

BS-MS (Dual Degree) CURRICULUM

First Year – Core Courses

I Semester

| Course No. | Course Title | Credit |
|------------|--------------------------------|--------|
| BIO101 | Biology I: Biomolecules | 3 |
| BIO103 | General Biology Laboratory | 1 |
| CHE101 | Introduction to Engineering | 2 |
| CHM101 | General Chemistry | 3 |
| HSS101 | English for Communication | 2 |
| EES101 | Introduction to Earth Sciences | 3 |
| MTH101 | Calculus of One Variable | 3 |
| PHY101 | Mechanics | 3 |
| PHY103 | General Physics Laboratory-I | 1 |
| PT101 | Physical Training | 0 |
| Total | | 21 |

II Semester

| Course No. | Course Title | Credit |
|------------|--|--------|
| BIO102 | Biology II: Fundamentals of Cell Biology | 3 |
| CHM112 | Basic Organic Chemistry-I | 3 |
| CHM114 | Chemistry Laboratory- I | 1 |
| EES102 | Introduction to Environmental Sciences | 3 |
| ECS102 | Introduction to Programming | 3 |
| MTH102 | Linear Algebra | 3 |
| PHY106 | Quantum Physics | 3 |
| Total | | 19 |

Pre-Major Year

During the Pre-Major year, credit requirement for per semester is a total of 18/21 credits. Student must register for courses specified by minimum of two disciplines.

III Semester

Biological Sciences

| Course No. | Course Title | Credit |
|------------|--|--------|
| BIO201 | Biology III: Fundamentals of Molecular Biology | 3 |
| BIO203 | Biology V: Diversity of Life I | 3 |
| BIO205 | Biology Laboratory I | 1 |
| CHM211 | Basic organic Chemistry-II | 3 |

Chemical Engineering

| Course No. | Course Title | Credit |
|------------|---------------------------------------|--------|
| CHE201 | Engineering Mechanics (Solid & Fluid) | 3 |
| CHE203 | Introduction to Thermodynamics | 3 |
| MTH201 | Multivariable Calculus | 3 |

Chemistry

| Course No. | Course Title | Credit |
|------------|----------------------------|--------|
| CHM211 | Basic Organic Chemistry-II | 3 |
| CHM221 | Basic Physical Chemistry | 3 |
| CHM223 | Chemistry Laboratory II | 1 |

Earth and Environmental Sciences

| Course No. | Course Title | Credit |
|------------|------------------------|--------|
| EES201 | Atmospheric Sciences | 3 |
| EES203 | Geochemistry | 4 |
| MTH201 | Multivariable Calculus | 3 |

Electrical Engineering & Computer Science

| Course No. | Course Title | Credit |
|-------------------|------------------------|---------------|
| ECS201 | Discrete Mathematics I | 3 |
| ECS203 | Basic Electronics | 3 |
| MTH201 | Multivariable Calculus | 3 |

Mathematics

| Course No. | Course Title | Credit |
|-------------------|-------------------------------------|---------------|
| MTH201 | Multivariable Calculus | 3 |
| MTH203 | Introduction to Groups and Symmetry | 3 |

Physics

| Course No. | Course Title | Credit |
|-------------------|-------------------------------|---------------|
| PHY201 | Waves and Optics | 3 |
| PHY203 | Electrodynamics | 3 |
| PHY205 | General Physics Laboratory-II | 1 |
| ECS203 | Basic Electronics | 3 |
| MTH201* | Multivariable Calculus | 3 |

*Recommended Course from Other Department

IV Semester

Biological Sciences

| Course No. | Course Title | Credit |
|------------|----------------------------------|--------|
| BIO202 | Biology IV: Basic Genetics | 3 |
| BIO204 | Biology VI: Diversity of Life II | 3 |
| BIO206 | Biology Laboratory II | 1 |
| CHM222 | Classical Thermodynamics | 3 |

Chemical Engineering

| Course No. | Course Title | Credit |
|------------|---|--------|
| CHE202 | Chemical Engineering Thermodynamics | 3 |
| CHE204 | Chemical Process Calculations | 3 |
| CHE206 | Introduction to Chemical Engineering Laboratory | 1 |
| MTH202 | Probability and Statistics | 3 |

