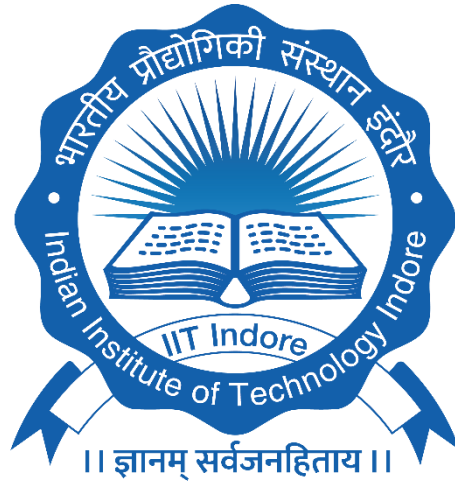


# Indian Institute of Technology Indore



## Course details of the Elective Program (Undergraduate program)

# Astronomy, Astrophysics and Space Engineering

| Course Code | Course Name                                    | Weekly Contact Hours<br>L-T-P | Credit |
|-------------|------------------------------------------------|-------------------------------|--------|
| AA 201      | Introduction to Astronomy                      | 2-1-0                         | 3      |
| AA 203      | Introduction to Atmospheric and Earth Sciences | 2-1-0                         | 3      |
| AA 204      | Introduction to Space Exploration              | 2-1-0                         | 3      |
| AA 202N     | Astronomical Techniques                        | 2-1-0                         | 3      |
| AA 214      | Stellar and Planetary Science                  | 2-1-0                         | 3      |
| AA 216      | Flight mechanics and classical control         | 2-1-0                         | 3      |
| AA 317      | Galaxies and Cosmology                         | 2-1-0                         | 3      |
| AA 303      | IoT for Space Applications                     | 2-1-0                         | 3      |
| AA 319      | Launch Vehicle and Propulsion Systems          | 2-1-0                         | 3      |
| AA 310      | Satellite Imaging                              | 2-0-2                         | 3      |
| AA 318      | Meteorology and Climate Modelling              | 2-0-2                         | 3      |
| AA 320      | Detectors for Space - II                       | 2-0-2                         | 3      |
| AA 322      | Computational Electromagnetics                 | 2-1-0                         | 3      |
| AA 301      | High Energy Astrophysics and Transient Sky     | 2-1-0                         | 3      |
| AA 301N     | High Energy Astrophysics and Transient Sky     | 2-1-0                         | 3      |
| AA 324      | Space Informatics                              | 2-0-2                         | 3      |
| AA 374      | Computational Fluids and Structures            | 2-1-0                         | 3      |
| AA 476/676  | Satellite Based Navigation Systems             | 2-0-2                         | 3      |

|               |                                                       |       |   |
|---------------|-------------------------------------------------------|-------|---|
| AA 414/614    | Cosmology                                             | 2-1-0 | 3 |
| AA 412/612    | Microwave Remote Sensing                              | 2-1-0 | 3 |
| AA 408N/608N  | Astrostatistics                                       | 2-1-0 | 3 |
| AA 474N/674N  | Radio Astronomy                                       | 2-1-0 | 3 |
| AA 472N/672N  | Galactic and Extragalactic Astronomy                  | 2-1-0 | 3 |
| AA404/604     | Spacecraft Attitude Control and Dynamics              | 2-0-2 | 3 |
| AA 413/613    | Electrodynamics and Radiative Processes               | 2-1-0 | 3 |
| AA 415/615    | Quantum Mechanics and Spectroscopy                    | 2-1-0 | 3 |
| AA 417/617    | Electronic Devices and Control                        | 2-1-0 | 3 |
| AA 401/601    | Astrophysical Fluids and Plasma                       | 2-1-0 | 3 |
| AA 407/AA 607 | Remote sensing for Atmospheric and Space Sciences     | 2-0-2 | 3 |
| AA 403/AA 603 | Space Engineering Systems                             | 2-0-2 | 3 |
| AA 405/AA 605 | Detectors and Sensors for Space Observations          | 2-0-2 | 3 |
| AA 406/606    | Random Signals and Applied Kalman Filtering           | 2-1-0 | 3 |
| AA 411/AA 611 | Advanced Optics                                       | 2-0-2 | 3 |
| AA 409/609    | Computational Methods in Astronomy and Space Sciences | 2-0-2 | 3 |

# Chemical engineering

| Course Code | Course Name                                | Weekly Contact Hours<br>L-T-P | Credit |
|-------------|--------------------------------------------|-------------------------------|--------|
| ChE 208     | Process Data Analytics & Monitoring        | 2-1-0                         | 3      |
| ChE 209     | Introduction to Soft Matter and Polymers   | 2-1-0                         | 3      |
| ChE 211     | Waste to Energy Conversion                 | 2-1-0                         | 3      |
| ChE 309     | Energy System and Sustainability           | 2-1-0                         | 3      |
| ChE 310     | Petroleum Refining                         | 2-1-0                         | 3      |
| ChE 311     | Heat Transfer Operations                   | 2-1-0                         | 3      |
| ChE 312     | Microhydrodynamics                         | 2-1-0                         | 3      |
| ChE 314     | Colloids and Interfaces                    | 2-1-0                         | 3      |
| ChE 316     | Industrial Catalyst Design and Development | 2-1-0                         | 3      |
| ChE 402/602 | Process Optimization                       | 2-1-0                         | 3      |
| ChE 404/604 | Advanced Soft Matter                       | 2-1-0                         | 3      |
| ChE 406/606 | Heterogeneous Catalysis and Reactor Design | 2-1-0                         | 3      |
| ChE 408/608 | Computational Synthetic Systems Biology    | 2-1-0                         | 3      |

