Academic Program Description Form

University Name: University of Babylon
College/Institute: College of Engineering - Al-Musayyib
Program Name: Academic Program for obtaining an undergraduate degree, Bachelor of Science in Automotive Engineering Department.
Final Degree Name: Bachelor of Science in Automotive Engineering Department.
Academic System: Semester + Bologna System
Description Preparation Date: ٩/٤/٢٠٢٣
File Completion Date: 3/5/2026
The file was prepared by the Academic Description Committee in the Department of Automotive Engineering Department. The coordinator here is a committee, which was formed by Administrative Order D/8/3124 on 14/10/2025.
Signature of the Head of the Quality Assurance Committee in the Department of Automotive Engineering

Dr. Mushrek Allawi Mahdi
Date: 3/5/2026

File reviewed by the Quality Assurance and University Performance Unit in the College
Director of the Quality Assurance and University Performance Unit:

Assist. Lec. Abbas Rashid Hatif
Date: 3/5/2026

Signature of the Department Head:

Dr. Dhai Hassan Jawad
Date: 3/5/2026

Signature of the Assistant Dean for Academic Affairs:

Assist. Prof. Dr. Sana'a Abdul Razzaq Jassim
Date: 3/5/2026

Endorsement by the Dean

Signature
Assist. Prof. Dr. Wissam Jaleel Khudayer
Date: 3/5/2026

TEMPLATE FOR PROGRAMME SPECIFICATION

HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

PROGRAMME SPECIFICATION

This Program Specification provides a concise summary of the main features of the program and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. It is supported by a specification for each course that contributes to the program.

1. Teaching Institution	University of Babylon
2. College	College of Engineering\Al-Musayab
3. University Department/Centre	Automobiles Engineering Department
4. Program Title	An academic program to obtain a Bachelor's degree in Automotive Engineering
5. Title of Final Award	Bachelor of Science in Automotive Engineering
6. Modes of Attendance offered	quarterly
7. Accreditation	National Accreditation Standards for Engineering Education
8. Other external influences	Training courses for students to develop professional skills for students / field visits / summer training
9. Date of production/revision of this specification	٢٠-٩-2022 (date of preparation of self-assessment)
10. objectives	

1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering
2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3- applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.
5- Participation in promoting engineering awareness, conducting scientific courses and site visits to manufacturing facilities, and recognizing the need for ongoing self-development of professional knowledge and how to locate, evaluate, compile, and correctly apply it.
6- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational programmer.
7- Active participation in community service activities

١١. Learning Outcomes, Teaching, Learning and Assessment Methods
1) The ability to analyses the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through

the analysis and installation processes in the design process.
3) The ability to evaluate control systems and their efficiency in all car systems, evaluate the automobile's operating system, exhaust emission rates, and their impact on environmental pollution by creating and implementing appropriate measurements and tests to ensure quality requirements are met, analyzing the results, and using engineering judgment to draw conclusions.
4) The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes.
5) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
6) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.
7) Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.
Teaching and Learning Methods
1- How to give lectures 2- Student Center 3- Student Groups Team Project 4- Work shop 5- Scientific trips to follow the practical reality of the manufacture and assembly of auto parts 6- Learning Technologies on Campus 7- Experiential learning 8-Thinking strategy according to the student's ability to understand the problem in terms of physics and engineering application of physical concepts 9- High thinking skill strategy 10- Critical thinking strategy in learning 11- Brainstorming
Assessment methods

1- Exams
2- continuous assessment
3- reports
4- stimuli
5- feedback from students
6- Learning Triangle