Chemistry

| Course No. | Course Title | Credit |
|------------|---------------------------|--------|
| CHM204 | Basic Inorganic Chemistry | 3 |
| CHM206 | Chemistry Laboratory III | 1 |
| CHM222 | Classical Thermodynamics | 3 |

Earth and Environmental Sciences

| Course No. | Course Title | Credit |
|------------|---|--------|
| EES202 | The Evolution of the Earth | 3 |
| EES204 | Oceanography | 3 |
| EES206 | Introduction to Earth and Environmental Sciences Laboratory | 1 |
| CHM222 | Classical Thermodynamics | 3 |

Electrical Engineering & Computer Science

| Course No. | Course Title | Credit |
|------------|---|---------|
| ECS202 | Data Structures and Algorithms | 4 (3+1) |
| ECS204 | Introduction to Signal Processing and Systems | 3 |
| MTH202 | Probability and Statistics | 3 |

Mathematics

| Course No. | Course Title | Credit |
|------------|----------------------------|--------|
| MTH202 | Probability and Statistics | 3 |
| MTH204 | Complex Variables | 3 |

Physics

| Course No. | Course Title | Credit |
|------------|--------------------------------|--------|
| PHY202 | Physics by Numerical Analysis | 3 |
| PHY204 | General Properties of Matter | 3 |
| PHY206 | General Physics Laboratory-III | 1 |
| CHM222 | Classical Thermodynamics | 3 |
| MTH202* | Probability and Statistics | 3 |

*Recommended Course from Other Department

Professional Courses

BIOLOGICAL SCIENCES

V Semester

| Course No. | Course Title | Credit |
|-------------|-------------------------|--------|
| BIO 301/601 | Cell Biology | 4 |
| BIO 303/603 | Biochemistry I | 4 |
| BIO 305/605 | Plant Biology I | 4 |
| BIO 307 | Biology Laboratory III | 3 |
| BIO 309/609 | Departmental Elective I | 4 |
| *** ** | Open Elective I | 3/4 |
| Total | | 19 |

VI Semester

| Course No. | Course Title | Credit |
|-------------|--------------------------|--------------|
| BIO 302/602 | Biochemistry II | 4 |
| BIO 304/604 | Molecular Biology | 4 |
| BIO 306/606 | Immunology I | 4 |
| BIO 308 | Biology Laboratory IV | 3 |
| BIO 310/610 | Departmental Elective II | 4 |
| *** ** | Open Elective II | 3/4 |
| Total | | 22/23 |

VII Semester

| Course No. | Course Title | Credit |
|-------------|---------------------------|--------------|
| BIO 401/621 | Immunology II | 4 |
| BIO 403/623 | Structural Biology | 4 |
| BIO 405/625 | Developmental Biology | 4 |
| BIO 407/627 | Departmental Elective III | 4 |
| BIO 409/629 | Departmental Elective IV | 4 |
| *** ** | Open Elective III | 3/4 |
| Total | | 23/24 |

VIII Semester

| Course No. | Course Title | Credit |
|-------------------|--------------------------|---------------|
| BIO 402/622 | Bioinformatics | 4 |
| BIO 404/624 | Neurobiology | 4 |
| BIO 406/626 | Evolutionary Ecology | 4 |
| BIO 408/628 | Departmental Elective V | 4 |
| BIO 410/630 | Departmental Elective VI | 4 |
| *** ** | Open Elective VII | 3/4 |
| Total | | 23/24 |

IX Semester

| Course No. | Course Title | Credit |
|-------------------|---|---------------|
| BIO 501 | MS Thesis | 18 |
| HSS 503 | Law Relating to Intellectual Property and Patents | 1 |
| Total | | 19 |

X Semester

| Course No. | Course Title | Credit |
|-------------------|---------------------|---------------|
| BIO 501 | MS Thesis | 18 |
| Total | | 18 |

