
| 7. | PH674 | Nanoscience and Technology | 3 |
| 8. | PH676 | Advanced Mathematical Physics | 3 |
| 9. | PH677 | Waveguides and Modern Optics | 3 |
| 10. | PH678 | Astrophysics and Cosmology | 3 |
| 11. | PH679 | Solar Photovoltaic Technology | 3 |
| 12. | PH680 | Computational Techniques | 3 |
| 13. | PH681 | Advanced Electromagnetic Theory | 3 |
| 14. | PH682 | Non-Destructive Testing | 3 |
| 15. | PH683 | Fiber Optic Sensors | 3 |
| 16. | PH684 | Quantum Electronics and Lasers Applications | 3 |

| | | | |
|---|---|---|---|
| 17. | PH685 | Sensors and Transducers | 3 |
| 18. | PH686 | Advanced Statistical Methods and Phase Transition | 3 |
| 19. | PH687 | Physics and Technology of Thin Films | 3 |
| 20. | PH688 | Semiconductor Physics | 3 |
| 21. | PH689 | Magnetic Characterization and Superconducting Materials | 3 |
| 22. | PH690 | Quantum Computation and Information | 3 |
| 23. | PH691 | Micro-Electro-Mechanical Systems | 3 |
| 24. | PH692 | Carbon Nanomaterials and their Applications | 3 |
| 25. | PH693 | Fluid Mechanics and Characteristics of Nanofluids | 3 |
| 26. | PH694 | Advanced Electronic Materials and Devices | 3 |
| 27. | PH695 | Nanophotonics | 3 |

Note: Electives are not limited to the given list. Courses from other PG Programmes can also be chosen as subjects of study. The courses will be offered based on the availability of the faculty concerned.

## MASTER OF COMPUTER APPLICATIONS

The total minimum credits required for completing the MCA Programme is 120.

### SEMESTER I

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA711 | Problem Solving and Programming | 3 |
| 2. | CA713 | Mathematical Foundations of Computer Applications | 3 |
| 3. | CA715 | Digital Logic and Computer Organization | 3 |
| 4. | CA717 | Data Structures and Applications | 3 |
| 5. | CA719 | Operating Systems | 4 |
| 6. | CA701 | Problem Solving Laboratory using Python | 2 |
| 7. | CA703 | Data Structures Laboratory using C | 2 |
| | | **Total** | **20** |

### SEMESTER II

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA710 | Design and Analysis of Algorithms | 3 |
| 2. | CA712 | Database Management Systems | 3 |
| 3. | CA714 | Probability and Statistical Methods | 4 |
| 4. | CA716 | Object-oriented Programming | 4 |
| 5. | CA718 | Computer Networks | 3 |
| 6. | CA702 | DBMS Laboratory | 2 |
| 7. | CA704 | Computer Networks Laboratory | 2 |
| | | **Total** | **21** |

### SEMESTER III

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA721 | Machine Learning Techniques | 3 |
| 2. | CA723 | Computational Intelligence | 3 |
| 3. | CA725 | Software Engineering | 3 |
| 4. | CA727 | Accounting and Financial Management | 3 |
| 5. | CA7A_ | Programme Elective I | 3 |
| 6. | CA705 | Machine Learning Laboratory | 2 |
| 7. | CA707 | Business Communication | 2 |
| 8. | CA709 | Computational Intelligence Laboratory | 2 |
| | | **Total** | **21** |

**SEMESTER IV**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA720 | Deep Learning and Its Applications | 3 |
| 2. | CA722 | Web Technology and Its Applications | 4 |
| 3. | CA724 | Distributed and Cloud Computing | 3 |
| 4. | CA7A_ | Programme Elective II | 3 |
| 5. | CA7B_ | Programme Elective III | 3 |
| 6. | CA706 | Deep Learning Laboratory | 2 |
| 7. | CA708 | Distributed and Cloud Computing Laboratory | 2 |
| | | **Total** | **20** |