12. Program Structure			
Level/Year	Course or Module Code	Course or Module Title	Credit rating

First Year									
1st Semester					**2nd Semester**				
Subject	units	Theo	Tut	Lab	Subject	units	Theo	Tut	Lab
English Language	1	1	1	-	Arabic language	1	1	-	-
Human rights & Democracy	1	1	-	-	Introduction to Computer Programming	3	2	-	2
Mathematics I	3	3	1	-	Mathematics II	3	3	1	-
Engineering Drawing & Descriptive Geometry I	3	2	-	3	Engineering Mechanics (Statics)	4	4	2	-
Electrical Engineering	3	2	-	2	Engineering Drawing II	2	1	-	3
Metallurgy	3	2	-	2	Automobile Electrical, Electronics and Instrumentation Systems	3	2	-	2
Manufacturing Processes	4	3	-	3	Automobile Materials	2	2	-	-
					Automobiles Technology I(Engines)	2	1	-	2
Total	18	14	2	١٠	Total	20	16	3	٩
		26					٢٨		

Second Year

1st Semester					2nd Semester				
Subject	units	Theo	Tut	Lab	Subject	units	Theo	Tut	Lab
Computer Programming, I (FORTRAN)	3	2	-	2	English Language	1	1	١	-
Engineering Mathematics I	2	2	1	-	Computer Programming II (FORTRAN)	3	2	-	2
Strength of Materials	5	4	2	2	Engineering Mathematics II	2	2	١	-
Fluid Mechanics	4	3	1	2	Engineering Mechanics II (Dynamics)	4	4	٢	-
Mechanical Construction, I (with AutoCAD of 20% weight)	3	1	-	٤	Automobile Pneumatic & Hydraulic Systems	2	2	١	-
Automobiles Technology II (Power Transmission + suspension System)	2	1	-	٢	Thermodynamics	5	4	٢	2
					Mechanical Construction, I (with Solid Works of 20% weight)	3	1	-	3
Total	19	١٣	٤	١٢	Total	20	١٦	٧	٧
		٢٩					٣٠		

Third Year

1st Semester					2nd Semester				
Subject	units	Theo	Tut	Lab	Subject	units	Theo	Tut	Lab
Heat Transfer I	3	2	1	2	Heat Transfer II	3	2	1	2
Mechanical Element Design I	2	2	1	-	Design of Machine System II	2	2	1	-
Theory of Machines	3	2	1	2	Theory of Vehicles	3	2	1	2
Corrosion and coating	2	2	-	-	Fuel and combustion	2	2	-	-
Aerodynamic	2	2	-	-	Tribology	2	2	-	-
Internal Combustion Engines I	3	2	1	2	Internal Combustion Engines II	3	2	1	2
Engineering Analysis	٢	٢	1	-	Numerical Analysis	٢	٢	1	-
Vehicle Maintenance II	2	١	١	2	Vehicle Technology II	2	١	١	2
Total	19	15	6	8	Total	19	15	6	8
		29					29		

Four Year									
1st Semester					2nd Semester				
Subject	units	Theo	Tut	Lab	Subject	units	Theo	Tut	Lab
Mechanical Vibration I	3	2	1	2	Mechanical Vibration II	3	2	1	2
Hydraulic Systems	2	2	-	-	Design & Selection of Materials	2	2	-	-
Measurement systems	3	2	1	2	Control systems	3	2	1	2
Vehicle Design I	2	١	-	-	Vehicle Design II	2	2	١	-
CAE I	2	2	-	2	CAE II	2	2	-	2
Automobile Air Conditioning I	3	2	1	2	Automobile Air Conditioning II	3	2	1	2
Industrial Engineering, I	2	2	-	-	Eng. Project	2	١	-	2
Eng. Project	2	١		2			13	4	10
Total	19	14	3	10	Total	17			
		27					27		

13. Awards and Credits

Bachelor Degree Requires (3500 hour) credits

14. Personal Development Planning

-١ VERBAL COMMUNICATION
Student able to express his ideas clearly and confidently in speech
-٢ TEAMWORK
Work confidently within a group
3- ANALYSING & INVESTIGATING
Gather information systematically to establish facts & principles. Problem solving

