

Manufacturing Engineering Curriculum for 4-Year Undergraduate Study

First-Year Curriculum

First Year		
MANU 111	<p>Introduction to Engineering I: An introduction to the engineering disciplines, the engineering design process, the relevant foundational scientific principles, prototyping, engineering graphics, technical communication, and engineering ethics.</p>	3
MANU 112	<p>Introduction to Engineering II: An introduction to the engineering design process, sustainability, prototype testing, the relevant foundational scientific principles, team functioning, engineering graphics, and technical communication.</p>	3
MANU 113	<p>Introduction to Computation in Engineering Design: Analysis and simulation, laboratory data acquisition and processing, measurement interfaces, engineering tools, computer systems organization, programming languages.</p>	3
MANU 114	<p>Chemistry for Engineering: Chemical bonding, properties of matter. Chemical thermodynamics with applications to phase equilibria, aqueous equilibria and electrochemistry. Processes at surfaces.</p>	3
MANU 115	<p>Strategies for University Writing: Study and practice of the principles of university-level discourse, with multidisciplinary readings and emphasis on processes of research-based writing. Essays are required.</p>	3
MANU 116	<p>Differential Calculus with Applications to Physical Sciences and Engineering: Derivatives of elementary functions. Applications and modeling: graphing, optimization.</p>	3
MANU 121	<p>Integral Calculus with Applications to Physical Sciences and Engineering: The definite integral, integration techniques, applications, modeling, infinite series.</p>	3

MANU 122	Linear Systems: 2D and 3D geometry, vectors and matrices, eigenvalues and vibration, physical applications. Laboratories demonstrate computer solutions of large systems.	3
MANU 123	Introductory Physics for Engineers I: Heat, thermodynamics, oscillations, waves, and sound.	3
MANU 124	Introductory Physics for Engineers II: Electricity and magnetism, DC and AC circuits, optics. Introductory of quantum mechanics, photonics for engineers	3
MANU 125	Introductory Physics Laboratory for Engineers: A laboratory course with emphasis on experimental design, measurement and analysis techniques.	1
MANU 126	Mechanics I: Statics of particles, equilibrium of rigid bodies, rigid-body statics and internal forces, trusses. Kinematics: rectilinear motion; dynamics: Newton's second law, friction, impulse, momentum, work and energy.	3
MANU 127	C/C++/Java programming: Programming languages that are useful are introduced. The course will cover the three computing languages C, Java, Python, and C++, each of which will be allocated one third of the semester.	3
COMP 1	*Complementary Studies - Elected from Humanities	2
COMP 2	*Complementary Studies - Elected from Humanities	2
Sum		39

* Elective module (choose any one of them)

Second-Year Curriculum

Second Year		
MANU 211	<p>Machine Design and Manufacturing Engineering Project 1 (includes boot camp): Technical drawing; mechanical components: nomenclature, function and selection; mechanical dissection of selected mechanical devices; design and selection of shafts, bearings, gears and other typical mechanical parts.</p>	4
MANU 212	<p>Multivariable Calculus: Partial and directional derivatives; maxima and minima; Lagrange multipliers and second derivative test; multiple integrals and applications.</p>	3
MANU 213	<p>Ordinary Differential Equations: Review of linear systems; nonlinear equations and applications; phase plane analysis; Laplace transforms; numerical methods</p>	3
MANU 214	<p>Elementary Statistics: Probability, discrete and continuous random variables, joint probability distributions, estimation, hypothesis testing, regression, analysis of variance, goodness of fit.</p>	3
MANU 215	<p>Technical Communications and Data Analytics: Scientific and technical documents writing skills, basic principles of good writing and on types of documents common in scientific and technical fields and organizations, introductory of data analytics, digital twin, and artificial intelligence.</p>	3
MANU 216	<p>Engineering Materials I: Atomic bonding; crystal structures and imperfections; properties of metals, ceramics, polymers, concrete and fiber composite materials; selection of materials; corrosion; mechanical testing and heat treatment.</p>	4
MANU 221	<p>Thermodynamics: Properties and behavior of pure substances; equation of states for ideal and real gases; compressibility factor; first and second laws of thermodynamics; control mass and control volume analyses.</p>	3
MANU 222	<p>Fluid Mechanics: Fluid properties; statics; kinematics, dynamics, energy, and momentum principles for one-dimensional flow; dimensional analysis and similarity; laminar and turbulent flow; pipe flow; principles of turbo-machine flow.</p>	3

