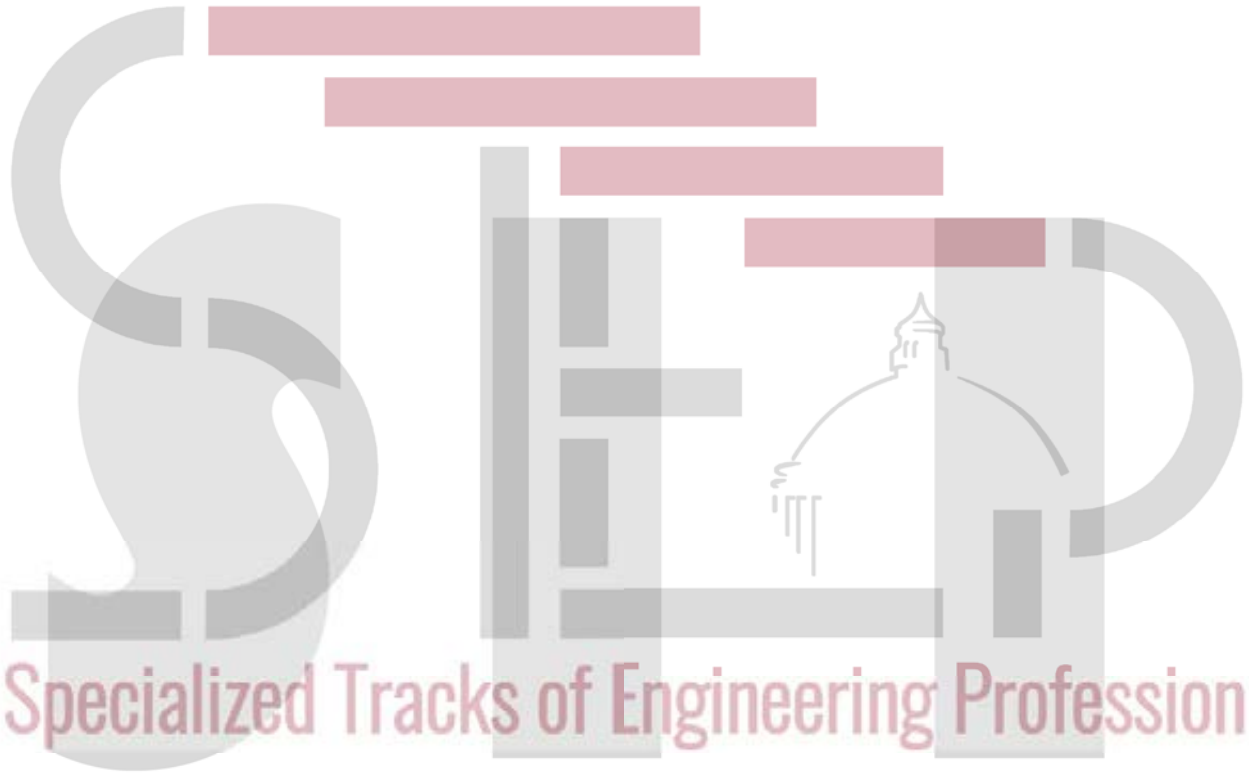

PART [C]: SPECIALIZED PROGRAMS

(11) MECHANICAL DESIGN ENGINEERING Program (MDE)

برنامج هندسة التصميم الميكانيكي

(11) Mechanical Design Engineering Program (MDE)

برنامج هندسة التصميم الميكانيكي

VISION رؤية البرنامج

The vision of the mechanical design engineering program is offering educational program where education, learning and scientific research synergize to provide the society with the innovative mechanical design engineer capable of providing optimal solutions and leading improvement in his profession and contributing to the country's progress.

طرح برنامج تعليمي يتكاتف فيه التعليم والتعلم والبحث العلمي على إمداد المجتمع بمهندس تصميم ميكانيكي مبتكر قادر على تقديم الحلول المثلى وقيادة التطوير في مهنته والمساهمة في تقدم البلاد.

MISSION رسالة البرنامج

The mission of the mechanical design engineering program is to offer distinguished academic services to provide the labor sector and the community with qualified mechanical design engineers capable of competing locally, regionally, and internationally and effectively applying the acquired scientific, technical knowledge and skills to resolve industrial problems and provide solutions and have the capacity for professional self-career development.

تقديم خدمة تعليمية متميزة لإمداد قطاع الأعمال والمجتمع باحتياجاتهم من مهندسي التصميم الميكانيكي القادرين على المنافسة محليا وإقليمياً ودوليا وعلى الاستخدام الكفء والفعال للعلوم والمعارف التقنية والمهارات لحل مشاكل الصناعة وتقديم الحلول والقادرين على التطوير الذاتي مهنياً.

GRADUATE ATTRIBUTES مواصفات الخريج

The mechanical engineering program has the following set of educational objectives:

1. Attracting outstanding local, regional and international students by providing distinguished academic services and encouraging competitive scientific activities.
2. Providing the students with the fundamentals and foundation of basic and engineering sciences to solve technical problems.
3. Providing the students with broad professional education that covers the contemporary and growing aspects in the field of mechanical engineering.
4. Upgrading students' skills in the areas of effective communication with others and working effectively within a team, as well as raising the skills of innovative and creative thinking, with an emphasis on adherence to professional ethics

5. Providing an attractive working environment for distinguished faculty members and providing them with the facilities for improving performance and continuous development.
6. Developing the program's courses to keep pace with the successive developments in science and raise the competitiveness of the graduates.
7. Improving laboratory facilities to support effective learning and research activities.
8. Seeking cooperation with local, regional and international educational and professional bodies to improve student's realization capacities and practical skills.

PROGRAM BENCHMARK مرجعية البرنامج

NARS 2018	LEVEL A	LEVEL B	LEVEL C	LEVEL D
√	Totally Adopted	Totally Adopted	See below	NA

The MDE program has adopted the National Academic Reference Standards (NARS) for Engineering issued by the National Authority for Quality Assurance and Accreditation for Education (NAQAAE) as the program objects to ensure the satisfaction of the national quality assurance standards. The NARS 2018 for Engineering are broad statements that define the main characteristics and performance expected from all engineering students (LEVEL A) upon their graduation so that the MDE program graduate must be able to:

1. Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
3. Behave professionally and adhere to engineering ethics and standards.
4. Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
5. Recognize his/her role in promoting the engineering field and contribute to the development of the profession and the community.
6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
7. Use techniques, skills, and modern engineering tools necessary for engineering practice.
8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.

9. Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
10. Demonstrate leadership qualities, business administration and entrepreneurial skills.

In addition to the Competencies for All Engineering Programs the BASIC MECHANICAL Engineering (LEVEL A) must be able to:

1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.
3. Select conventional mechanical equipment according to the required performance.
4. Adopt suitable national and international standards and codes; and integrate legal, economic, and financial aspects to design, build, operate, inspect and maintain mechanical equipment and systems.