# Chemistry

| Course Code | Course Name                                    | Weekly Contact Hours<br>L-T-P | Credit |
|-------------|------------------------------------------------|-------------------------------|--------|
| CH 2XX      | Principles of Optoelectronics                  | 2-1-0 (1/2 Semester)          | 1.5    |
| CH 2XX      | Environmental Chemistry                        | 2-1-0 (1/2 Semester)          | 1.5    |
| CH 2XX      | Chemistry of Inner Transition Metals           | 2-1-0 (1/2 Semester)          | 1.5    |
| CH 2XX      | Colloidal Chemistry                            | 2-1-0 (1/2 Semester)          | 1.5    |
| CH 2XX      | Molecular Self-Assembly                        | 2-1-0 (1/2 Semester)          | 1.5    |
| CH 2XX      | Computer Programming for Chemical Applications | 2-1-0 (1/2 Semester)          | 1.5    |
| CH 3XX      | Magnetochemistry                               | 2-1-0                         | 3      |
| CH 3XX      | Sustainable Chemical Process                   | 2-1-0                         | 3      |
| CH 3XX      | Molecular Material                             | 2-1-0                         | 3      |
| CH 3XX      | Electrochemical Systems                        | 2-1-0                         | 3      |
| CH 3XX      | Quantum Chemistry: Atoms and Molecules         | 2-1-0                         | 3      |
| CH 3XX      | Pharmaceutical Chemistry                       | 2-1-0                         | 3      |
| CH 3XX      | Chemistry of Semiconducting Materials          | 2-1-0                         | 3      |
| CH 4XX      | Materials for Energy Applications              | 2-1-0                         | 3      |
| CH 4XX      | Chemistry in Healthcare                        | 2-1-0                         | 3      |

|        |                              |       |   |
|--------|------------------------------|-------|---|
| CH 4XX | Molecular Modelling          | 2-1-0 | 3 |
| CH 4XX | Electronic Structure Methods | 2-1-0 | 3 |
| CH 4XX | Sensors                      | 2-1-0 | 3 |
| CH 4XX | Oil, Gas and Petrochemicals  | 2-1-0 | 3 |

# Civil Engineering

| Course Code     | Course Name                                              | Weekly Contact Hours<br>L-T-P | Credit |
|-----------------|----------------------------------------------------------|-------------------------------|--------|
| CE 211          | Smart Cities                                             | 2-1-0                         | 3      |
| CE 213          | Optimization Methods in Civil Engineering                | 2-1-0                         | 3      |
| CE 220          | Water Resources Planning and Management                  | 2-1-0                         | 3      |
| CE 222          | Estimation and Costing                                   | 2-1-0                         | 3      |
| CE 316          | Statistical Hydroclimatology                             | 2-1-0                         | 3      |
| CE 317          | Water and Wastewater Engineering                         | 2-1-0                         | 3      |
| CE 318          | Computational Hydraulics                                 | 2-1-0                         | 3      |
| CE 319          | Open Channel Hydraulics                                  | 2-0-2                         | 3      |
| CE 322          | Railway Engineering                                      | 2-1-0                         | 3      |
| CE 324          | Sustainable Geotechnics                                  | 2-1-0                         | 1.5    |
| CE 326          | Intelligent Transportation Systems                       | 3-0-0                         | 3      |
| CE 401 / CE 601 | Mechanics of Advanced Composite Materials and Structures | 2-1-0                         | 3      |
| CE 410 / CE 610 | Offshore Engineering                                     | 2-1-0                         | 3      |
| CE 412 / CE 612 | Sustainable Construction                                 | 2-1-0                         | 3      |
| CE 414 / CE 614 | Design of Short and Medium Span Bridges                  | 2-1-0                         | 3      |
| CE 418 / CE 618 | Disaster Management                                      | 2-1-0                         | 3      |
| CE 422          | Hydraulic Structures                                     | 2-1-0                         | 3      |