MANU 223	Microcomputer and interfacing technology: The basic theory about architecture and operation mechanism of CPU and system bus; the technology about connection criterion of device and system bus, and about interaction mechanism of device and CPU.	3
MANU 224	Solid Mechanics: The branch of continuum mechanics studies the behavior of solid materials, especially their motion and deformation under the action of forces, temperature changes, phase changes, and other agents.	3
MANU 225	Electrotechnics & Electronics (including experiments): Fundamental knowledge of electrical circuit, electronics, electricity and information technology. Experimental understanding of AC and DC principles and laws, the use of common electrical control equipment.	3
MANU 226	Production Systems Management I: Production management concepts and philosophies concerned with designing and controlling the process of production and redesigning business operations in the production of goods	3
COMP 3	*Complementary Studies - Elected from Humanities	2
COMP 4	*Complementary Studies - Elected from Humanities	2
Sum		40

* Elective module (choose any one of the listed courses by the university)

Third -Year Curriculum

Third Year		
MANU 311	<p>Machine Design and Manufacturing Engineering Project 2 (includes boot camp): Manufacturing process planning, operations and inspection procedures supported by manufacturing boot camp. Students will be trained to use basic machine tools and measurement instruments in the machine shop.</p>	5
MANU 312	<p>Machine Dynamics: Kinetics and dynamics of rigid bodies in planar motion; equilibrium of rigid bodies; mass centers and moments of inertia of rigid bodies; kinetics of particles; moments of inertia of rigid bodies; kinematics of linkages.</p>	3
MANU 313	<p>Manufacturing Processes I: Production Fundamentals: Material production, casting, forming, machining, non-traditional machining, welding, surface treatment, metrology, additive manufacturing; Automation fundamentals.</p>	3
MANU 314	<p>Engineering Materials II: Mechanical behavior of materials (metals, polymers, ceramics and composites), phase transformations, microstructure engineering.</p>	3
MANU 315	<p>Mechanical Vibrations: Theory of vibration of mechanical systems; undamped vibration, forced vibrations and resonance, damping, multiple degree-of-freedom systems; vibration measuring instruments and frequency spectrum analysis.</p>	3
MANU 321	<p>Interchangeability and Engineering Measurements: Fundamental understanding of interchangeability, surface roughness, tolerance and fits for components, architecture of electronic instrumentation systems, signal processing and computer-based readout.</p>	4
MANU 322	<p>Computer-Aided Manufacturing: NC programming with CAD/CAM systems; curve and surface geometry for tool-path generation; tool-path generation methodologies; geometric modeling techniques for simulation of manufacturing processes.</p>	3
MANU 323	<p>Industrial Automation: Robots, PLC, Embedded Systems (with labs): Programming of PLCs, CNC machines, robots; ladder diagrams; PLC troubleshooting; NC programming; robot programming; cell design.</p>	3

MANU 324	Machine and Part Metrology: Machine tool accuracy and performance testing; use of homogeneous transformations for error mapping; error budgeting and management; spindle accuracy, and cutting performance tests; machine checking.	3
MANU 325	Production Systems Management II: Practices and theory related to management of production systems, including IT in production management, enterprise resource planning, supply chain management, energy and resource management.	3
MANU 326	Product Design and Development: The focus of Product Design and Development is integration of the marketing, design, and manufacturing functions of the firm in creating a new product.	3
COMP 5	*Complementary Studies - Elected from Humanities	2
COMP 6	*Complementary Studies - Elected from Humanities	2
Sum		40

* Elective module (choose any one of them)