In addition to the competencies of all engineering and basic mechanical engineering, the Mechanical Design Engineering (LEVEL C) graduate must be able to:

1. Use the concepts acquired to evaluate, develop, design, and improve the mechanical systems integrated with the electrical, thermal and hydraulic systems within the industrial projects.
2. Familiarize with the manufacturing process, the effective use of available resources and facilities, project planning and management, time and budget management, safety, and the standard regulations to execute reliable design.

SPECIALIZED COURSES CONTENTS توصيف المقررات

Code	Name	Credit Hours	Category	Pre-requisite
MDES280	Engineering Seminar	1	DR	30 CR.HRS. + AA APROVAL
MDES281	Industrial Training-1	1	FR	60 CR.HRS. + AA APPROVAL
MDES381	Industrial Training-2	2	DR	MDES281. + AA APROVAL
MDES481	Graduation Project-1	1	FR	110 CR.HRS. + SOPHOMORE
MDES482	Graduation Project-2	3	DR	MDES481 + AA APROVAL
Total		**2+6**		

COURSES CONTENTS توصيف المقررات

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
Faculty Requirements										
MDES280	Engineering Seminar	1	1	0						1
	Pre-requisites: 30 CR.HRS. + AA APROVAL									
	Talks and presentations are invited from industrial establishments relevant to the program. The guest speaker should discuss the organization, management, and recent technologies implemented in his/her industrial establishment. Students exercise writing brief technical reports on the guest presentation and deliver their own presentation about the topic. *The course is graded as Pass/Fail grade-system.*									
MDES281	Industrial Training-1	1	0	0						1
	Pre-requisites: 60 CR.HRS. + AA APROVAL									
	Training on industrial establishments relevant to the program. Training lasts for a total of 90 hours, during a minimum period of three weeks. The program training advisor schedules at least one follow up visit to the training venue and formally reports on performance of trainee(s). A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presertation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. *The course is graded as Pass/Fail grade-system.*									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDES381	Industrial Training-2	2	0	0						2
	Pre-requisites: MDES281 + AA Approval									
	Training on industrial establishments relevant to the program. Training lasts for a total of 180 hours, during a minimum period of six weeks. The program training advisor schedules at least two follow-up visits to the training venue and formally reports on performance of trainee(s). A Mentor in the industrial establishment provides a formal report on the student's performance during training. The student submits a formal report and presentation to be evaluated by a panel of three members with one member being an external examiner appointed from industry or other colleges of engineering. *The course is graded as Pass/Fail grade-system.*									
MDES481	Graduation Project-1	1	0	2						2
	Pre-requisites: 110 credits + SOPHOMORE									
	Students – in groups (or individually in some programs) - undertake a final project as part of the program. In GP1, students provide a clear identification of a real-life problem that represents an actual need for the industry or the community and reflects the mission and strategic objective of CUFE. Students are expected to survey the related literature, collect, and interpret market data, and proposed an approach for the solution, using the engineering knowledge and skills acquired. The course is graded as Pass/Fail based upon a report/oral presentation stating the expected cost and required material, tools, and facilities as well as a timed list of deliverables.									
MDES482	Graduation Project-2	3	1	4						5
	Pre-requisites: MDES481 + AA Approval									
	Graduation Project-2 is the second phase of the graduation project. The aim is to develop innovative solutions to problems encountered during the implementation process thus fulfilling the deliverables stated in Graduation Project-1. A dissertation on the project is submitted taking into consideration technical, economic, social, and environmental requirements while analysing the major results and presenting direct conclusions.									

PROGRAM REQUIREMENTS متطلبات البرنامج

Category		No. of courses	Course Credit Hour	Total Credit Hours
Discipline Requirements (DR)	core/ compulsory	1	4	4
		19	3	57
		1	2	2
	Elective	0	0	0
Total DR courses		21		63
Program Requirement (PR)	core/ compulsory	1	2	2
		7	3	21
	Elective	0	2	0
		7	3	21
Total PR courses		15		44
Total Elective courses (DR & PR)		7	3	21

- **Discipline Requirements (DR) core/compulsory courses list**

Code	Name	Credit Hours	Pre-requisite
MTHS102	Linear Algebra and Multivariable Integrals	3	MTHS003
MTHS104	Differential Equations	3	MTHS003
MTHS114	Numerical Analysis	3	MTHS102+ MTHS104
EPES201	Electrical Engineering Fundamentals	3	PHYS002
EPES303	Electric Drive Systems	3	EPES201
MCNS101	Thermodynamics	3	PHYS001
MCNS202	Fluid Mechanics	3	MTHS002
MCNS326	Heat Transfer	3	MCNS101
MDPS001	Fundamentals of Manufacturing Engineering	2	NONE
MDPS132	Material Science	3	NONE
MDPS217	Machine Drawing	3	INTS001
MDPS232	Engineering Materials	3	MDPS132
MDPS241	Manufacturing Processes I	3	PHYS001
MDPS242	Manufacturing Processes II	3	MDPS132

Code	Name	Credit Hours	Pre-requisite
MDPS251	Kinematics of Machine Components	3	EMCS001
MDPS261	Stress Analysis	3	EMCS002
MDPS352	Machine Design	3	MDPS261
MDPS354	Machine and System Design	4	MDPS352+ MDPS355
MDPS355	Dynamics of Machine Components	3	MDPS251
MDPS371	Mechanical Vibrations	3	MDPS355
MDPS372	Control System Dynamics	3	MDPS355
Total		**63**	

- **Program Requirements (PR) core/compulsory courses list**

Code	Name	Credit Hours	Pre-requisite
EPES305	Industrial Instrumentation	3	EPES303
MDPS370	Mechanics of Solids	3	MDPS261
MDPS332	Computer Aided Design and Manufacturing CAD/CAM	3	MDPS241
MDPS363	Finite Element Analysis	3	MDPS261
MDPS381	Fundamentals of Industrial Engineering	3	NONE
MDPS410	Mechanical Lab	2	108 CREDITS
MDPS464	Failure Analysis	3	MDPS261 + MDPS232
MDPS482	Quality Management	3	MTHS005
Total		**23**	

- **Program Requirements (PR) elective courses list**

Code	Name	Credit Hours	Pre-requisite
ELECTIVES 7 courses (21 Credits)			
MDPS353	Mechanism Design	3	MDPS355
MDPS398	Material Handling Systems	3	MDPS381
MDPS399	Product Development and Innovation	3	MDPS381
MDPS432	Pressure Vessels and Piping	3	85 Credits+ AA Approval
MDPS421	Tribology	3	85 Credits+ AAA pproval
MDPS442	Advanced Finite Element Analysis	3	MDPS363+ 85 Credits+ AA Approval
MDPS414	Special Topics in Mechanical Design	3	85 Credits+ AA Approval
MDPS490	Design for Manufacturing	3	MDPS381 + MDPS242