CHEMICAL ENGINEERING

V Semester

| Course No. | Course Title | Credit |
|------------|---|--------|
| CHE 301 | Heat Transfer Operations | 4 |
| CHE 303 | Fluid Mechanics and Mechanical Operations | 4 |
| CHE 305 | Numerical Methods in Chemical Engineering | 4 |
| CHE 307 | Thermodynamics Laboratory | 2 |
| CHE *** | Department Elective – I | 4 |
| *** ** | Open Elective – I | 4 |
| Total | | 22 |

VI Semester

| Course No. | Course Title | Credit |
|------------|--------------------------------------|--------|
| CHE 302 | Chemical Reaction Engineering-I | 4 |
| CHE 304 | Mass Transfer and Separation Process | 4 |
| CHE 306 | Heat Transfer Laboratory | 2 |
| CHE 308 | Fluid Mechanics Laboratory | 2 |
| CHE *** | Department Elective – II | 4 |
| *** ** | Open Elective – II | 4 |
| Total | | 20 |

VII Semester

| Course No. | Course Title | Credit |
|--------------|--|--------|
| CHE 401/ 421 | Statistical Mechanics | 4 |
| CHE 403 | Process Dynamics and Control | 4 |
| CHE 407 | Chemical Reaction Engineering Laboratory | 2 |
| CHE 409 | Mass Transfer Laboratory | 2 |
| CHE *** | Department Elective – III | 4 |
| *** ** | Open Elective – III | 4 |
| Total | | 20 |

VIII Semester

| Course No. | Course Title | Credit |
|-------------------|--|---------------|
| CHE 402 | Process Design and Economics | 4 |
| CHE 404 | Chemical Reaction Engineering-II | 4 |
| CHE 406 | Advanced Transport Phenomena | 4 |
| CHE 408 | Process Control and Instrumentation Laboratory | 2 |
| CHE *** | Department Elective – IV | 4 |
| *** ** | Open Elective – IV | 4 |
| Total | | 22 |

IX Semester

| Course No. | Course Title | Credit |
|-------------------|---|---------------|
| CHE 501 | MS Thesis | 12 |
| CHE *** | Department Elective – V | 4 |
| *** ** | Open Elective – V | 4 |
| HSS 503 | Law Relating to Intellectual Property and Patents | 1 |
| Total | | 21 |

X Semester

| Course No. | Course Title | Credit |
|-------------------|---------------------|---------------|
| CHE 501 | MS Thesis | 18 |
| Total | | 18 |

CHEMISTRY

V Semester

| Course No. | Course Title | Credit |
|------------|-----------------------------------|--------|
| CHM 301 | Symmetry and Group Theory | 4 |
| CHM 311 | Organic Chemistry I | 4 |
| CHM 313 | Organic Chemistry Laboratory | 3 |
| CHM 321 | Physical Chemistry of Solutions | 4 |
| CHM 325 | Mathematical Methods for Chemists | 4 |
| *** ** | Department/Open Elective I | 3/4 |
| Total | | 22/23 |

VI Semester

| Course No. | Course Title | Credit |
|------------|-----------------------------------|--------|
| CHM 302 | Chemistry of Transition Metals | 4 |
| CHM 312 | Organic Chemistry II | 4 |
| CHM 314 | Quantitative Methods in Chemistry | 4 |
| CHM 322 | Principles of Quantum Chemistry | 4 |
| CHM *** | Departmental Elective II | 4 |
| *** ** | Open Elective II | 3/4 |
| Total | | 23/24 |

VII Semester

| Course No. | Course Title | Credit |
|------------|--------------------------------|--------|
| CHM 401 | Main Group Chemistry | 4 |
| CHM 403 | Inorganic Chemistry Laboratory | 3 |
| CHM 411 | Physical Organic Chemistry | 4 |
| CHM 421 | Statistical Mechanics | 4 |
| CHM *** | Departmental Elective III | 4 |
| *** ** | Open Elective III | 3/4 |
| Total | | 22/23 |

VIII Semester

| Course No. | Course Title | Credit |
|-------------------|---|---------------|
| CHM 402 | Applications of Modern Physical Methods | 4 |
| CHM 416 | Spectroscopy and Its Application in Organic Molecules | 4 |
| CHM 422 | Molecular Spectroscopy | 4 |
| CHM 426 | Physical Chemistry Laboratory | 3 |
| CHM *** | Departmental Elective IV | 4 |
| *** ** | Open Elective IV | 3/4 |
| Total | | 22/23 |