Fourth Year Curriculum
“Production Tech” Stream Curriculum

	Fourth Year	
MANU 411	Machine Design and Manufacturing Engineering Project 3: Design and application of mechanisms, linkages, and cams; design for manufacturing concepts; fatigue and fracture considerations in design; introduction to FEM in mechanical design.	6
MANU 412	Manufacturing Processes II: Fundamentals of manufacturing processes for metals, polymers, ceramics and composites by cutting, drilling, turning, milling and material forming methods for polymers, ceramics and compositions.	3
MANU 413	Finite Element Methods: Theory and element selection; virtual work and weighted residual formulation; linear elastic analysis; heat transfer analysis; isoparametric elements; development of computer programs for simple problems.	3
MANU 414	Precision Engineering: Concepts and technology enable precision such that the ratio of overall dimensions to uncertainty of measurement is large relative to normal engineering practice, introduction to micro- and nano-manufacturing, the three manufacturing paradigms.	3
MANU 415	Computer Control of Mechatronics Systems: Block diagrams and transfer functions; continuous and discrete domain transformations; feedback control system characteristics; control design in the continuous and discrete domain; absolute and relative stability.	4
MANU 421	Engineering Economy: Time value of money; cash flow; capital and operating cost estimation; financial decision-making and relevant case studies for sustainable manufacturing (LCA, remanufacturing).	3
MANU 422	Manufacturing Processes III: Manufacturing processes with emphasis on joining novel machining processes, novel manufacturing processes, e.g., additive, roll-to-roll.	3
MANU 423	Professional Engineering Practice: Legislation affecting the practice of engineering; ethical principles and responsibilities; management of engineering enterprises; independent contractors; intellectual property; evidence and expert witnessing.	3

MANU 424	<p>Final Year Project: This course introduces the student to independent project research in the field of design, theories, methods, history and philosophy or architecture. It is essentially an individual study under the supervision of an academic staff. At the end of the session, he produces a final research report to the approved standard.</p>	6
COMP 7	<p>Introduction to robotics (Technical electives) * Overview of the research fields of robotics. Robotic systems in industrial manufacturing as well as service robots are covered. The key aspects consist of modelling of robots as well as methods for robot control.</p>	3
COMP 8	<p>Failure of structural materials: deformation and fracture (Technical electives) * Introduction to the relationship between externally applied load and materials strength, the foundation of linear elastic fracture mechanics and main empirical materials models for deformation and fracture.</p>	3
Sum		40

*Elective module (all credits have to be acquired)

“Production Management” Stream Curriculum

	Fourth Year	
MANU 411	Machine Design and Manufacturing Engineering Project 3: Design and application of mechanisms, linkages, and cams; design for manufacturing concepts; fatigue and fracture considerations in design; introduction to FEM in mechanical design.	6
MANU 416	Production System Management III: Inventory analysis and control for single and multi-item systems based on deterministic and stochastic demand models; demand forecasting; production control methods: MRP, MRP-II, Just-in-time, and Kanban.	3
MANU 417	Life Cycle Analysis and Sustainability: Resource analysis, including energy and exergy flows, efficiencies, material resources analysis; LCA of products and services, including input-output models, hybrid models, consequential LCA.	3
MANU 418	Capstone Design and Manufacturing Project: Developing a complete paper or conceptual solution. The teams interact with the project sponsor to define design specifications and expected results.	4
MANU 419	Supply Chain Tactics & Strategies: Review of manufacturing processes for process automation; supply chain configuration and flow balancing; process reengineering and lean manufacturing techniques; design of decision support systems.	3
MANU 421	Engineering Economy: Time value of money, cash flows, capital and operating cost estimation, financial decision-making and relevant case studies.	3
MANU 423	Professional Engineering Practice: Legislation affecting the practice of engineering; ethical principles and responsibilities; management of engineering enterprises; independent contractors; intellectual property; evidence and expert witnessing.	3
MANU 425	Digital Enterprise Management (DEM) and Manufacturing Strategies: Financial, organizational, and operational concepts used in industrial firms: manufacturing operations; interfaces with marketing, engineering, and finance; technology strategy; competitive assessment.	3