**SEMESTER V**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA731 | Cyber Security | 3 |
| 2. | CA733 | Mobile Applications Development | 3 |
| 3. | CA735 | Organizational Behavior | 3 |
| 4. | CA7C_ | Programme Elective IV | 3 |
| 5. | CA7D_ | Programme Elective V | 3 |
| 6. | CA70A | Cyber Security Laboratory | 2 |
| 7. | CA70B | Mobile Applications Development Laboratory | 2 |
| 8. | CA749 | Project Work (Phase I) | 2 |
| | | **Total** | **21** |

**SEMESTER VI**

| Code | Course of Study | Credit |
|---|---|---|
| CA750 | Project work (Phase II) | 12 |

**SUMMER TERM (Evaluation in the III Semester)**

| Code | Course of Study | Credit |
|---|---|---|
| CA748 | Internship / Industrial Training / Academic Attachment (I/A) (6 weeks to 8 weeks) | 2 |

**OPEN ELECTIVES (OE) (To be completed between I to IV Semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | Open Elective I | 3 |

## PROGRAMME ELECTIVES (PE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| **ELECTIVE I & II** | | | |
| 1. | CA7A1 | Data Science | 3 |
| 2. | CA7A2 | Big Data Management | 3 |
| 3. | CA7A3 | Advanced Database Technology | 3 |
| 4. | CA7A4 | Data Mining and Warehousing | 3 |
| 5. | CA7A5 | Marketing Management | 3 |
| 6. | CA7A6 | Business Ethics | 3 |
| 7. | CA7A7 | Business Intelligence | 3 |
| **ELECTIVE III** | | | |
| 8. | CA7B1 | Software Architecture and Project Management | 3 |
| 9. | CA7B2 | Service Oriented Architecture | 3 |
| 10. | CA7B3 | Agile Technology | 3 |
| 11. | CA7B4 | Modelling and Computer Simulation | 3 |
| 12. | CA7B5 | Block Chain Technology | 3 |
| 13. | CA7B6 | Internet of Things | 3 |
| **ELECTIVE IV** | | | |
| 14. | CA7C1 | Bioinformatics | 3 |
| 15. | CA7C2 | Evolutionary Computing | 3 |
| 16. | CA7C3 | Image Processing | 3 |
| 17. | CA7C4 | Natural Language Processing | 3 |
| 18. | CA7C5 | DevOps | 3 |
| 19. | CA7C6 | MEAN Stack Development | 3 |
| **ELECTIVE V** | | | |
| 20. | CA7D1 | Resource Management Techniques | 3 |
| 21. | CA7D2 | Green Computing | 3 |
| 22. | CA7D3 | Mobile Computing | 3 |
| 23. | CA7D4 | Human Computer Interaction | 3 |
| 24. | CA7D5 | Multi-core Programming | 3 |
| 25. | CA7D6 | Social Network Analysis | 3 |
| 26. | CA7D7 | Computer Vision | 3 |

## OPEN ELECTIVES (OE)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | CA7B5 | Block Chain Technology | 3 |

## MASTER OF BUSINESS ADMINISTRATION

The total minimum credits required for completing the MBA Programme is 80.

### TRIMESTER I

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MB711 | Organizational Structure and Design | 2 |
| 2. | MB712 | Legal Aspects of Business | 2 |
| 3. | MB713 | Business Statistics | 2 |
| 4. | MB714 | Financial Reporting and Analysis | 2 |
| 5. | MB715 | Marketing Management - Concepts and Design | 2 |
| 6. | MB716 | Business Communication | 2 |
| 7. | MB717 | Microeconomics | 2 |
| 8. | MB718 | Indian Ethos and Business Ethics | 1 |
| | | **Total** | **15** |