IX Semester

| Course No. | Course Title | Credit |
|-------------------|---|---------------|
| CHM 501 | MS Thesis | 10 |
| CHM *** | Departmental Elective V/ Research Credit | 4 |
| CHM *** | Departmental Elective VI/ Research Credit | 4 |
| HSS 503 | Law Relating to Intellectual Property and Patents | 1 |
| Total | | 19 |

X Semester

| Course No. | Course Title | Credit |
|-------------------|---------------------|---------------|
| CHM 501 | MS Thesis | 18 |
| Total | | 18 |

EARTH AND ENVIRONMENTAL SCIENCES

V Semester

| Course No. | Course Title | Credit |
|-------------------|-------------------------------|---------------|
| EES 301 | Mineralogy | 3 |
| EES 303 | Structural Geology | 3 |
| EES 305 | Geohydrology | 3 |
| *** ** | Open Elective I | 3/4 |
| EES *** | Department Elective I | 4 |
| EES 311 | Mineralogy Laboratory | 1 |
| EES 313 | Structural Geology Laboratory | 1 |
| Total | | 21/22 |

VI Semester

| Course No. | Course Title | Credit |
|-------------------|------------------------------------|---------------|
| EES 302 | Igneous Petrology | 3 |
| EES 304 | Environmental Chemistry | 3 |
| EES 306 | Solid Earth Geophysics | 3 |
| *** ** | Open Elective II | 3/4 |
| EES *** | Department Elective II | 4 |
| EES 312 | Igneous Petrology Laboratory | 1 |
| EES 314 | Environmental Chemistry Laboratory | 1 |
| EES 316 | Basic Field Geology | 2 |
| Total | | 20/21 |

VII Semester

| Course No. | Course Title | Credit |
|-------------------|--|---------------|
| EES 401 | Sedimentology and Principles of Stratigraphy | 3 |
| EES 403 | Metamorphic Petrology | 3 |
| EES 405/647 | Data Analyses and Statistics for Geosciences | 4 |
| *** ** | Open Elective III | 3/4 |
| EES *** | Departmental Elective III | 4 |
| EES 411 | Sedimentology Laboratory | 1 |
| EES 413 | Metamorphic Petrology Laboratory | 1 |
| Total | | 19/20 |

VIII Semester

| Course No. | Course Title | Credit |
|-------------|---|--------|
| EES 402/614 | Earth Surface Processes | 4 |
| EES 404 | Geodynamics* | 3 |
| EES 406 | Global Climate Change** | 3 |
| *** ** | Open Elective IV | 3/4 |
| EES *** | Departmental Elective IV | 4 |
| EES 414 | Geodynamics Laboratory* | 1 |
| EES 416 | Global Climate Change Laboratory** | 1 |
| EES 408 | Advanced Field Geology [#] | 3 |
| EES 410 | Field Work in Environmental Sciences [#] | 3 |
| Total | | 18/19 |

[#] Students should register for either one of these two courses

Students should register for both the * or both the ** courses

IX Semester

| Course No. | Course Title | Credit |
|----------------------|--|--------|
| EES 501 | MS Thesis | 12 |
| EES 505/645 | Remote Sensing and GIS | 4 |
| EES *** | Departmental Elective V | 4 |
| HSS 503 [§] | Law Relating to Intellectual Property and Patents [§] | 1 |
| Total | | 21 |

[§] Students can credit this course during any semester of their BS-MS study

[#] Students can credit this course in the 9th or 10th semester

X Semester

| Course No. | Course Title | Credit |
|-------------|-----------------------------------|--------|
| EES 501 | MS Thesis | 16 |
| EES 502/503 | Contemporary Environmental Issues | 3 |
| Total | | 19 |

ELECTRICAL ENGINEERING & COMPUTER SCIENCE

Computer Science

V Semester

| Course No. | Course Title | Credit |
|------------|-----------------------------|--------|
| ECS301 | Principles of Communication | 4 |
| ECS303 | Computer Organization | 4 |
| ECS 305 | Discrete Mathematics II | 4 |
| ECS 307 | Theory of Computation | 4 |
| ECS 309 | Departmental Elective I | 4 |
| Total | | 20 |