MANU 424	Final Year Project: This course introduces the student to independent project research in the field of design, theories, methods, history and philosophy or architecture. It is essentially an individual study under the supervision of an academic staff. At the end of the session, he produces a final research report to the approved standard.	6
COMP 9	Quality Management (Technical electives) * The course covers the state of the art in preventive and non-preventive quality management methods in addition to manufacturing metrology, statistical methods and service-related quality management.	3
COMP 10	Strategic product development - identification of potentials of innovative products (Technical electives) * Introduction to future management, development of scenarios, scenario based strategy development, trend management, innovation- and technology management, scenarios in product development.	3
SUM		40

*Elective module (all credits have to be acquired)

Manufacturing Engineering Curriculum for 5-Year Undergraduate Study

First-Year Curriculum

First Year		
MANU 111	<p>Introduction to Engineering I: An introduction to the engineering disciplines, the engineering design process, the relevant foundational scientific principles, prototyping, engineering graphics, technical communication, and engineering ethics.</p>	3
MANU 112	<p>Introduction to Engineering II: An introduction to the engineering design process, sustainability, prototype testing, the relevant foundational scientific principles, team functioning, engineering graphics, and technical communication.</p>	3
MANU 113	<p>Introduction to Computation in Engineering Design: Analysis and simulation, laboratory data acquisition and processing, measurement interfaces, engineering tools, computer systems organization, programming languages.</p>	3
MANU 114	<p>Chemistry for Engineering: Chemical bonding, properties of matter. Chemical thermodynamics with applications to phase equilibria, aqueous equilibria and electrochemistry. Processes at surfaces.</p>	3
MANU 115	<p>Strategies for University Writing: Study and practice of the principles of university-level discourse, with multidisciplinary readings and emphasis on processes of research-based writing. Essays are required.</p>	3
MANU 116	<p>Differential Calculus with Applications to Physical Sciences and Engineering: Derivatives of elementary functions. Applications and modeling: graphing, optimization.</p>	3
MANU 121	<p>Integral Calculus with Applications to Physical Sciences and Engineering: The definite integral, integration techniques, applications, modeling, infinite series.</p>	3

MANU 122	Linear Systems: 2D and 3D geometry, vectors and matrices, eigenvalues and vibration, physical applications. Laboratories demonstrate computer solutions of large systems.	3
MANU 123	Introductory Physics for Engineers I: Heat, thermodynamics, oscillations, waves, and sound.	3
MANU 124	Introductory Physics for Engineers II: Electricity and magnetism, DC and AC circuits, optics, introductory of quantum mechanics, photonics for engineers.	3
MANU 125	Introductory Physics Laboratory for Engineers: A laboratory course with emphasis on experimental design, measurement and analysis techniques.	1
MANU 126	Mechanics I: Statics of particles, equilibrium of rigid bodies, rigid-body statics and internal forces, trusses. Kinematics: rectilinear motion; dynamics: Newton's second law, friction, impulse, momentum, work and energy.	3
MANU 127	C/C++/Java Programming: Programming languages that are useful are introduced. The course will cover the three computing languages C, Java, python and C++, each of which will be allocated one third of the semester.	3
COMP 1	*Complementary Studies - Elected from Humanities	2
COMP 2	*Complementary Studies - Elected from Humanities	2
Sum		39

* Elective module (choose any one of them)