Code	Name	Credit Hours	Pre-requisite
MDPS323	Modern Manufacturing Processes	3	MDPS241 + MDPS242
MDPS444	Sheet Metal Processing	3	MDPS242
MDPS492	Computer Integrated Manufacturing CIM	3	MDPS381 + MDPS242
EPES450	Programmable Logic Controllers	3	EPES303
MDPS423	Robotics Engineering	3	MDPS251
MDPS473	Automatic Control I	3	MDPS372
MDPS457	Fluid Power Systems	3	MCNS202 + MDPS372
MDPS458	Hydraulic Servo Control	3	MDPS457 + MDPS473
MDPS474	Automatic Control II	3	MDPS473
MDPS477	Micro and Nano-Electromechanical Systems	3	MDPS372
MDPS478	Vehicle System Dynamics and Control	3	MDPS372
MDPS382	Engineering Economy and Financial Management	3	E-A (GENS120)
MDPS383	Operations Research I	3	MTHS102
MDPS390	Project Management	3	MDPS381
MDPS394	Design of Experiments	3	MTHS005
MDPS395	Human Factors and Ergonomics	3	MDPS381
MDPS396	Work Design and Measurement	3	MDPS381
MDPS397	Safety Engineering	3	MDPS381
MDPS484	Production and Operations Management	3	MDPS381
MEPS345	Turbomachinery I	3	MCNS202
MEPS425	Renewable Energy	3	85 Credits+ AA Approval
MEPS435	Internal Combustion Engines	3	85 Credits+ AA Approval

Proposed Study Plan - 8 semesters - Including Freshman Level

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	Off Hr	Total
SEMESTER 1	PHYS001	Mechanical Properties of Matter and Thermodynamics	3	2		2	1				5
	MTHS002	Calculus I	3	2	2						4
	EMCS001	Engineering Mechanics - Dynamics	3	1	2		1				4
	CHES001	Chemistry of Engineers	2	1	2						3
	INTS001	Engineering Graphics	3	2				3			5
	INTS005	Information Technology	2	1			3				4
	GENS004	Proficiency and Capacity Building	1	1							1
	GENS001	Critical and Creative Thinking	2	2							2
		Sub-Total	**19**	**13**	**6**	**2**	**4**	**3**	**0**	**0**	**28**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs.	Total
SEMESTER 2	MTHS003	Calculus 2	3	2	2						4
	EMCS002	Engineering Mechanics - Statics	2	1	2						3
	PHYS002	Electricity and Magnetism	3	2		2	1				5
	MTHS005	Introduction to Probability and Statistics	3	2	2	0					4
	MCNS101	Thermodynamics	3	2	2						4
	MDPS132	Materials Science	3	2		2	1				5
	MDPS001	Fundamentals of Manufacturing Engineering	2	1		1	2				4
		Sub-Total	**19**	**12**	**8**	**5**	**4**	**0**	**0**	**0**	**28**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	Off Hr	Total
SEMESTER 3	MDPS261	Stress Analysis	3	2	2						4
	MDPS217	Machine Drawing	3	1	2	0	2				5
	MDPS241	Manufacturing Processes I	3	2		1	2				5
	MTHS102	Linear Algebra and Multivariable Integrals	3	2	2	0					4
	MTHS104	Ordinary Differential Equations & Mathematical Equations	3	2	2	0					4
	GENS00X	E-0	2	2							2
	E-A (GENS005)	Elective E-A (Writing and Presentation Skills)	2	2							2
		Sub-Total	**19**	**13**	**10**	**1**	**2**	**0**	**0**	**0**	**26**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs.	Total
SEMESTER 4	EPES201	Electrical Engineering Fundamentals	3	2		3					5
	MCNS202	Fluid Mechanics	3	2	2						4
	MDPS251	Kinematics of Machine Components	3	2		3					5
	MDPS232	Engineering Materials	3	2	2						4
	MTHS114	Numerical Analysis	3	2	2	0					4
	MDPS242	Manufacturing Processes II	3	2		2	1				5
	MDES280	Seminar	1	1							1
		Sub-Total	**19**	**13**	**6**	**8**	**1**	**0**	**0**	**0**	**28**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	Off Hr	Total
SEMESTER 5	MDPS352	Machine Design	3	2		3					5
	MCNS326	Heat Transfer	3	2	2						4
	MDPS381	Fundamentals of Industrial Engineering	3	2		3					5
	MDPS355	Dynamics of Machine Componen:s	3	2		3					5
	EPES303	Electric Drive Systems	3	2		3					5
	E-A (GENS120)	Elective E-A (Fund. of Economics and Accounting)	2	2							2
	E-A (GENS110)	Elective E-A (Fundamental of Management, Risk and Environment)	2	2							2
		Sub-Total	**19**	**14**	**2**	**12**	**0**	**0**	**0**	**0**	**28**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs.	Total
SEMESTER 6	MDPS372	Control System Dynamics	3	2		2	1				5
	MDPS354	Machine and System Design	4	2	4						6
	MDPS371	Mechanical Vibrations	3	2	2						4
	MDPS363	Finite Element Analysis	3	2	2						4
	MDPS370	Mechanics of Solids	3	2	2						4
	XXXSXXX	Program Elective 1	3	2	2						4
		Sub-Total	**19**	**12**	**12**	**2**	**1**	**0**	**0**	**0**	**27**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App Tut	Lab	Stud	Off Tut	Off Hr	Total
SEMESTER 7	MDPS482	Quality Management	3	2	2						4
	MDPS332	Computer Aided Design and Manufacturing CAD/CAM	3	2	2						4
	EPES305	Industrial Instrumentation	3	2	2						4
	XXXSXXX	Program Elective 2	3	2	2						4
	XXXSXXX	Program Elective 3	3	2	2						4
	XXXSXXX	Program Elective 4	3	2	2						4
	MDES481	Graduation Project I	1	0	2						2
		Sub-Total	**19**	**12**	**14**	**0**	**0**	**0**	**0**	**0**	**26**

S	Code	Name	Credit Hours	Contact Hours							
				Lec	Tut (2)	App. Tut	Lab	Stud	Off Tut	Off. Hrs.	Total
SEMESTER 8	GENS30X	E-1	2	2							2
	MDPS410	Mechanical Lab	2	1			3				4
	MDPS464	Failure Analysis	3	2	2						4
	XXXSXXX	Program Elective 5	3	2	2						4
	XXXSXXX	Program Elective 6	3	2	2						4
	XXXSXXX	Program Elective 7	3	2	2						4
	MDES482	Graduation Project II	3	1	4						5
		Sub-Total	**19**	**12**	**12**	**0**	**3**	**0**	**0**	**0**	**27**