### TRIMESTER II

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MB721 | Managing People in Organization | 2 |
| 2. | MB722 | Information Management | 2 |
| 3. | MB723 | Operations Research | 2 |
| 4. | MB724 | Cost and Management Accounting | 2 |
| 5. | MB725 | Marketing Management - Planning and Control | 2 |
| 6. | MB726 | Macro Economics | 2 |
| 7. | MB727 | Business Intelligence Tools | 1 |
| 8. | MB728 | Design Thinking | 1 |
| | | **Total** | **14** |

### TRIMESTER III

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MB731 | Human Resource Management | 2 |
| 2. | MB732 | Corporate Information Strategy and Management | 2 |
| 3. | MB733 | Production and Operations Management | 2 |
| 4. | MB734 | Financial Management | 2 |
| 5. | MB735 | Business Research Methods | 2 |
| 6. | | Programme Elective - 1 | 2 |
| 7. | | Programme Elective - 2 | 2 |
| | | **Total** | **14** |

**TRIMESTER IV**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MB741 | Strategic Management | 2 |
| 2. | MB742 | Summer Project* | 3 |
| 3. | | Programme Elective - 3 | 2 |
| 4. | | Programme Elective - 4 | 2 |
| 5. | | Programme Elective - 5 | 2 |
| 6. | | Programme Elective - 6 | 2 |
| 7. | | Programme Elective - 7 | 2 |
| | | **Total** | **15** |

* Students take up summer projects at the end of First year during the vacation for 8 Weeks

**TRIMESTER V**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MB751 | Project Management | 2 |
| 2. | MB752 | Strategic Total Quality Management | 2 |
| 3. | | Programme Elective - 8 | 2 |
| 4. | | Programme Elective - 9 | 2 |
| 5. | | Programme Elective - 10 | 2 |
| 6. | | Programme Elective - 11 | 2 |
| | | **Total** | **12** |

**TRIMESTER VI**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | MB761 | Entrepreneurship Development | 2 |
| 2. | | Programme Elective - 12 | 2 |
| 3. | | Programme Elective - 13 | 2 |
| 4. | | Programme Elective - 14 | 2 |
| 5. | | Programme Elective - 15 | 2 |
| | | **Total** | **10** |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| | | **Human Resource Management** | |
| 1. | MB811 | Talent Management | 2 |
| 2. | MB812 | Training and Development | 2 |
| 3. | MB813 | Interpersonal Effectiveness | 2 |

| | | | |
|---|---|---|---|
| 4. | MB814 | Compensation and Benefits | 2 |
| 5. | MB815 | Counselling in the Workplace | 2 |
| 6. | MB816 | Change Management | 2 |
| 7. | MB817 | Strategic Human Resource Development | 2 |
| 8. | MB818 | Negotiation and Conflict Management | 2 |
| 9. | MB819 | Industrial Psychology | 2 |
| 10. | MB820 | HR Analytics | 2 |
| 11. | MB821 | Industrial Relations and Labor Laws | 2 |
| 12. | MB822 | International Human Resource Management | 2 |
| 13. | MB823 | Knowledge Management and Innovation | 2 |
| 14. | MB824 | Managing HR in the Digital Age | 2 |
| **Marketing Management** | | | |
| 1. | MB831 | Strategic Brand Management | 2 |
| 2. | MB832 | Retail Management | 2 |
| 3. | MB833 | Consumer Behaviour | 2 |
| 4. | MB834 | Services Marketing | 2 |
| 5. | MB835 | Customer Relationship Management | 2 |
| 6. | MB836 | Marketing Research | 2 |
| 7. | MB837 | Advertising Management | 2 |
| 8. | MB838 | Sales Management | 2 |
| 9. | MB839 | Strategic Marketing | 2 |
| 10. | MB840 | Marketing Metrics | 2 |
| 11. | MB841 | Analytics for Strategic Market Planning | 2 |
| 12. | MB842 | Analytics for Strategic Market Implementation | 2 |
| 13. | MB843 | Business Market Management | 2 |
| 14. | MB844 | International Marketing | 2 |
| 15. | MB845 | Digital Marketing | 2 |
| 16. | MB846 | Neuro Marketing | 2 |
| **Financial Management** | | | |
| 1. | MB851 | Financial Institution and Services | 2 |
| 2. | MB852 | Investment Security Analysis and Portfolio Management | 2 |
| 3. | MB853 | Financial Derivatives | 2 |