Second-Year Curriculum

Second Year		
MANU 211	<p>Machine Design and Manufacturing Engineering Project 1 (includes boot camp): Technical drawing; mechanical components: nomenclature, function and selection; mechanical dissection of selected mechanical devices; design and selection of shafts, bearings, gears and other typical mechanical parts.</p>	4
MANU 212	<p>Multivariable Calculus: Partial and directional derivatives; maxima and minima; Lagrange multipliers and second derivative test; multiple integrals and applications.</p>	3
MANU 213	<p>Ordinary Differential Equations: Review of linear systems; nonlinear equations and applications; phase plane analysis; Laplace transforms; numerical methods</p>	3
MANU 214	<p>Elementary Statistics: Probability, discrete and continuous random variables, joint probability distributions, estimation, hypothesis testing, regression, analysis of variance, goodness of fit.</p>	3
MANU 215	<p>Technical Communications and Data Analytics: Scientific and technical documents writing skills, basic principles of good writing and on types of documents common in scientific and technical fields and organizations, data analytics, digital twin and AI.</p>	3
MANU 216	<p>Engineering Materials I: Atomic bonding; crystal structures and imperfections; properties of metals, ceramics, polymers, concrete and fiber composite materials; selection of materials; corrosion; mechanical testing and heat treatment.</p>	4
MANU 221	<p>Thermodynamics: Properties and behavior of pure substances; equation of states for ideal and real gases; compressibility factor; first and second laws of thermodynamics; control mass and control volume analyses.</p>	3
MANU 222	<p>Fluid Mechanics: Fluid properties; statics; kinematics, dynamics, energy, and momentum principles for one-dimensional flow; dimensional analysis and similarity; laminar and turbulent flow; pipe flow; principles of turbo-machine flow.</p>	3

MANU 223	Microcomputer and Interfacing Technology: The basic theory about architecture and operation mechanism of CPU and system bus; the technology about connection criterion of device and system bus, and about interaction mechanism of device and CPU.	3
MANU 224	Solid Mechanics: The branch of continuum mechanics studies the behavior of solid materials, especially their motion and deformation under the action of forces, temperature changes, phase changes, and other agents.	3
MANU 225	Electrotechnics & Electronics (including experiments): Fundamental knowledge of electrical circuit, electronics, electricity and information technology. Experimental understanding of AC and DC principles and laws, the use of common electrical control equipment.	3
MANU 226	Production Systems Management I: Production management concepts and philosophies concerned with designing and controlling the process of production and redesigning business operations in the production of goods	3
COMP 3	*Complementary Studies - Elected from Humanities	2
COMP 4	*Complementary Studies - Elected from Humanities	2
Sum		40

* Elective module (choose any one of them)

Third -Year Curriculum

Third Year		
MANU 311	<p>Machine Design and Manufacturing Engineering Project 2 (includes boot camp): Manufacturing process planning, operations and inspection procedures supported by manufacturing boot camp. Students will be trained to use basic machine tools and measurement instruments in the machine shop.</p>	5
MANU 312	<p>Machine Dynamics: Kinetics and dynamics of rigid bodies in planar motion; equilibrium of rigid bodies; mass centers and moments of inertia of rigid bodies; kinetics of particles; moments of inertia of rigid bodies; kinematics of linkages.</p>	3
MANU 313	<p>Manufacturing Processes I: Production Fundamentals: Material production, casting, forming, machining, non-traditional machining, welding, surface treatment, metrology, additive manufacturing; Automation fundamentals.</p>	3
MANU 314	<p>Engineering Materials II: Mechanical behavior of materials (metals, polymers, ceramics and composites), phase transformations, microstructure engineering.</p>	3
MANU 315	<p>Mechanical Vibrations: Theory of vibration of mechanical systems; undamped vibration, forced vibrations and resonance, damping, multiple degree-of-freedom systems; vibration measuring instruments and frequency spectrum analysis.</p>	3
MANU 321	<p>Interchangeability and Engineering Measurements: Fundamental understanding of interchangeability, surface roughness, tolerance and fits for components, architecture of electronic instrumentation systems, signal processing and computer-based readout.</p>	4
MANU 322	<p>Computer-Aided Manufacturing: NC programming with CAD/CAM systems; curve and surface geometry for tool-path generation; tool-path generation methodologies; geometric modeling techniques for simulation of manufacturing processes.</p>	3
MANU 323	<p>Industrial Automation: Robots, PLC, Embedded Systems (with labs): Programming of PLCs, CNC machines, robots; ladder diagrams; PLC troubleshooting; NC programming; robot programming; cell design.</p>	3