COURSES CONTENTS توصيف المقررات

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
Discipline Courses (Compulsory)										
MTHS102	Linear Algebra and Multivariable Integrals	3	2	2	0					4
	Pre-requisites: MTHS003									
	Solving Linear Systems, Vector Spaces and Subspaces, Inner Product Spaces and Orthonormal Bases, The Eigenvalue Problem; Diagonalization of Matrices, Computing Functions of Matrices. Functions of Several Variables, The Gradient of a Scalar Function and its Applications, Vector Fields, Curl and Divergence, Double and Triple Integrals with Applications, Line and Surface Integrals with Applications.									
References	- Calculus Early Transcendentals", by J. Stewart, 8th edition, 2015, Cengage Learning - Elementary Linear Algebra with Applications" by B. Kolman and D. Hill, 2013, Pearson.									
MTHS104	Differential Equations	3	2	2	0					4
	Pre-requisites: MTHS003									
	First-order differential equations, separable, exact, linear, homogeneous and Bernoulli equations; modeling with first order differential equations; higher-order differential equations; method of undetermined coefficients; variation of parameters; modeling with higher order differential equations; series solutions; Laplace transform; properties and applications, shifting theorems, convolution theorem; solutions of differential equations using Laplace transform; Fourier series; Fourier transform.									
References	1- "A First Course in Differential Equations with Modeling Applications" 11th Edition 2017, by Dennis G. Zill 2- "Fundamentals of Differential Equations", 9th Edition, 2017, by R. Nagle, Edward Saff, Arthur Snider									
MTHS114	Numerical Analysis	3	2	2	0					4
	Pre-requisites: MTHS102 + MTHS104									
	Basic concepts of floating- point arithmetic- Conditioning of a problem-Numerical stability of an algorithm – Linear systems: direct methods (Gauss elimination, LU factorization, Choleski) – Iterative methods (Jacobi –Gauss-Seidle – SOR). Approximation of Functions: polynomials and piecewise polynomial interpolation, splines, discrete least squares. Nonlinear equations: Newton's method and its discrete variants, fixed point iteration. Numerical integration: Newton- Cotes formulas, Gaussian quadrature rules, composite rules. Initial value problems for ordinary differential equation: one-step methods (Runge-Kutta methods) and multistep (Adams) methods. Stiff problems.									
References	S. Chapra and R. Canali, Numerical Methods for Engineers, 7th ed., McGraw Hill, 2014.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
EPES201	Electrical Engineering Fundamentals	3	2	0	3					5
	Pre-requisites: PHYS002									
	Electrical elements and electrical quantities. Basic electrical laws (voltage and current divider rules, star-delta transformation). Analysis of DC circuits (branch currents, node voltages and Thevenin's theorem). First order capacitive transients. Time varying signals (average and RMS values, voltage and current waveforms). Analysis of AC circuits (vector and complex representations of sine waves, concept of impedance, power analysis, power factor correction). Three phase circuits (line and phase voltages, star and delta connected balanced loads, three phase power). Transformers circuits. Course project.									
References	A. R. Hambley, Electrical Engineering: Principles and Applications, 7th ed. Pearson, 2018.									
EPES303	Electric Drive Systems	3	2	0	3					5
	Pre-requisites: EPES201									
	Power Electronic Converters for Motor Drives: Controlled Rectifiers, DC Choppers, Inverters. DC Motor Drives: Structure and Operation of DC Motors, Types of DC Motors, Thyristor and Chopper DC Drives. Induction Motor Drives: Motor Structure and Operation, Speed Control, Inverter-fed Drives. Stepper Motor Drives: Principle of Operation, Motor Characteristics, Drive Circuits. Course Project.									
References	P. C. Sen, Principles of Electric Machines and Power Electronics, 3rd ed., Wiley, 2013									
MCNS101	Thermodynamics	3	2	2	0					4
	Pre-requisites: PHYS001									
	Basic concepts. Pure substances - First law of thermodynamics and applications – second law of thermodynamics and corollaries – entropy. May include a visit to a power plant, course project									
References	Claus Borgnakke and Richard E. Sonntag, Fundamentals of Thermodynamics, 10th Edition, Wiley, 2019.									
MCNS202	Fluid Mechanics	3	2	2	0					4
	Pre-requisites: MTHS002									
	Fluid kinematics. flow types. Integral analysis of flow: Continuity, Linear momentum, Angular momentum and Energy equations, Applications. Similitude and dimensional analysis and modeling, Viscous flow in pipes anc ducts. Flow measurement. General applications. Course project computer oriented.									
References	Philip M. Gerhart, Andrew L. Gerhart, John I. Hochstein, Munson, Young and Okiishi's Fundamentals of Fluid Mechanics, 8th Edition, Wiley, 2018.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MCNS326	Heat Transfer	3	2	2	0					4
	Pre-requisites: MCNS101									
	Conduction: General equation of conduction, one dimensional steady-state conduction, steady-state conduction with internal heat generation, steady conduction with variable thermal conductivity, fins and extended surfaces, unsteady conduction. Convection: fundamentals of convection, dimensionless groups, natural and forced convection, use of empirical correlations. Radiation: Fundamentals of heat transfer by radiation. Case studies and computer applications.									
References	Frank P. Incropera, David P. DeWitt, Theodore L. Bergman, Adrienne S. Lavine, Fundamentals of Heat and Mass Transfer, 6th Edition, John Wiley & Sons, 2006.									
MDPS001	Fundamentals of Manufacturing Engineering	2	1	0	1	2				4
	Pre-requisites: NONE									
	Engineering Materials - Elements of Manufacturing Processes - Casting and molding processes- metal forming processes - Shaping of plastic material - Joining processes - Metal cutting and finishing processes - Modern Manufacturing, additive manufacturing and 3D printing									
References	Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th Edition, Wiley, 2019.									
MDPS132	Materials Science	3	2	0	2	1				5
	Pre-requisites: NONE									
	Introduction to materials engineering, atomic structure and interatomic bonding, Crystal structures, crystal imperfections, Diffusion, Mechanical properties, Strengthening mechanisms and plastic deformation, phase diagrams, Iron carbon phase diagram, Types of cast iron, Phase transformations and isothermal heat treatments (TTT). Classification of Metals. Mechanical testing of metals: tension, compression, bending, torsion, hardness.									
References	William D. Callister Jr., David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, Wiley, 2018.									
MDPS217	Machine Drawing	3	1	2	0	2				5
	Pre-requisites: INTS001									
	Sketching and drafting of actual Mechanical components and Assemblies - Assembly drawing, working drawing, dimensioning, limits, fits, Geometrical and dimensional tolerances, surface roughness. Standard machine elements (threads, fasteners, locking devices, keys, splines, gears, pulleys, bearings, pipe connections, etc.) - Welding and riveting conventions. Standardization and designation of machine elements. Computer aided graphics application.									
References	David A. Madsen, David P. Madsen, Engineering Drawing and Design, 6th Edition, Cengage Learning, 2016.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS232	Engineering Materials	3	2	2						4
	Pre-requisites: MDPS132									
	Heat treatments of steel, Classification of Alloy steels, Non-ferrous metals and alloys: copper and its alloys and aluminum and its alloys, Age hardening, Introduction to Polymers, Introduction to Composites, Introduction to Ceramics.									
References	William D. Callister Jr., David G. Rethwisch, Materials Science and Engineering: An Introduction, 10th Edition, Wiley, 2018.									
MDPS241	Manufacturing Processes I	3	2	1	2					5
	Pre-requisites: PHYS001									
	Examination of metal cutting processes including turning, shaping, drilling and milling. Mechanics of cutting, chip formation, shear plane, velocity relations, merchant circle, tool material, tool wear, tool life, economy in metal cutting. Introduction and definitions of metrology – Gauges – Errors in measurement – Linear and angle measuring instruments test of geometrical shape: straightness and flatness.									
References	Fundamentals of Machining and Machine Tools, Geoffrey Boothroyd, 3rd edition, Taylor & Francis Inc									
MDPS242	Manufacturing Processes II	3	2	0	2	1				5
	Pre-requisites: MDPS132									
	Casting: Types of foundries, steps in making a casting; cast metals; types, materials and allowances of patterns; Molding processes and materials; gating and risering; casting defects. Forming: Metal forming process classification, basic metal working concepts and plasticity; yield criterion; slip line fields; estimation of force and energy requirements; technology of bulk and sheet metal forming processes; precision forming processes; features of different types of metal forming dies; principles of powder forming. Welding: Welding processes; welding energy sources and their characteristics; fluxes and coatings; weldability and welding of various metals and alloys; metallurgical characteristics of welded joints; weld testing and inspection. Course project.									
References	Manufacturing Technology, Vol. 1 Foundry, Forming and Welding, RAO, 4th Edition. McGraw Hill 2013									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS251	Kinematics of Machine Components	3	2		3					5
	Pre-requisites: EMCS001									
	Kinematics fundamentals: geometry of motion and mechanism topology, Machine components, indexing mechanisms, linkage mechanisms and planar robots: (position, velocity and acceleration), Cam-follower mechanisms: design and analysis, standard cams and equivalent mechanisms, Gear trains (simple, compound and planetary): Kinematics, geometry and assembly conditions, Simulation using Computer Graphics and MATLAB Software and case studies, Course project									
References	R.L. Norton, Design of Machinery, 6th ed. McGraw Hill, 2019.									
MDPS261	Stress Analysis	3	2	2						4
	Pre-requisites: EMCS002									
	Equilibrium, continuity, material mechanical behavior. Normal force, shearing force, bending and twisting moment diagrams. Stresses in simply loaded elastic bars: axial loading, bending and torsion, deformation, stiffness, strain energy. Stresses in elastic and elasto-plastic bars, residual stresses. Combined loading, eccentric normal load, oblique bending, combined bending and torsion. Two-dimensional stresses, principal stresses, maximum shear stress, allowable stresses, Mohr's circle representation. Application to simple frames, thin-walled vessels, springs, load and displacement measurement. Course project computer oriented.									
References	Russell C. Hibbeler, Mechanics of Materials in SI Units, 10th edition, Pearson, 2018.									
MDPS352	Machine Design	3	2	0	3					5
	Pre-requisites: MDPS261									
	Design procedures – Factors affecting design details – Selection of materials – Modes of loading – Safety factors and allowable stresses – Design variants and inversions. The various design calculations. Interpretation and usage of component data sheets. Design of detachable joints: (threaded joints, keys and splines) – Design of permanent joints: (welding, interference fitting, riveting, riveting, riveting, adhesion) – Design of some machine elements: springs, power screws. Applications to small-scale mechanical systems. Course project.									
References	Richard Budynas, Keith Nisbett, Shigley's Mechanical Engineering Design, 10th Edition, McGraw Hill, 2014.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS354	Machine and System Design	3	2	4						6
	Pre-requisites: MDPS352 + MDPS355									
	Design of Power transmission elements, Shaft design, Bearing design and Selection, Gear design (spur, helical and bevel gears), Sprocket and chain design, Belts and Pulley, Brake Design, Clutch design. Course Project is a major activity and is evaluated by 40% of the course term grades. In the project students in small groups will apply the knowledge acquired on the mechanics of machines and components and on mechanical design to handle the design of some mechanical modules. These will be selected, such as to be of educational value and of an accuracy level commensurate with their functional requirements. The designs will be constructed and assessed as to the extent of verifying and coping with their requirements. The evaluation of the project will be in form of a presentation by each group before their fellow students and the instructor.									
References	Richard Budynas, Keith Nisbett, Shigley's Mechanical Engineering Design, 10th Edition, McGraw Hill, 2014.									
MDPS355	Dynamics of Machine Components	3	2		3					5
	Pre-requisites: MDPS251									
	Dynamics fundamentals and basic concepts, Plane Kinetics of Rigid bodies: force-mass-acceleration, work and energy, virtual work, balancing of machinery: rotating elements, 4-bar linkage, reciprocating elements, Engine dynamics, balancing of single cylinder engine, Flywheel design and turning moment diagram, multi-cylinder engines: Line engines, V-engines, W-engines, Simulation using Computer Graphics and MATLAB Software and case studies, Course project									
References	R.L. Norton, Design of Machinery, 6th ed. McGraw Hill, 2019.									
MDPS371	Mechanical Vibrations	3	2	2						4
	Pre-requisites: MDPS355									
	Introduction and basic concepts, sources and causes of vibrations, free and forced vibrations of SDOF systems, vibration transmissibility, vibration control, free and forced vibrations of 2DOF systems, vibration absorber, MDOF systems: (natural frequencies and normal modes, forced vibrations), vibration measurement methods, computer-aided simulation and case studies, course project									
References	S. S. Rao, Mechanical Vibrations, 6th ed., Pearson, 2017.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS372	Control System Dynamics	3	2	0	2	1				5
	Pre-requisites: MDPS355									
	Introduction to system dynamics; Mathematical modelling of dynamic systems (mechanical, electrical, electronic, hydraulic, pneumatic, and thermal); Transfer-function approach; State-space approach; Time-domain analysis – Block diagrams - Transient response – Stability analysis – Root locus; Frequency-domain analysis– Bode diagrams – Nyquist plots. Computer simulation and case studies. Course project.									
References	K. Ogata, Modern Control Engineering, 5th ed., Pearson, 2010.									