|                 |                                                            |       |     |
|-----------------|------------------------------------------------------------|-------|-----|
| CE 424          | Ground Water Hydrology                                     | 2-1-0 | 3   |
| CE 426          | Water Resources Systems                                    | 2-1-0 | 3   |
| CE 428 / CE 628 | Theory of Plates and Shells                                | 2-1-0 | 3   |
| CE 430 / CE 630 | Elastic Stability                                          | 2-1-0 | 3   |
| CE 432 / CE 632 | Plastic Analysis and Design                                | 2-1-0 | 3   |
| CE 434 / CE 634 | Numerical Methods in Civil Engineering                     | 2-1-0 | 3   |
| CE 436 / CE 636 | Finite Element Analysis                                    | 2-1-0 | 3   |
| CE 438 / CE 638 | Probabilistic and Statistical Methods in Civil Engineering | 2-1-0 | 3   |
| CE 442          | Machine Foundations                                        | 2-1-0 | 3   |
| CE 444 / CE 644 | Solid Waste Engineering and Management                     | 2-0-2 | 3   |
| CE 448          | Pre-stressed Concrete                                      | 2-1-0 | 3   |
| CE 450 / CE 650 | Design of Long-span Bridges                                | 2-1-0 | 1.5 |
| CE 452 / CE 652 | Project Management                                         | 2-1-0 | 1.5 |
| CE 454 / CE 654 | Precast and Prefabricated Construction                     | 2-1-0 | 1.5 |
| CE 456 / CE 656 | Elastic Stability                                          | 2-1-0 | 1.5 |
| CE 458 / CE 658 | Time-series Analysis                                       | 2-1-0 | 3   |
| CE 460 / CE 660 | AI/ML Applications in Civil Engineering                    | 2-1-0 | 3   |
| CE 462 / CE 662 | Structural Dynamics                                        | 2-1-0 | 3   |
| CE 464 / CE 664 | Advanced Solid Mechanics                                   | 2-1-0 | 3   |
| CE 468 / CE 668 | Bayesian Inference and Reliability                         | 2-1-0 | 3   |
| CE 470          | Transportation Planning                                    | 2-1-0 | 3   |



|                 |                                                   |       |   |
|-----------------|---------------------------------------------------|-------|---|
| CE 472          | Advanced Traffic Engineering                      | 2-1-0 | 3 |
| CE 474 / CE 674 | Road Safety                                       | 2-1-0 | 3 |
| CE 476          | Geo-Informatics in Transportation Engineering     | 2-1-0 | 3 |
| CE 478          | Advanced Pavement Material and Design             | 2-1-0 | 3 |
| CE 480          | Computer Aided Design of Civil Engineering System | 2-1-0 | 3 |
| CE 482          | Construction Management                           | 2-1-0 | 3 |
| CE 484 / CE 684 | Advanced Concrete Technology                      | 2-0-2 | 3 |
| CE 486          | Rock Mechanics and Tunneling Technology           | 2-1-0 | 3 |
| CE 488          | Environmental Geotechnics                         | 2-1-0 | 3 |
| CE 490          | Elements of Remote Sensing                        | 2-1-0 | 3 |
| CE 494 / CE 694 | Earthquake Engineering                            | 2-1-0 | 3 |
| CE 496 / CE 696 | Safety of Dams and Reservoirs                     | 2-1-0 | 3 |
| CE 4XX / CE XX  | Pre-stressed Concrete Design                      | 2-1-0 | 3 |

# Computer Science and Engineering

| Course Code    | Course Name                                             | Weekly Contact Hours<br>L-T-P | Credit |
|----------------|---------------------------------------------------------|-------------------------------|--------|
| CS 211         | UX/UI Design                                            | 2-0-2                         | 3      |
| CS 213/MA 225  | Matrix Factorization and Applications                   | 2-1-0                         | 3      |
| CS 215/MA 227  | Mathematics for AI and ML                               | 2-1-0                         | 3      |
| CS 212/MA 228  | Foundation of Algebraic Graph Theory                    | 2-1-0                         | 3      |
| CS 214         | Foundations of Hardware Security                        | 2-1-0                         | 3      |
| CS 216         | Introduction to Blockchain                              | 2-1-0 (½ Semester)            | 3      |
| CS 217/MA 217  | Linear Programming                                      | 2-1-0                         | 3      |
| CS 219/MA 219  | Introduction to Dynamical Systems                       | 2-0-2                         | 3      |
| CS 218         | Programmable and Interoperable Blockchains              | 2-1-0 (½ Semester)            | 3      |
| CS 220/MA 210  | Elementary Number Theory and Algebra                    | 2-1-0                         | 3      |
| CS 236/336/436 | Introduction to Data Science                            | 2-0-2 (1.5, ½ Semester)       | 1.5    |
| CS 315/MA 321  | Introduction to Complexity Theory                       | 2-1-0                         | 3      |
| CS 316/MA 316  | Spectral Graph Theory                                   | 2-1-0                         | 3      |
| CS 317         | Introduction to Internet of Things                      | 2-1-0                         | 3      |
| CS 319/MA 219  | Foundations of Cryptography                             | 2-1-0                         | 3      |
| CS 320/MA 310  | Algorithmic Techniques and Applications of Data Science | 2-1-0                         | 3      |

|               |                                                |          |   |
|---------------|------------------------------------------------|----------|---|
| CS 321        | Introduction to Big Data Analysis              | 2-1-0    | 3 |
| CS 323/MA 311 | Statistical Distribution Theory                | 2-1-0    | 3 |
| CS 325/MA 315 | Mathematical Foundations for Cryptography      | 2-1-0    | 3 |
| CS 312        | Foundations of Secure Computation              | 2-1-0    | 3 |
| CS 314        | Computer and Network Security                  | 2-1-0    | 3 |
| CS 327/MA 327 | Mathematical Methods in Risk Theory            | 2-1-0    | 3 |
| CS 329/MA 329 | Algebraic Coding Theory                        | 2-1-0    | 3 |
| CS 401/CS 601 | Soft Computing                                 | 2-0-2    | 3 |
| CS 403/CS 603 | Machine Learning                               | 2-0-2    | 3 |
| CS 404/EE 304 | Digital Signal Processing                      | 3/1/2000 | 4 |
| CS 406/CS 606 | Data Mining and Data Warehousing               | 2-0-2    | 3 |
| CS 407        | Peripherals and Interfaces                     | 2-0-2    | 3 |
| CS 408        | Algorithms for Convex Programming              | 2-0-2    | 3 |
| CS 409/CS 609 | Advanced Topics in Database Management Systems | 2-1-0    | 3 |
| CS 410        | Genetic Algorithms                             | 2-0-2    | 3 |
| CS 411/CS 611 | Advanced Algorithms                            | 2-0-2    | 3 |
| CS 412/CS 612 | Pattern Recognition                            | 2-0-2    | 3 |
| CS 413        | Topics in Artificial Intelligence Programming  | 2-1-0    | 3 |
| CS 414/CS 614 | Cloud Computing and Applications               | 2-1-0    | 3 |
| CS 416/CS 616 | Service Oriented Systems                       | 2-1-0    | 3 |