MANU 324	Machine and Part Metrology: Machine tool accuracy and performance testing; use of homogeneous transformations for error mapping; error budgeting and management; spindle accuracy, and cutting performance tests; machine checking.	3
MANU 325	Production Systems Management II: Practices and theory related to management of production systems, including IT in production management, enterprise resource planning, supply chain management, energy and resource management.	3
COMP 5	*Engineering Ethics and Law Introduction to the theory and the practice of engineering ethics using a multi-disciplinary and cross-cultural approach. Theory includes ethics and philosophy of engineering.	2
COMP 6	*Complementary Studies - Elected from Humanities	2
Sum		37

* Elective module (choose any one of them)

Fourth Year Curriculum
“Production Tech” Stream Curriculum

	Fourth Year	
MANU 411	Machine Design and Manufacturing Engineering Project 3: Design and application of mechanisms, linkages, and cams; design for manufacturing concepts; fatigue and fracture considerations in design; introduction to FEM in mechanical design.	6
MANU 412	Manufacturing Processes II: Fundamentals of manufacturing processes for metals, polymers, ceramics and composites by cutting, drilling, turning, milling and material forming methods for polymers, ceramics and compositions.	3
MANU 413	Heat Transfer: Conduction, forced and natural convection, and radiation; heat transfer with fluid flow; applications of heat exchange and solidification of castings.	3
MANU 414	Nanomanufacturing and ACSM: Introduction to the concepts, perspectives and applications of nanomanufacturing, atomic manufacturing (ACSM). The developments of materials, approaches and processes in nanomanufacturing and atomic manufacturing.	3
MANU 415	Product Design and Development: The focus of Product Design and Development is integration of the marketing, design, and manufacturing functions of the firm in creating a new product.	3
MANU 421	Finite Element Methods: Theory and element selection; virtual work and weighted residual formulation; linear elastic analysis; heat transfer analysis; isoparametric elements; development of computer programs for simple problems.	3
MANU 422	Computer Control of Mechatronics Systems: Block diagrams and transfer functions; continuous and discrete domain transformations; feedback control system characteristics; control design in the continuous and discrete domain; absolute and relative stability.	4
MANU 423	Engineering Economics: Time value of money; cash flow; capital and operating cost estimation; financial decision-making and relevant case studies for sustainable manufacturing (LCA and remanufacturing).	3

MANU 424	Professional Engineering Practice I: Legislation affecting the practice of engineering; ethical principles and responsibilities; management of engineering enterprises; labour relations; safety and environmental legislation.	3
COMP 7	*Complementary Studies - Elected from Humanities	3
Sum		34

*Elective module (all credit has to be acquired)

“Production Management” Stream Curriculum

	Fourth Year	
MANU 411	Machine Design and Manufacturing Engineering Project 3: Design and application of mechanisms, linkages, and cams; design for manufacturing concepts; fatigue and fracture considerations in design; introduction to FEM in mechanical design.	6
MANU 414	Nanomanufacturing and ACSM: Introduction to the concepts, perspectives and applications of nanomanufacturing, atomic manufacturing (ACSM). The developments of materials, approaches and processes in nanomanufacturing and atomic manufacturing.	3
MANU 415	Product design and development: The focus of Product Design and Development is integration of the marketing, design, and manufacturing functions of the firm in creating a new product.	3
MANU 416	Production System Management III: Inventory analysis and control for single and multi-item systems based on deterministic and stochastic demand models; demand forecasting; production control methods: MRP, MRP-II, Just-in-time, and Kanban.	3
MANU 417	Engineering Economy: Time value of money, cash flows, capital and operating cost estimation, financial decision-making and relevant case studies.	3
MANU 424	Professional Engineering Practice I: Legislation affecting the practice of engineering; ethical principles and responsibilities; management of engineering enterprises; labour relations; safety and environmental legislation.	3
MANU 425	Capstone Design and Manufacturing Project I: Developing a complete paper or conceptual solution in just ten weeks. The teams interact with the project sponsor to define design specifications and expected results.	4
MANU 426	Supply Chain Tactics & Strategies: Review of manufacturing processes for process automation; supply chain configuration and flow balancing; process reengineering and lean manufacturing techniques; design of decision support systems.	3