Program Courses (Compulsory)

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
EPES305	Industrial Instrumentation	3	2	2	0	0				4
	Pre-requisites: EPES303									
	Logic gates, circuit design with logic gates. Operational amplifier circuits and applications. Digital electronics. Performance of analogue and digital transducers; selecting a proper transducer for a given application. Analogue transducers: solenoids, thermocouples, pressure transducers. Digital transducers: optical encoders, ultrasonic sensors. Signal conditioning: signal analysis, frequency response, filter design, op-amp circuits. Data acquisition systems (A/D and D/A converters). Stepper motors: microprocessors: structure, programming, applications. Course project.									
References	William Dunn, Fundamentals of Industrial Instrumentation and Process Control,2nd Edition, McGraw Hill, 2018.									
MDPS370	Mechanics of Solids	3	2	2	0					4
	Pre-requisites: MDPS261									
	Energy methods, curved bars, Thin-walled pressure vessels, Shear stresses in non-circular sections, Introduction to Theory of Elasticity, States of stress and Strain, Stress-strain Relations, Application to problems in polar coordinates such as: Thick- walled spheres and cylinders, Inelastic material behavior: introduction to theory of plasticity, Yield and flow criterion, applications to beams, shafts and cylinders, Computer applications and case studies, Course project.									
References	Russell C. Hibbeler, Mechanics of Materials in SI Units, 10th edition, Pearson, 2018.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS332	Computer Aided Design and Manufacturing CAD/CAM	3	2	2	0	0				4
	Pre-requisites: MDPS241									
	Product Cycle and CAD/CAM, Automation and CAD/CAM, Programming for lathe, drilling and milling machines, canned cycles, subroutines, Do Loops, Computer assisted part programming, DNC, CNC, Adaptive control. Industrial robotics: Robot physical configurations, robot motions, accuracy, repeatability, end effecter, sensors, robot programming, robot languages. Group Technology: part families, part classifications and coding systems, group technology machine, cell, concepts of composite part, benefits and limitations. Computer aided process planning: Retrieval type process planning systems, generative process planning systems, machinability data systems, computer generated time standard. Computer Integrated Manufacturing: Types of manufacturing systems, types of CIMS, special manufacturing systems, Flexible Manufacturing Systems FMS, Manufacturing Cells, Course project.									
References	Sheet Metal Forming Fundamentals, Taylan Altan & Erman Takkaya, 2012, ASM International.									
MDPS363	Finite Element Analysis	3	2	2	0	0				4
	Pre-requisites: MDPS261									
	Basic principles of continuum mechanics and finite element methods, modern application to solution of practical problems in solid, structural, and fluid mechanics, heat and mass transfer, and other field problems. Kinematics of deformation, strain and stress measures, constitutive relations, conservation laws, virtual work, and variational principles. Discretization of governing equations using finite element methods. Solution of central problems using an existing general-purpose finite element analysis program, Course project.									
References	Nam-Ho Kim, Bhavani V. Sankar, Ashok V. Kumar, Introduction to Finite Element Analysis and Design, 2nd Edition, Wiley, 2018.									
MDPS381	Fundamentals of Industrial Engineering	3	2	0	3					5
	Pre-requisites: None									
	This course provides an introduction to the field of industrial engineering, covering the basic concepts, principles, and tools used by industrial engineers to improve productivity, efficiency, and quality in manufacturing and service industries. Topics covered include production systems design, work methods and measurement, production planning and control, and quality control. The course also covers the history and current state of the field, as well as the various career opportunities available in industrial engineering.									
References	"Introduction to Industrial Engineering" by Avraham Shtub and Jonathan F. Bard.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS410	Mechanical Lab	2	1	0	0	3				4
	Pre-requisites: 108 CREDITS									
	Introduction to experimentation, Endurance test setups for mechanical components, acquisition, adjusting, plotting and interpretation of test results, extraction of reliability data. Experiments are oriented to four disciplines: Design and Tribology; Solid Mechanics; Metallurgy and Microstructure; Dynamics. The evaluation of students will be upon reports submitted by students, a written exam in Mid-Term and an Oral Exam by a panel of beer examiners.									
References	Not applicable									
MDPS464	Failure Analysis	3	2	2	0	0				4
	Pre-requisites: MDPS261 + MDPS232									
	Functional and structural failures. Tribological surface failure, abrasive, adhesive, fatigue wear, fretting and corrosive wear. Design against wear. Modes of bulk failures, excessive deformation, buckling, yielding, plastic instability, creep and creep rupture. Incremental collapse, fracture mechanics and crack propagation. Damage-tolerant design. Identification and detection of failures. Applications to some mechanical components. Case studies. Course project.									
References	Russell C. Hibbeler, Mechanics of Materials in SI Units, 10th edition, Pearson, 2018.									
MDPS482	Quality Management	3	2	2	0					4
	Pre-requisites: MTHS005									
	Introduction to quality systems. Cost of quality. Total quality management. Quality systems and standards: six sigma and ISO. Reengineering. Statistical quality control: control charts for variables and attributes, process capability analysis, acceptance-sampling plans. Quality function deployment. Quality circles. Quality loss functions.									