|                          |                                         |       |   |
|--------------------------|-----------------------------------------|-------|---|
| CS 417/CS 617            | Cryptography and Network Security       | 2-0-2 | 3 |
| CS 418/CS 618            | Systems and Usable Security             | 2-1-0 | 3 |
| CS 419/ICS<br>419/CS 619 | Computer Vision                         | 2-1-0 | 3 |
| CS 420/CS 620            | Embedded Systems                        | 2-1-0 | 3 |
| CS 422/CS 622            | Numerical Simulation                    | 2-1-0 | 3 |
| CS 424                   | Functional and Logic Programming        | 2-0-2 | 3 |
| CS 425/CS 625            | Natural Language Processing             | 2-0-2 | 3 |
| CS 426/CS 626            | Foundations of Cyber-Physical Systems   | 2-0-2 | 3 |
| CS 427/CS 627            | Advanced Computer Networks              | 2-1-0 | 3 |
| CS 428/CS 628            | Algorithmic Graph Theory                | 2-1-0 | 3 |
| CS 430/CS 630            | Data Center Networking                  | 2-1-0 | 3 |
| CS 432/CS 632            | Reinforcement Learning                  | 2-0-2 | 3 |
| CS 334/CS<br>434/CS 634  | Wireless Networks and Applications      | 2-1-0 | 3 |
| CS 435/CS 635            | Deep Learning                           | 2-0-2 | 3 |
| CS 438/CS 638            | Network Softwarization and Management   | 2-0-2 | 3 |
| CS 440/640               | Distributed Network Algorithms          | 2-1-0 | 3 |
| CS 442/642               | Algebraic Graph Theory                  | 2-0-2 | 3 |
| CS 444                   | Advanced Blockchain                     | 2-1-0 | 3 |
| CS 446                   | Blockchain for Responsible Computing    | 2-1-0 | 3 |
| CS 448/648               | Software Verification and Certification | 2-1-0 | 3 |
| CS 450/CS 650            | Generative AI                           | 2-1-0 | 3 |

|               |                                              |       |   |
|---------------|----------------------------------------------|-------|---|
| CS 454/CS 654 | Distributed Algorithms for Robots and Agents | 2-1-0 | 3 |
| CS 456/CS 656 | Software-defined IoT                         | 2-0-2 | 3 |
| CS 470/CS 670 | Explainable Artificial Intelligence          | 2-0-2 | 3 |

# Electrical Engineering

| Course Code   | Course Name                                                       | Weekly Contact Hours<br>L-T-P | Credit |
|---------------|-------------------------------------------------------------------|-------------------------------|--------|
| E 211         | Applied Probability for Communication Engineering                 | 2-1-0                         | 3      |
| EE 213        | Fundamentals of Optimization                                      | 2-1-0                         | 3      |
| EE 214        | Electronic Instrumentation                                        | 2-1-0                         | 3      |
| EE 216        | Machine Learning for Signal Processing                            | 2-1-0                         | 3      |
| EE 218        | Synchronous and Special Electrical Machines                       | 2-1-0                         | 3      |
| EE 319        | Design and Analysis of Communication Networks                     | 2-1-0                         | 3      |
| EE 321        | Design of Photovoltaic Systems                                    | 2-1-0                         | 3      |
| EE 312        | Microwave and Satellite Communication                             | 2-1-0                         | 3      |
| EE 314        | Restructured Power Systems                                        | 2-1-0                         | 3      |
| EE 316        | RF Devices for Guided and Wireless Transmission                   | 2-1-0                         | 3      |
| EE 318        | Statistical and Experimental Design Methods for Signal Processing | 2-1-0                         | 3      |
| EE 401/EE 601 | Power Electronics                                                 | 2-1-0                         | 3      |
| EE 409/EE 609 | Power System Modelling                                            | 2-1-0                         | 1.5    |
| EE 410/EE 610 | Power Electronics Applications to Power Transmission              | 2-1-0                         | 3      |
| EE 411        | Communication System Theory                                       | 2-1-0                         | 3      |