MANU 427	<p>Digital Enterprise Management (DEM) and Manufacturing Strategies: Financial, organizational, and operational concepts used in industrial firms: manufacturing operations; interfaces with marketing, engineering, and finance; technology strategy; competitive assessment.</p>	3
COMP 7	<p>Classic Philosophy*: Introduction of the beliefs, assumptions, and analyses of experience, together with the intellectual edifice erected upon them, worked out by Ancient Greek philosophers.</p>	3

*Elective module (all credit has to be acquired)

Fifth Year Curriculum

“Production Tech” Stream Curriculum

	Fifth Year	
MANU 511	Machine Design and Manufacturing Engineering Project 4: Final-year machine/product design project with planning of sequential manufacturing operations, tooling and cost estimates.	6
MANU 512	Manufacturing Processes III: Manufacturing processes with emphasis on joining novel machining processes, novel manufacturing processes, e.g., additive, roll-to-roll.	3
MANU 513	Precision Engineering: Concepts and technology enable precision such that the ratio of overall dimensions to uncertainty of measurement is large relative to normal engineering practice, introduction to micro and nanomanufacturing, three manufacturing paradigms.	3
MANU 521	Professional Engineering Practice II: The legal system; companies, partnerships, independent contractors; contract documents, liability, torts and liens; intellectual property; evidence and expert witnessing; employment law; code of ethics.	6
MANU 522	Final Year Project: This course introduces the student to independent project research in the field of design, theories, methods, history and philosophy or architecture. It is essentially an individual study under the supervision of an academic staff. At the end of the session, he produces a final research report to the approved standard.	8
COMP 8	Introduction to Robotics (Technical electives) * Overview of the research fields of robotics. Robotic systems in industrial manufacturing as well as service robots are covered. The key aspects consist of modelling of robots as well as methods for robot control.	3
COMP 9	Failure of Structural Materials: Deformation and Fracture (Technical electives) * Introduction to the relationship between externally applied load and materials strength, the foundation of linear elastic fracture mechanics and main empirical materials models for deformation and fracture.	3
Sum		32

*Elective module (all credit has to be acquired)

Consider to have an industrial group project to solve a large and complex real-world industrial problem.

“Production Management” Stream Curriculum

	Fifth Year	
MANU 511	Machine Design and Manufacturing Engineering Project 4: Final-year machine/product design project with planning of sequential manufacturing operations, tooling and cost estimates.	6
MANU 514	Life Cycle Analysis and Sustainability: Resource analysis, including energy and exergy flows, efficiencies, material resources analysis; LCA of products and services, including input-output models, hybrid models, consequential LCA.	3
MANU 515	Capstone Design and Manufacturing Project II: Implementing to test, and revise the former works in ten-week term. For sponsors, it is an excellent way to leverage cost effective "research and development" while inspiring students with "real- world" experience.	4
MANU 521	Professional Engineering Practice II: The legal system; companies, partnerships, independent contractors; contract documents, liability, torts and liens; intellectual property; evidence and expert witnessing; employment law; code of ethics.	6
MANU 522	Final Year Project: This course introduces the student to independent project research in the field of design, theories, methods, history and philosophy or architecture. It is essentially an individual study under the supervision of an academic staff. At the end of the session, he produces a final research report to the approved standard.	8
COMP 10	Quality Management (Technical electives) * The course covers the state of the art in preventive and non- preventive quality management methods in addition to manufacturing metrology, statistical methods and service-related quality management.	3
COMP 11	Strategic Product Development - Identification of Potentials of Innovative Products (Technical electives) * Introduction to future management, development of scenarios, scenario based strategy development, trend management, innovation- and technology management, scenarios in product development.	3
Sum		33

*Elective module (all credits have to be acquired)

Consider to have an industrial group project to solve a large and complex real-world industrial problem.