| | | | |
|---|---|---|---|
| 4. | MB854 | Investment Banking | 2 |
| 5. | MB855 | Asset Based Financing | 2 |
| 6. | MB856 | Behavioral Finance | 2 |
| 7. | MB857 | Personal Finance | 2 |
| 8. | MB858 | Advanced Corporate Finance | 2 |
| 9. | MB859 | Insurance and Pension Schemes | 2 |
| 10. | MB860 | Strategic cost Accounting and Management control | 2 |
| 11. | MB861 | Tax Laws and Tax Planning | 2 |
| 12. | MB862 | Treasury Management | 2 |
| 13. | MB863 | International Finance | 2 |
| 14. | MB864 | Corporate Valuation | 2 |
| 15. | MB865 | Financial Risk Analytics | 2 |
| 16. | MB866 | Introduction to FinTech | 2 |
| **Operations Management** | | | |
| 1. | MB871 | Production Planning and Control | 2 |
| 2. | MB872 | Logistics Management | 2 |
| 3. | MB873 | Supply Chain Management | 2 |
| 4. | MB874 | Services Operation Management | 2 |
| 5. | MB875 | Advanced Materials Management | 2 |
| 6. | MB876 | Advanced Operation Research | 2 |
| 7. | MB877 | Technology Forecasting | 2 |
| 8. | MB878 | Manufacturing Strategy | 2 |
| 9. | MB879 | Supply Chain Analytics | 2 |
| 10. | MB880 | Lean Manufacturing | 2 |
| 11. | MB881 | Game Theory and Applications | 2 |
| **Business Analysis and IT Consulting** | | | |
| 1. | MB891 | Introduction to Business Analysis and IT Consulting | 2 |
| 2. | MB892 | Business Analysis and ITC in Marketing and Retail | 2 |
| 3. | MB893 | Business Analysis and ITC in Banking and Financial Services | 2 |
| 4. | MB894 | Business Analysis and ITC in Manufacturing | 2 |
| 5. | MB895 | Systems Analysis and Design | 2 |

| | | | |
|---|---|---|---|
| 6. | MB896 | Software Project Management | 2 |
| 7. | MB897 | Software Quality Management | 2 |
| **Business Analytics** | | | |
| 1. | MB911 | Introduction to Business Analytics | 2 |
| 2. | MB912 | Basic Data Analytics | 2 |
| 3. | MB913 | Big Data Analytics and Data Science | 2 |
| 4. | MB914 | Advanced Data Analytics | 2 |
| 5. | MB915 | Machine Learning Techniques | 2 |
| 6. | MB916 | Advanced Machine Learning Techniques | 2 |
| 7. | MB917 | Data Mining Techniques | 2 |
| 8. | MB918 | Google Analytics | 2 |
| 9. | MB919 | Text Analytics | 2 |
| 10. | MB920 | Digital Analytics | 2 |
| 11. | MB921 | Data Analytics Software Laboratory | 2 |
| **General Management** | | | |
| 1. | MB931 | Innovation and R&D Management | 2 |
| 2. | MB932 | Technology Management | 2 |
| 3. | MB933 | Course of Independent Study | 2 |
| 4. | MB934 | Intellectual Property Rights Management | 2 |
| 5. | MB935 | Information and Internet Economics | 2 |
| 6. | MB936 | International Business and Strategy | 2 |

## MA (ENGLISH)

The total minimum credits required for completing the MA Programme in English is 80.