Program Courses (Electives)										
Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
EPES450	Programmable Logic Controllers	3	2	2	0	0				4
	Pre-requisites: EPES303									
	Selecting a proper PLC configuration for a given application. Hardware structure and wiring techniques. Basics of programming (bit and word programming, analogue values processing). Programming sequential control tasks. Structured programming techniques. Networking. Building simple supervisory control and data acquisition (SCADA) system integrated with a PLC for sequential control problems. Course project.									
References	F. Petruzella, Programmable Logic Controllers, 5th ed., McGraw Hill, 2016.									
MDPS323	Modern Manufacturing Processes	3	2	2	0	0				4
	Pre-requisites: MDPS241 + MDPS242									
	Gear and thread manufacturing; non-conventional metal cutting; Electro-chemical machining; Electro discharge machining; Laser beam machining; Electron beam machining; Water jet machining; Rapid Prototyping; micro system product; micro fabrication processes; Property enhancing of metals; cleaning and surface treatment; Coating and deposition processes; Thermal and mechanical coating; Processing of integrated circuit.									
References	Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 7th Edition, Wiley, 2019									
MDPS353	Mechanism Design	3	2	2	0	0				4
	Pre-requisites: MDPS355									
	Introduction and basic concepts, Mechanisms and structures, Number synthesis, Paradoxes, Isomers, Linkage transformation, Intermittent motion, Inversion, Function path and motion generation Graphical synthesis of planar mechanisms: Two-position synthesis, Three-position synthesis, Quick-return mechanisms, Coupler curves, Analytical synthesis of planar mechanisms, Optimal planar mechanism synthesis, Analytical synthesis of simple toggles, Introduction to spatial mechanism synthesis, simulation using Computer Graphics and MATLAB Software and case studies. Course project									
References	R.L. Norton, Design of Machinery, 6th ed. McGraw Hill, 2019.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS382	Engineering Economy and Financial Management	3	2	2	0	0				4
	Pre-requisites: E-A (GENS120)									
	principles of economics and finance as they apply to engineering projects and organizations, including time value of money, investment analysis, cost estimation, financial accounting, budgeting, risk management, and financial reporting.									
References	"Engineering Economic Analysis" by Donald G. Newnan, Jerome P. Lavelle, and Ted G. Eschenbach.									
MDPS383	Operations Research I	3	2		2	1				5
	Pre-requisites: MTHS102									
	Introduction to Operations Research. Formulation of linear programming problems. Graphical solution. The Simplex algorithm. Duality and sensitivity analysis. Transportation and assignment problems. Integer and Goal programming.									
References	Frederick Hillier, Gerald Lieberman, Introduction to Operations Research 11th Edition, McGraw Hill, 2021.									
MDPS390	Project Management	3	2	2	0	0				4
	Pre-requisites: MDPS381									
	Introduction to Project planning and scheduling, Project charter, Scope statement, Work Breakdown Structure, Responsibility Chart. Network diagram, Schedule analysis and possibilities using the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT). Resource leveling and allocation, Time-cost trade off (Crashing a schedule), Gantt Chart, Time overlaps, Time and cost control, Risk monitoring and control, Computer applications with case studies.									
References	"A Guide to the Project Management Body of Knowledge (PMBOK Guide)" by Project Management Institute.									
MDPS394	Design of Experiments	3	2	2						4
	Pre-requisites: MTHS005									
	Principles of experimental design. Randomized complete block designs. Latin square and Greco-Latin square designs. General factorial designs. 2k Factorial designs. Response surface methodology and robust design. Planning, performing and analyzing industrial experiments.									
References	"Design and Analysis of Experiments" by Douglas C. Montgomery									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS395	Human Factors and Ergonomics	3	2	2	0	0				4
	Pre-requisites: MDPS281									
	This course covers the principles and techniques of human factors and ergonomics, which focus on designing products, systems, and environments that are safe, efficient, and comfortable for human use. Topics include human physiology and anatomy, cognitive psychology, biomechanics, anthropometry, and human-computer interaction. The course also covers the application of human factors and ergonomics in various industries, such as manufacturing, healthcare, and transpo tation.									
References	"Handbook of Human Factors and Ergonomics" by Gavriel Salvendy									
MDPS396	Work Design and Measurement	3	2	2	0	0				4
	Pre-requisites: MDPS381									
	This course covers the principles and techniques of human factors and ergonomics, which focus on designing products, systems, and environments that are safe, efficient, and comfortable for human use. Topics include human physiology and anatomy, cognitive psychology, biomechanics, anthropometry, and human-computer interaction. The course also covers the application of human factors and ergonomics in various industries, such as manufacturing, healthcare, and transpo tation.									
References	"Handbook of Human Factors and Ergonomics" by Gavriel Salvendy									
MDPS397	Safety Engineering	3	2	2	0	0				4
	Pre-requisites: MDPS381									
	This course covers the principles and techniques of safety engineering, which focus on identifying and controlling hazards in various industries to prevent accidents and injuries. Topics include hazard analysis, risk assessment, safety regulations and standards, accident investigation, and safety management systems. The course also covers the application of safety engineering in various industries, such as manufacturing, construction, and healthcare.									
References	"Safety Engineering: Principles and Practices" by G. D. Hale									
MDPS398	Material Handling Systems	3	2	2	0	0				4
	Pre-requisites: MDPS381									
	This course covers the principles and techniques of material handling systems, which focus on the movement, storage, control, anc protection of materials in various industries. Topics include material handling equipment, systems, and operations; transportation systems; storage systems; and control systems. The course also covers the application of material handling systems in various industries, such as manufacturing, distribution, and logistics.									
References	"Material Handling and Logistics" by John A. White, Jr., et al.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS399	Product Development and Innovation	3	2	2	0	0				4
	Pre-requisites: MDPS381									
	This course covers the theory and practice of product development and innovation, with an emphasis on the industrial engineering perspective. Topics include the product development process, creativity and ideation techniques, concept development and selection, design for manufacturability, prototyping and testing, and commercialization. The course also covers the application of product development and innovation principles in various industries, such as consumer goods, electronics, and medical devices.									
References	"Product Design and Development" by Karl T. Ulrich and Steven D. Eppinger.									
MDPS414	Special Topics in Mechanical Design	3	2	2	0	0				4
	Pre-requisites: 85 Credits+ AA Approval									
	Students study one or more topics in Mechanical Design Engineering that are not covered by other program courses and/or that present recent or advanced development of interest to mechanical engineers. Course project.									
MDPS421	Tribology	3	2	2	0	0				4
	Pre-requisites: 85 Credits+ AA Approval									
	Surface topography, Nature of surface and contacts, Viscosity and Rheology, Methods of fluid-film formation, Friction mechanism, Mechanisms of wear, Plain bearing materials, Bearing surface coatings and treatments, Wear resistant materials, Rolling bearing materials, Gear materials, Friction materials, Properties of friction materials, Mineral oils, Synthetic oils, Greases, Solid lubricants and coatings, Selection of lubricant types, Plain bearing lubrication, Rolling bearing lubrication, Gear and chain lubrication, Selection of bearing type and form, Selection of journal bearing, Selection of thrust bearing, Pressure-fed fluid film bearings, Grease, wick, and drip-fed lubricated journal bearings, Dry rubbing bearings, Plain-thrust bearings, Profiled-pad thrust bearings, Tilting-pad thrust bearing, Plain bearings form and installation, Mechanical seals, Selection of seals, Wear-resistant parts, (material selection), course project and computer applications									