|                       |                                             |       |   |
|-----------------------|---------------------------------------------|-------|---|
| EE 412/EE 612         | Digital Communication Systems               | 2-1-0 | 3 |
| EE 413                | Discrete Data and Digital Control           | 2-1-0 | 3 |
| EE 414                | Special Semiconductor Devices               | 2-1-0 | 3 |
| EE 415                | Electronic Instrumentation                  | 2-1-0 | 3 |
| EE 416                | Industrial Instrumentation                  | 2-1-0 | 3 |
| EE 417                | Analog Filters                              | 2-1-0 | 3 |
| EE 418                | Control System Design                       | 2-1-0 | 3 |
| EE 419/EE 619         | Biomedical Optics                           | 2-1-0 | 3 |
| EE 420/EE 620         | IC Fabrication Technology                   | 2-1-0 | 3 |
| EE 421/EE 621         | MOS Devices and Modeling                    | 2-1-0 | 3 |
| EE 422/EE 622         | Digital Circuit Design                      | 2-1-0 | 3 |
| EE 424/EE 724         | Advanced Micro-processes and Nanotechnology | 2-1-0 | 3 |
| EE 426/EE 626         | MOSFET Reliability Issues                   | 2-1-0 | 3 |
| EE 427                | Physics of Semiconductor Devices            | 2-1-0 | 3 |
| EE 428/EE 628         | Advanced Memory Technology                  | 2-1-0 | 3 |
| EE 429/EE 629         | Nanotechnology and Nanoelectronics          | 2-1-0 | 3 |
| EE 430/EE 630         | Analog CMOS IC Design                       | 2-1-0 | 3 |
| EE 431/IEE 431/EE 631 | Organic Electronics                         | 2-1-0 | 3 |
| EE 432/EE 632         | Optoelectronics                             | 2-1-0 | 3 |
| EE 434/EE 634         | Semiconductor Based Devices                 | 2-1-0 | 3 |
| EE 435/EE 635         | VLSI Technology                             | 2-1-0 | 3 |

|                 |                                                  |       |     |
|-----------------|--------------------------------------------------|-------|-----|
| EE 436          | Microwave and Satellite Communication            | 2-1-0 | 3   |
| EE 438          | Computer Control and Automation of Power Systems | 2-1-0 | 3   |
| EE 440/EE 640   | Analog and Mixed Signal IC Design                | 2-1-0 | 3   |
| EE 441/EE 641   | Advanced Signal Processing                       | 2-1-0 | 3   |
| EE 446/EE 646   | Information and Coding Theory                    | 2-1-0 | 3   |
| EE 447/EE 647   | Advanced Photonics                               | 2-1-0 | 3   |
| EE 448/EE 648   | Antennas and Propagation                         | 2-1-0 | 3   |
| EE 449/EE 649   | Power System Stability                           | 2-1-0 | 1.5 |
| EE 450/EE 650   | Internet of Things (IoT) Networks                | 2-1-0 | 3   |
| EE 450N/EE 650N | IoT Communication Networks                       | 2-1-0 | 3   |
| EE 455/EE 655   | Optical Wireless Communications                  | 2-1-0 | 3   |
| EE 456/EE 656   | Deregulated Power Systems                        | 2-1-0 | 1.5 |
| EE 463/EE 663   | Design of Electric Motors                        | 2-1-0 | 1.5 |
| EE 459/EE 659   | Linear Systems Theory                            | 2-1-0 | 1.5 |
| EE 460/EE 660   | Microgrids and Distributed Generation            | 2-1-0 | 1.5 |
| EE 464/EE 664   | Optimal and Adaptive Control                     | 2-1-0 | 1.5 |
| EE 466/EE 666   | Electromagnetic Interference and Compatibility   | 2-1-0 | 1.5 |
| EE 468/EE 668   | Game Theory and Mechanism Design                 | 2-1-0 | 3   |
| EE 470/EE 670   | Brain Signal Processing                          | 2-1-0 | 3   |
| EE 472/EE 672   | Human-Centric Multimedia Quality Analysis        | 2-1-0 | 3   |



|               |                                                   |       |     |
|---------------|---------------------------------------------------|-------|-----|
| EE 467/EE 667 | Cyber Resiliency in Smart Grid                    | 2-1-0 | 1.5 |
| EE 483/EE 683 | Error Correcting Codes                            | 2-1-0 | 3   |
| EE 484/EE 684 | Power System Protection                           | 2-1-0 | 3   |
| E 211         | Applied Probability for Communication Engineering | 2-1-0 | 3   |

# Mathematics

| Course Code     | Course Name                                             | Weekly Contact Hours<br>L-T-P | Credit |
|-----------------|---------------------------------------------------------|-------------------------------|--------|
| MA 217 / CS 217 | Linear Programming                                      | 2-1-0                         | 3      |
| MA 219 / CS 219 | Introduction to Dynamical Systems                       | 2-0-2                         | 3      |
| MA 223          | Database Management System                              | 2-0-2                         | 3      |
| MA 225 / CS 213 | Matrix Factorization and Applications                   | 2-1-0                         | 3      |
| MA 227 / CS 215 | Mathematics for AI and ML                               | 2-1-0                         | 3      |
| MA 228 / CS 212 | Foundation of Algebraic Graph Theory                    | 2-1-0                         | 3      |
| MA 210 / CS 220 | Elementary Number Theory and Algebra                    | 2-1-0                         | 3      |
| MA 212          | Regression Analysis                                     | 2-1-0                         | 3      |
| MA 317          | Stochastic Calculus for Finance                         | 2-1-0                         | 3      |
| MA 309          | Numerical Methods for Partial Differential Equations    | 2-0-2                         | 3      |
| MA 311 / CS 323 | Statistical Distribution Theory                         | 2-1-0                         | 3      |
| MA 310 / CS 320 | Algorithmic Techniques and Applications of Data Science | 2-1-0                         | 3      |
| MA 312          | Analytical Methods in Partial Differential Equations    | 2-1-0                         | 3      |
| MA 314          | Random Matrices                                         | 2-1-0                         | 3      |
| MA 315 / CS 325 | Mathematical Foundations for Cryptography               | 2-1-0                         | 3      |
| MA 316 / CS 316 | Spectral Graph Theory                                   | 2-1-0                         | 3      |