## CURRICULUM

### SEMESTER I

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | HS603 | Language and Linguistics | 3 |
| 2. | HS605 | Indian Writing in English | 3 |
| 3. | HS607 | Renaissance to Neoclassical Literature | 3 |
| 4. | HS609 | Romantic and Victorian Literature | 4 |
| 5. | HS617 | English Language Teaching | 4 |
| 6. | | Programme Elective I | 3 |
| | | **Total** | **20** |

### SEMESTER II

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | HS602 | Modern Literature | 3 |
| 2. | HS606 | Postmodern Literature | 3 |
| 3. | HS608 | Language through Literature | 3 |
| 4. | HS610 | Reading, Writing and Cognition | 3 |
| 5. | HS614 | English for Specific Purposes | 4 |
| 6. | | Programme Elective II | 3 |
| | | **Total** | **19** |

### SUMMER TERM (Evaluation in the III Semester)

| Code | Course of Study | Credit |
|---|---|---|
| HS650 | Internship / Industrial Training / Academic Attachment (I/A) / Seminar (6 weeks to 8weeks) | 2 |

### SEMESTER III

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | HS613 | Second Language Acquisition | 3 |
| 2. | HS615 | Biolinguistics | 3 |
| 3. | HS619 | Translation Studies | 3 |

| | | | |
|---|---|---|---|
| 4. | HS621 | Introduction to Cultural Studies | 3 |
| 5. | HS623 | American Literature | 3 |
| 6. | | Programme Elective III | 3 |
| | | **Total** | **18** |

**SEMESTER IV**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | HS604 | Research Methodology | 3 |
| 2. | HS612 | Literary Theory and Aesthetics: East and West | 3 |
| 3. | HS647 | Project Work | 12 |
| | | **Total** | **18** |

**OPEN ELECTIVES (OE) / ONLINE COURSE (OC) (To be completed between I to IV semester)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | NPTEL | 3 |

**PROGRAMME ELECTIVES (PE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | HS611 | Technical Communication | 3 |
| 2. | HS616 | Language Learning and Teaching | 3 |
| 3. | HS618 | Comics and Graphic Storytelling | 3 |
| 4. | HS620 | Health Humanities | 3 |
| 5. | HS622 | Film Studies | 3 |
| 6. | HS624 | Introduction to Cognitive Sciences | 3 |
| 7. | HS625 | Elements of Literature | 3 |
| 8. | HS626 | Communicative Language Teaching | 3 |
| 9. | HS627 | Critical Discourse Analysis | 3 |
| 10. | HS628 | Journalism and Media Studies | 3 |
| 11. | HS631 | The Neuroscience of Reading | 3 |
| 12. | HS632 | Language and the Human Brain | 3 |
| 13. | HS633 | Learning, Memory and Cognition | 3 |
| 14. | HS634 | Assessment and Teaching of 21$^{st}$ Century Skills Education | 3 |

| | | | |
|---|---|---|---|
| 15. | HS635 | Applied Linguistics and Language Pedagogy | 3 |
| 16. | HS636 | Research Methodology in Applied Linguistics | 3 |
| 17. | HS637 | Introduction to Theories for the Humanities | 3 |
| 18. | HS638 | Texts and Contexts in Gender Studies | 3 |
| 19. | HS639 | Visual Cultural Studies Using Film and Media | 3 |
| 20. | HS640 | Introduction to Graphic Medicine | 3 |
| 21. | HS641 | Cultural Politics, Ideologies, and Representation | 3 |
| 22. | HS642 | Artificial Intelligence in English Language Education | 3 |
| 23. | HS643 | Teaching English to Young Learners | 3 |

**OPEN ELECTIVES (OE)**

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | HS611 | Technical Communication | 3 |

**MICROCREDITS (MC)** (Students can opt 3 courses of 1credit (4weeks) each as microcredits instead of 1 OE/OC)

| Sl. No. | Code | Course of Study | Credit |
|---|---|---|---|
| 1. | | | |