References	J. Craig, Introduction to Robotics: Mechanics and Control, 4th ed. Pearson, 2017.									
MDPS423	Robotics Engineering	3	2	2	0	0				4
	Pre-requisites: MDPS251									
	Introduction to Robotics Technology, Robot structures and components, Kinematics and dynamics of planar robots, Kinematics of 3-D robots and homogeneous transformation, Trajectory planning and robot control methods, computer simulation and practical training. course project									
References	J. Craig, Introduction to Robotics: Mechanics and Control, 4th ed. Pearson, 2017.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS432	Pressure Vessels and Piping	3	2	2	0	0				4
	Pre-requisites: MDPS261 + MDPS132 + 85 Credits+ AA Approval									
	Introduction to ASME Boiler, Pressure Vessels, and Piping Codes. Section VIII Divs. 1 and 2. B31 code series. Material selection. Basic principles in design. Types of loads. Failure theories. Design for internal and external pressure. Design of end closures with various geometries. Design of openings and nozzles. Fabrication requirements. Non-destructive examination and testing. Piping stress and flexibility analyses, design and selection of piping supports. Computer implementation of general-purpose software packages. course project									
References										
MDPS442	Advanced Finite Element Analysis	3	2	2						4
	Pre-requisites: MDPS363 + 85 Credits+ AA Approval									
	Basic principles of continuum mechanics and finite element methods. Kinematics of deformation, strain and stress measures, constitutive relations, conservation laws, virtual work, and variational principles. Modern application to solution of practical problems in solid mechanics, heat transfer, and dynamic problems. Multiphysics problems with emphasis on thermo-mechanics and elasto-dynamic applications. Solution of fundamental problems using an existing general-purpose finite element analysis program. course project									
References	Nam-Ho Kim, Bhavani V. Sankar, Ashok V. Kumar, Introduction to Finite Element Analysis and Design, 2nd Edition, Wiley, 2018.									
MDPS444	Sheet Metal Processing	3	2	0	2	1				5
	Pre-requisites: MDPS242									
	Review of Sheet metal industry applications, Sheet Metal Properties, Deformation of sheet metals, Simple Stamping Analysis, Deep Drawing Die design, Sheet metal shearing and bending, Non-Conventional Sheet metal processes. Die design: Standard parts, progressive and compound dies, Mechanical and Hydraulic Presses selection-CNC punch presses. Course project									
References	References Sheet Metal Forming Fundamentals, Taylan Altan & Erman Takkaya, 2012, ASM International.									
MDPS457	Fluid Power Systems	3	2	2	0	0				4
	Pre-requisites: MCNS202 + MDPS372									
	Fluid power transmission; actuation and control – Properties of hydraulic fluids – Positive displacement pumps and motors; types, static characteristics of constant and variable geometric volume units, flow rate, torque and power – Cylinders – Pressure, flow, and directional control valves; direct and pilot operated, static flow forces acting on poppets and spools, static characteristics of valves – Accumulators – Accessories – Throttling and non-throttling systems –Basics of design of fluid power systems and examples from industrial and mobile applications – Course project.									
References	M. G. Rabie, Fluid Power Engineering, McGraw Hill, 2009.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS458	Hydraulic Servo Control	3	2	2	0					4
	Pre-requisites: MDPS457 + MDPS473									
	Fields of applications of hydraulic servo systems –Hydraulic servo systems versus proportional systems and electric servo systems – Hydraulic servo valves; types, static characteristics, valves coefficients, lapping conditions – Transient and steady state flow forces acting on spools and flappers – Pilot operated servo valves and types of feedback – Dynamic characteristics of servo valves and fluid lines – Hydro mechanical and electro-hydraulic servo systems; loop gain, stability, dynamics – Course project.									
References	M. G. Rabie, Fluid Power Engineering, McGraw Hill, 2009.									
MDPS473	Automatic Control I	3	2	2	0					4
	Pre-requisites: MDPS372									
	Introduction to feedback control systems; Control system characteristics; Control Design by the Root locus method; Control Design by the Frequency-response method; PID Controllers and Tuning. Computer simulation and case studies. Course project.									
References	K. Ogata, Modern Control Engineering, 5th ed., Pearson, 2010.									
MDPS474	Automatic Control II	3	2	2	0					4
	Pre-requisites: MDPS473									
	Linear control systems analysis in State Space – State-Transition Matrix - Controllability – Observability; Linear control systems design in State Space – Pole placement – State Observers – Linear quadratic regulators. Computer simulation and case studies. Course project.									
References	K. Ogata, Modern Control Engineering, 5th ed., Pearson, 2010.									
MDPS477	Micro and Nano-Electromechanical Systems	3	2	2	0	0				4
	Pre-requisites: MDPS372									
	Introduction to Micro and Nano-Electromechanical Systems (MEMS/NEMS); Design of MEMS/NEMS; Fabrication of MEMS/NEMS; Principles of sensing and actuation in MEMS/NEMS: Electrostatic – Piezoresistive - Magnetic; Applications of MEMS/NEMS; Computer Simulations and Course Project.									
References	Sergey Edward Lyshevski, Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering, Second Edition, CRC Press, 2005									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MDPS478	Vehicle System Dynamics and Control	3	2	2	0	0				4
	Pre-requisites: MDPS372									
	Introduction – vehicle body motion – Tires – Suspension systems – Equations of motion of passenger cars – vehicle stability - Simulation of motion of passenger cars - Fundamentals of Hybrid Electric Vehicles and Electric Vehicles, Course Project.									
References	Dean Karnopp, Vehicle Dynamics, Stability, and Control, 2nd Edition, CRC Press, 2013.									
MDPS484	Production and Operations Management	3	2	2	0	0				4
	Pre-requisites: MDPS381									
	Basic concepts of Production and Operations Management (POM). Design of products and services. Processes and technologies, Inventory management. Forecasting. Material Requirements Planning (MRP). Scheduling. Supply-Chain management. Just-in-time and lean production. Introduction to Enterprise Requirement Planning (ERP). Capacity and Aggregate planning.									
References	Khojasteh Yacob, Production Management: Advanced Models, Tools, and Applications, CRC Press, 2017.									
MDPS490	Design for Manufacturing	3	2	2	0	0				4
	Pre-requisites: MDPS381 + MDPS242									
	This course covers the principles and practices of designing products for efficient and cost-effective manufacturing. Topics include design guidelines for various manufacturing processes, such as casting, forming, machining, and assembly, as well as considerations for material selection, geometric tolerancing, and design for sustainability. The course also covers the use of computer-aided design (CAD) and computer-aided manufacturing (CAM) tools to optimize the design and production process.									
References	"Design for Manufacturability Handbook" by James G. Bralla.									
MDPS492	Computer Integrated Manufacturing CIM	3	2	2	0	0				4
	Pre-requisites: MDPS381 + MDPS242									
	The Computer Integrated Manufacturing (CIM) course provides an overview of the principles and practices of computer-based manufacturing systems. The course covers the key activities involved in CIM, such as computer-aided design (CAD), computer-aided manufacturing (CAM), computer numerical control (CNC), and robotics. It also covers emerging topics in CIM, such as additive manufacturing, virtual manufacturing, and smart manufacturing. The course emphasizes the integration of computer-based technologies with traditional manufacturing processes, such as casting, machining, and assembly.									
References	"Computer Integrated Manufacturing" by James A. Rehg and Henry W. Kraebber.									