|                             |                                               |       |     |
|-----------------------------|-----------------------------------------------|-------|-----|
| CS 315 / MA 321             | Introduction to Complexity Theory             | 2-1-0 | 3   |
| MA 319 / CS 319             | Foundations of Cryptography                   | 2-1-0 | 3   |
| MA 327 / CS 327             | Mathematical Methods in Risk Theory           | 2-1-0 | 3   |
| MA 329 / CS 329             | Algebraic Coding Theory                       | 2-1-0 | 3   |
| MA 452 / MA 652             | Theory of Transforms                          | 2-1-0 | 3   |
| MA 407 / MA 607             | Nonlinear Dynamics and Computations           | 2-0-2 | 3   |
| MA 456 / MA 656             | Stochastic Approximation                      | 2-1-0 | 3   |
| MA 454 / MA 654             | Mathematical Modeling and Simulations         | 2-0-2 | 3   |
| MA 405 / MA 605             | Differential Equations in Population Dynamics | 2-0-2 | 3   |
| MA 402 / MA 602             | Industrial Statistics                         | 2-0-2 | 3   |
| MA 404 / MA 604             | Foundation of Approximation Theory            | 2-1-0 | 3   |
| MA 406 / MA 606             | Graph Theory                                  | 2-1-0 | 3   |
| MA 408 / MA 608             | Mathematical Theory of Waves                  | 2-1-0 | 3   |
| MA 414 / MA 614             | Time Series Analysis                          | 2-1-0 | 3   |
| MA 416 / MA 608             | Integral Equations                            | 2-1-0 | 3   |
| MA 422 / MA 622             | Hyperbolic Geometry                           | 2-1-0 | 3   |
| MA 424 / MA 624             | Algebraic Number Theory                       | 2-1-0 | 3   |
| MA 426 / MA 626             | Theory of Modular Forms                       | 2-1-0 | 3   |
| MA 432 / MA 632             | Introduction to Commutative Algebra           | 2-1-0 | 3   |
| MA 434 / MA 634             | Introduction to Modal Logic                   | 2-1-0 | 3   |
| MA 236 / MA 336<br>/ MA 436 | Bayesian Statistical Methods                  | 2-1-0 | 1.5 |

# Mechanical Engineering

| Course Code     | Course Name                                       | Weekly Contact Hours<br>L-T-P | Credit |
|-----------------|---------------------------------------------------|-------------------------------|--------|
| ME 216          | Thermal Systems and Applications                  | 2-1-0 (Half-Sem)              | 1.5    |
| ME 217          | Industrial Data Analytics                         | 2-1-0                         | 3      |
| ME 218          | Quality Management                                | 2-1-0 (Half-Sem)              | 1.5    |
| ME 219          | Energy Storage Systems                            | 2-1-0 (Half-Sem)              | 1.5    |
| ME 220          | Fundamentals of Acoustics                         | 2-1-0 (Half-Sem)              | 1.5    |
| ME 221          | Optical Measurement Techniques in Fluid Mechanics | 2-1-0 (Half-Sem)              | 1.5    |
| ME 222          | Introduction to Experimental Aerodynamics         | 2-1-0 (Half-Sem)              | 1.5    |
| ME 223          | Design Thinking                                   | 2-1-0 (Half-Sem)              | 1.5    |
| ME 224          | Fundamentals of Microscale Flows                  | 2-1-0 (Half-Sem)              | 1.5    |
| ME 225          | Fundamentals of Vibrations                        | 2-1-0 (Half-Sem)              | 1.5    |
| ME 227          | Plastic Parts Manufacturing                       | 2-0-2 (Half-Sem)              | 1.5    |
| ME 228          | High Strain Rate Forming Process                  | 2-1-0 (Half-Sem)              | 1.5    |
| ME 230          | Introduction to Smart Materials                   | 2-1-0 (Half-Sem)              | 1.5    |
| ME 407 / ME 607 | Biofluid Mechanics                                | 2-1-0                         | 3      |
| ME 408 / ME 608 | Hybrid Electric Vehicles                          | 2-1-0                         | 3      |
| ME 407 / ME 607 | Biofluid Mechanics                                | 2-1-0                         | 3      |
| ME 408 / ME 608 | Hybrid Electric Vehicles                          | 2-1-0                         | 3      |