VI Semester

| Course No. | Course Title | Credit |
|------------|---|--------|
| ECS302 | Operating Systems | 4 |
| ECS304 | Introduction to Data Science and Machine Learning | 4 |
| ECS 306 | Algorithms | 4 |
| ECS 308 | Departmental Elective II | 4 |
| *** ** | Open Elective VII | 3/4 |
| Total | | 19/20 |

VII Semester

| Course No. | Course Title | Credit |
|------------|---------------------------|--------|
| ECS401 | Departmental Elective III | 4 |
| ECS403 | Departmental Elective IV | 4 |
| ECS405 | Departmental Elective V | 4 |
| ECS407 | Departmental Elective VI | 4 |
| *** ** | Open Elective VIII | 3/4 |
| Total | | 19/20 |

VIII Semester

| Course No. | Course Title | Credit |
|------------|----------------------------|--------|
| ECS402 | Concurrency Theory | 4 |
| ECS404 | Departmental Elective VIII | 4 |
| ECS406 | Departmental Elective IX | 4 |
| ECS408 | Departmental Elective X | 4 |
| *** ** | Open Elective IX | 3/4 |
| Total | | 19/20 |

IX Semester

| Course No. | Course Title | Credit |
|------------|--------------------------|--------|
| ECS501 | MS Thesis | 16 |
| ECS599 | Departmental Elective XI | 4 |
| Total | | 20 |

X Semester

| Course No. | Course Title | Credit |
|------------|--------------|--------|
| ECS501 | MS Thesis | 16 |
| Total | | 16 |

Electrical Engineering

V Semester

| Course No. | Course Title | Credit |
|------------|-----------------------------|--------|
| ECS301 | Principles of Communication | 4 |
| ECS303 | Computer Organization | 4 |
| ECS 321 | Electronic Devices | 4 |
| ECS 323 | Control Systems | 4 |
| ECS 325 | Analog Circuits | 4 |
| ECS 327 | Electronics Lab I | 1 |
| Total | | 21 |

VI Semester

| Course No. | Course Title | Credit |
|------------|------------------------------|--------|
| ECS 322 | Electromagnetic Theory | 4 |
| ECS 324 | Digital Signal Processing | 4 |
| ECS 326 | Digital Circuits and Systems | 4 |
| ECS 328 | Communication Systems | 4 |
| ECS 330 | Electronics Lab II | 3 |
| *** ** | Open Elective VII | 3/4 |
| Total | | 21/23 |

VII Semester

| Course No. | Course Title | Credit |
|------------|---------------------------|--------|
| ECS421 | Departmental Elective I | 4 |
| ECS423 | Departmental Elective II | 4 |
| ECS425 | Departmental Elective III | 4 |
| ECS427 | Departmental Elective IV | 4 |
| *** ** | Open Elective VIII | 3/4 |
| Total | | 19/20 |

VIII Semester

| Course No. | Course Title | Credit |
|------------|----------------------------|--------|
| ECS422 | Departmental Elective V | 4 |
| ECS424 | Departmental Elective VI | 4 |
| ECS426 | Departmental Elective VII | 4 |
| ECS428 | Departmental Elective VIII | 4 |
| *** ** | Open Elective IX | 3/4 |
| Total | | 19/20 |

IX Semester

| Course No. | Course Title | Credit |
|------------|--------------------------|--------|
| ECS501 | MS Thesis | 16 |
| ECS 521 | Departmental Elective IX | 4 |
| Total | | 20 |

X Semester

| Course No. | Course Title | Credit |
|------------|--------------|--------|
| ECS501 | MS Thesis | 16 |
| Total | | 16 |

MATHEMATICS

V Semester

| Course No. | Course Title | Credit |
|------------|--------------------------|--------|
| MTH 301 | Group Theory | 4 |
| MTH 303 | Real Analysis I | 4 |
| MTH 305 | Elementary Number Theory | 4 |
| MTH *** | Departmental Elective I | 4 |
| *** ** | Open Elective I | 3/4 |
| Total | | 19/20 |