Code	Name/Content	Credit Hours	Contact Hours							
			Lec	Tut (2)	App. Tut	Lab	Stud	Off. Tut	Off. Hrs.	Total
MEPS345	Turbomachinery I	3	2	2	0	0				4
	Pre-requisites: MCNS202									
	Fans, Compressors, Pumps and Turbines: Terminology - Basic concepts and laws - Similarity – Turbo-machinery Classifications - Axial flow fans and compressors – Centrifugal pumps, fans and compressors - Axial and radial flow hydraulic turbines – Sizing in Various Applications (steam and gas power plants, compressed air system, chilled water system, AC air distribution system, pneumatic control system, etc.), Course Project									
References	V. Dakshina Murty, Turbomachinery: Concepts, Applications, and Design, First Edition, CRC Press, 2018.									
MEPS425	Renewable Energy	3	2	2	0	0				4
	Pre-requisites: 85 Credits+ AA Approval									
	General review of thermodynamics; solar power systems for heat and electric power; electric power generation from solar energy; hydroelectric power generation; geothermal and ocean thermal energy recovery systems; tidal and wave power; economics and system integrations. Course project.									
References	Mehmet Kanoglu, Yunus Cengel, John Cimbala, Fundamentals and Applications of Renewable Energy, 1st Edition, McGraw Hill; 2019.									
MEPS435	Internal Combustion Engine	3	2	2	0	0				4
	Pre-requisites: 85 Credits+ AA Approval									
	Introduction to engine design with topics that include air capacity, engine vibration, kinematics and dynamics of the crank mechanism, air cycles, combustion, petroleum and alternative fuels, engine electronics and fuel cells. Automotive emissions, government standards, test procedures, instrumentation, and laboratory reports. course project									
References	Ganesan, Internal Combustion Engines, 4th ed., McGraw Hill, 2012.									