|                             |                                                  |       |   |
|-----------------------------|--------------------------------------------------|-------|---|
| ME 436 / ME 736             | Finite Element Analysis                          | 2-0-2 | 3 |
| ME 438 / ME 738             | Composite Materials                              | 2-1-0 | 3 |
| ME 439 / ME 639             | Mechanical Behavior of Materials                 | 2-1-0 | 3 |
| ME 440 / ME 640             | Smart Materials and Structures                   | 2-1-0 | 3 |
| ME 441 / ME 641             | Design of Laminated Composite Structures         | 2-1-0 | 3 |
| ME 443 / ME 643             | Micromechanics and Nanomechanics                 | 2-1-0 | 3 |
| ME 444 / ME 644             | Robotics                                         | 2-0-2 | 3 |
| ME 446 / ME 646             | Dynamics and Control Systems                     | 2-1-0 | 3 |
| ME 448 / ME 648             | MEMS and Micro System Design                     | 2-1-0 | 3 |
| ME 451 / ME 751             | Theory of Advanced Machining Processes           | 2-0-2 | 3 |
| ME 453 / ME 653             | Computer Aided Manufacturing                     | 2-0-2 | 3 |
| ME 454 / ME 654             | Rapid Product Manufacturing                      | 2-0-2 | 3 |
| ME 456 / ME 756             | Industrial Automation                            | 2-0-2 | 3 |
| ME 458 / ME 658             | Laser Based Measurements and Micro-Manufacturing | 2-1-0 | 3 |
| ME 468 / ME 668             | Propulsion System                                | 2-1-0 | 3 |
| ME 470 / ME 670             | Machine Component Design                         | 2-1-0 | 3 |
| ME 471 / ME 671<br>/ MA 671 | Operations Research                              | 2-0-2 | 3 |
| ME 478 / ME 678             | Solar Energy Technology                          | 2-1-0 | 3 |
| ME 482 / ME 682             | Heat and Mass Transfer in Textiles               | 2-1-0 | 3 |
| ME 484 / ME 684             | Transport Phenomena in Porous Textiles           | 2-1-0 | 3 |
| ME 486 / ME 686             | Technical Textiles for Ballistic Protection      | 2-1-0 | 3 |

|        |                                  |          |   |
|--------|----------------------------------|----------|---|
| ME 630 | Robotic Control Systems          | 2/1/2002 | 4 |
| ME 663 | Theory of Conventional Machining | 2-1-0    | 3 |
| ME 730 | Theory of Elasticity             | 2-1-0    | 3 |

# Metallurgical Engineering and Materials Science

| Course Code | Course Name                                       | Weekly Contact Hours<br>L-T-P | Credit |
|-------------|---------------------------------------------------|-------------------------------|--------|
| MM 221      | Finite Element Simulations in Materials           | 2-1-0                         | 1.5    |
| MM 223      | Statistical Mechanics for Materials Science       | 2-1-0                         | 1.5    |
| MM 225      | Materials Economics and Sustainability            | 2-1-0                         | 1.5    |
| MM 226      | Materials Informatics                             | 2-1-0                         | 1.5    |
| MM 228      | Ceramic Science and Technology                    | 2-1-0                         | 1.5    |
| MM 229      | Nucleation and Crystal Growth                     | 2-1-0                         | 1.5    |
| MM 230      | Diffusion in Solids                               | 2-1-0                         | 1.5    |
| MM 232      | Thin Film Technology                              | 2-1-0                         | 1.5    |
| MM 317      | Lightweight Materials for Structural Applications | 2-1-0                         | 1.5    |
| MM 318      | Multicomponent Alloys                             | 2-1-0                         | 3      |
| MM 319      | Superalloys for High Temperature Applications     | 2-1-0                         | 1.5    |
| MM 320      | Crystallographic Texture and Crystal Plasticity   | 2-1-0                         | 3      |
| MM 321      | Mechanical Behavior of Materials at Nanoscale     | 2-1-0                         | 1.5    |
| MM 322      | Surface Engineering of Alloys                     | 2-1-0                         | 3      |

|                 |                                                    |       |     |
|-----------------|----------------------------------------------------|-------|-----|
| MM 323          | Phase Transformation of Nanoalloys                 | 2-1-0 | 1.5 |
| MM 324          | Sustainable Geotechnics                            | 2-1-0 | 3   |
| MM 325          | Advances in Metals and Alloys Processing           | 2-1-0 | 3   |
| MM 3XX          | Advances in Sintering Technology                   | 2-1-0 | 1.5 |
| MM 3XX          | Mechanical Behavior at Nanoscale                   | 2-1-0 | 1.5 |
| MM 3XX          | Phase Transformation of Nano-Alloys                | 2-1-0 | 1.5 |
| MM 3XX          | Genetic Algorithms in Engineering Process Modeling | 2-1-0 | 1.5 |
| MM 3XX          | Metallic Glass                                     | 2-1-0 | 1.5 |
| MM 3XX          | CO <sub>2</sub> Capture and Utilisation            | 2-1-0 | 1.5 |
| MM 3XX          | Engineered Soft Materials                          | 2-1-0 | 1.5 |
| MM 3XX          | High Entropy Materials                             | 2-1-0 | 1.5 |
| MM 3XX          | Advanced Materials and Processes                   | 2-1-0 | 3   |
| MM 3XX          | Fuels, Furnaces and Refractories                   | 2-1-0 | 3   |
| MM 3XX          | Functional Coatings                                | 2-1-0 | 3   |
| MM 404          | Creep, Fatigue and Fracture Mechanics              | 2-1-0 | 3   |
| MM 405 / MM 605 | Green Hydrogen: Materials and Technologies         | 2-1-0 | 3   |
| MM 406          | Electronics Materials                              | 2-1-0 | 3   |
| MM 408          | Bio-Materials                                      | 2-1-0 | 3   |
| MM 410          | Modern Materials                                   | 2-1-0 | 3   |