VI Semester

| Course No. | Course Title | Credit |
|------------|---------------------------------|--------|
| MTH 302 | Rings and Modules | 4 |
| MTH 304 | General Topology | 4 |
| MTH 306 | Ordinary Differential Equations | 4 |
| MTH *** | Departmental Elective II | 4 |
| *** ** | Open Elective II | 3/4 |
| Total | | 19/20 |

VII Semester

| Course No. | Course Title | Credit |
|------------|--------------------------------|--------|
| MTH 401 | Fields and Galois Theory | 4 |
| MTH 403 | Real Analysis II | 4 |
| MTH 405 | Partial Differential Equations | 4 |
| MTH 407 | Complex Analysis I | 4 |
| *** ** | Open Elective III | 3/4 |
| Total | | 19/20 |

VIII Semester

| Course No. | Course Title | Credit |
|------------|--|--------|
| MTH 404 | Measure and Integration | 4 |
| MTH 406 | Differential Geometry of Curves and Surfaces | 4 |
| MTH *** | Departmental Elective III | 4 |
| *** ** | Open Elective IV | 3/4 |
| *** ** | Open Elective V | 3/4 |
| Total | | 18/20 |

IX Semester

| Course No. | Course Title | Credit |
|-------------------|---|---------------|
| MTH 501 | MS Thesis | 12 |
| MTH 503 | Functional Analysis | 4 |
| MTH *** | Departmental Elective V | 4 |
| HSS 503 | Law Relating to Intellectual Property and Patents | 1 |
| Total | | 21 |

X Semester

| Course No. | Course Title | Credit |
|-------------------|---------------------------|---------------|
| MTH 501 | MS Thesis | 12 |
| MTH *** | Departmental Elective VI | 4 |
| MTH *** | Departmental Elective VII | 4 |
| Total | | 20 |

PHYSICS

V Semester

| Course No. | Course Title | Credit |
|------------|------------------------|--------|
| PHY 301 | Mathematical Methods I | 4 |
| PHY 303 | Quantum Mechanics I | 4 |
| PHY 305 | Classical Mechanics | 4 |
| PHY 307 | Physics Laboratory I | 3 |
| *** ** | Open Elective I | 3/4 |
| Total | | 18/19 |

VI Semester

| Course No. | Course Title | Credit |
|------------|-------------------------|--------|
| PHY 302 | Mathematical Methods II | 4 |
| PHY 304 | Quantum Mechanics II | 4 |
| PHY 306 | Statistical Mechanics | 4 |
| PHY 308 | Physics Laboratory II | 3 |
| *** ** | Open Elective II | 3/4 |
| Total | | 18/19 |

VII Semester

| Course No. | Course Title | Credit |
|------------|--|--------|
| PHY 401 | Electrodynamics and Special Theory of Relativity | 4 |
| PHY 403 | Condensed Matter Physics | 4 |
| PHY 405 | Condensed Matter Physics Laboratory | 3 |
| *** ** | Open Elective III | 3/4 |
| *** ** | Open Elective IV | 3/4 |
| Total | | 17/19 |

VIII Semester

| Course No. | Course Title | Credit |
|------------|------------------------------|--------|
| PHY 402 | Atomic and Molecular Physics | 4 |
| PHY 404 | Nuclear and Particle Physics | 4 |
| PHY 406 | Nuclear Laboratory | 3 |
| *** ** | Open Elective V | 3/4 |
| *** ** | Open Elective VI | 3/4 |
| Total | | 17/19 |

IX Semester

| Course No. | Course Title | Credit |
|-------------------|---|---------------|
| PHY 501 | Project Work | 14 |
| *** ** | Open Elective VII | 4 |
| *** ** | Open Elective VIII | 4 |
| HSS 503 | Law Relating to Intellectual Property and Patents | 1 |
| Total | | 23 |

X Semester

| Course No. | Course Title | Credit |
|-------------------|---------------------|---------------|
| PHY 501 | Project Work | 14 |
| *** ** | Open Elective IX | 4 |
| *** ** | Open Elective X | 4 |
| Total | | 22 |