|                 |                                                        |       |   |
|-----------------|--------------------------------------------------------|-------|---|
| MM 412          | Surface Modification                                   | 2-1-0 | 3 |
| MM 414          | Particulate Processing                                 | 2-1-0 | 3 |
| MM 416          | Modeling and Simulation in Materials Engineering       | 2-0-2 | 3 |
| MM 418          | Defects and Failures in Manufacturing and Services     | 2-1-0 | 3 |
| MM 420          | Metallurgical Plant Design                             | 2-1-0 | 3 |
| MM 422          | Sintering Technology                                   | 2-1-0 | 3 |
| MM 424          | Magnetic Materials                                     | 2-1-0 | 3 |
| MM 426          | Advanced Materials Processing                          | 2-1-0 | 3 |
| MM 428          | Intelligent Materials                                  | 2-1-0 | 3 |
| MM 430 / MM 730 | Two-Dimensional Materials and Electronic Devices       | 2-1-0 | 3 |
| MM 442 / MM 642 | Quality Assurance in Metallurgy                        | 2-0-2 | 3 |
| MM 447 / MM 647 | Metallurgical Thermodynamics and Phase Transformations | 2-1-0 | 3 |
| MM 448 / MM 648 | Solidification and Phase Field Modeling                | 2-0-2 | 3 |
| MM 449 / MM 649 | Advance Welding Technology                             | 2-0-2 | 3 |
| MM 450 / MM 650 | Ferrous and Non-Ferrous Alloys                         | 2-1-0 | 3 |
| MM 451 / MM 651 | Non-destructive Evaluation                             | 2-0-2 | 3 |
| MM 452 / MM 652 | Thermomechanical Processing                            | 2-0-2 | 3 |
| MM 453 / MM 653 | Non-equilibrium Processing of Materials                | 2-1-0 | 3 |
| MM 454 / MM 654 | Advanced Foundry Technology                            | 2-0-2 | 3 |

|                 |                                                      |          |   |
|-----------------|------------------------------------------------------|----------|---|
| MM 457 / MM 657 | Advances in Energy Storage Materials                 | 2-1-0    | 3 |
| MM 474 / MM 674 | Fluorescence Phenomenon                              | 2/1/2002 | 4 |
| MM 475 / MM 675 | Advanced Fracture Mechanics                          | 2-1-0    | 3 |
| MM 477 / MM 677 | High Temperature Deformation of Materials            | 2-1-0    | 3 |
| MM 479 / MM 679 | Fundamentals and Engineering of Solar Energy Devices | 2-1-0    | 3 |
| MM 481 / MM 681 | High-Pressure Materials Processing                   | 2-1-0    | 3 |
| MM 483 / MM 683 | Analysis and Modeling of Welding                     | 2-0-2    | 3 |
| MM 485 / MM 685 | Materials Degradation                                | 2-0-2    | 3 |
| MM 486 / MM 686 | Applied Photo Electrochemistry                       | 2-1-0    | 3 |
| MM 487 / MM 687 | Advanced Battery Technologies                        | 2-1-0    | 3 |
| MM 488 / MM 688 | Electrochromic                                       | 2-1-0    | 3 |

# Physics

| Course Code | Course Name                                                      | Weekly Contact Hours<br>L-T-P | Credit |
|-------------|------------------------------------------------------------------|-------------------------------|--------|
| PH 211      | Fundamentals of Vacuum Science and Technology                    | 2-1-0                         | 3      |
| PH 213      | Detector Physics                                                 | 1/1/2002                      | 3      |
| PH 214      | Classical Field Theory                                           | 2-1-0                         | 3      |
| PH 215      | Geometrical Methods in Physics                                   | 2-1-0                         | 3      |
| PH 216      | Accelerator Physics                                              | 2-1-0                         | 3      |
| PH 218      | Introduction to General Relativity                               | 2-1-0                         | 3      |
| PH 311      | Physics of Semiconductor Devices                                 | 3-0-0                         | 3      |
| PH 312      | Solar Photovoltaics: Fundamentals, Technologies and Applications | 2-1-0                         | 3      |
| PH 313      | Quantum Transport Theory and Simulations                         | 2-0-2                         | 3      |
| PH 314      | Introduction to Quantum Field Theory                             | 2-1-0                         | 3      |
| PH 315      | Advanced Quantum Mechanics                                       | 2-1-0                         | 3      |
| PH 317      | Data Analysis in High Energy Physics                             | 2-1-0                         | 3      |
| PH 320      | Physics of the Early Universe and Dark Matter                    | 2-1-0                         | 3      |
| PH 322      | Introduction to Quantum Information and Computation              | 2-0-2                         | 3      |
| PH 402      | Principles and Applications of Optical Spectroscopy              | 2-0-2                         | 3      |

|                 |                                                              |       |   |
|-----------------|--------------------------------------------------------------|-------|---|
| PH 408 / PH 608 | Experimental and Theoretical Aspects of Heavy Ion Collisions | 2-1-0 | 3 |
| PH 412 / PH 612 | Dualities in Field Theory and Gravity                        | 2-1-0 | 3 |
| PH 432 / PH 632 | Group Theory in Particle Physics                             | 2-1-0 | 3 |
| PH 440 / PH 640 | Introduction to String Theory                                | 2-1-0 | 3 |