Curriculum Skills Map

٤- INITIATIVE/SELF MOTIVATION ,Able to act on initiative identify opportunities & proactive in putting forward ideas & solutions ٥- WRITTEN COMMUNICATION Student able to express himself clearly in writ
15. Admission criteria.
central
16. Key sources of information about the programme
College and University website University Guide The most important books and resources for the department

please tick in the relevant boxes where individual Programme Learning Outcomes are being assessed											
program learning outcomes							Core (C) Title or Option (O)	Course Title	**Course Code**	No	Level
7	6	5	4	3	2	1					
*		*	*				C	English Language		١	First Year
		*	*				C	Human rights & Democracy		**2**	
*		*	*		*	*	C	Mathematics I		**3**	
*	*		*		*	*	C	Engineering Drawing & Descriptive Geometry I		**4**	
	*	*	*	*		*	C	Electrical Engineering		**5**	
*		*	*		*	*	C	Metallurgy		**6**	
	*	*	*		*	*	C	Manufacturing Processes		**7**	
	*	*	*				C	Arabic language		**8**	
	*		*	*	*	*	C	Introduction to Computer Programming		**9**	
*		*	*			*	C	Mathematics II		**10**	
	*	*			*		C	Engineering Mechanics (Statics)		**11**	
*	*		*		*	*	C	Engineering Drawing II		**12**	
	*	*			*	*	C	Automobile Electrical, Electronics and Instrumentation Systems		**13**	
	*			*		*	C	Automobile Materials		**14**	
	*	*	*	*		*	C	Automobiles Technology I (Engines)		**15**	
	*		*	*	*	*	C	Computer Programming, I (FORTRAN)		**16**	Second Year
	*	*	*			*	C	Engineering Mathematics I		**17**	
*	*	*	*		*		C	Strength of Materials		**18**	
*	*	*	*		*	*	C	Fluid Mechanics		**19**	
*	*	*	*		*		C	Mechanical Construction, I (with AutoCAD of 20% weight)		**20**	
	*	*		*	*	*	C	Automobiles Technology II (Power Transmission + suspension System)		**21**	
*		*	*				C	English Language		**22**	
	*	*	*		*		C	Computer Programming II		**23**	
*		*			*	*	C	Engineering Mathematics II		**24**	
	*	*	*		*	*	C	Engineering Mechanics II (Dynamics)		**25**	
	*	*		*	*	*	C	Automobile Pneumatic & Hydraulic Systems		**26**	
	*			*		*	C	Thermodynamics		**27**	
	*	*	*		*		C	Mechanical Construction, I (with Solid Works of 20% weight)		**28**	

*	*	*				*	C	Heat Transfer I		**29**	Third Year
	*		*	*	*	*	C	Mechanical Element Design I		**30**	
	*	*			*		C	Theory of Machines		**31**	
	*	*	*	*	*		C	Corrosion and coating		**32**	
		*			*	*	C	Aerodynamic		**33**	
	*				*	*	C	Internal Combustion Engines I		**34**	
	*	*	*			*	C	Engineering Analysis		**35**	
	*			*		*	C	Vehicle Maintenance I		**36**	
	*	*		*	*		C	Heat Transfer II		**37**	
	*		*	*	*	*	C	Design of Machine System II		**38**	
	*	*			*		C	Theory of Vehicles		**39**	
	*				*	*	C	Fuel and combustion		**40**	
*		*		*	*	*	C	Tribology		**41**	
	*	*			*	*	C	Internal Combustion Engines II		**42**	
	*	*	*		*	*	C	Numerical Analysis		**43**	
*	*	*	*	*	*	*	C	Vehicle Technology II		**44**	
	*	*	*	*	*	*	C	Mechanical Vibration I		**45**	Four Year
	*	*	*	*	*	*	C	Hydraulic Systems		**46**	
*	*	*	*	*	*	*	C	Measurement systems		**47**	
*	*			*	*	*	C	Vehicle Design I		**48**	
*			*	*	*	*	C	CAE I		**49**	
	*	*	*		*	*	C	Automobile Air Conditioning I		**50**	
	*	*			*		C	Industrial Engineering, I		**51**	
*	*	*	*	*	*	*	C	Eng. Project		**52**	
*			*	*	*	*	C	Mechanical Vibration II		**53**	
*	*	*			*	*	C	Design & Selection of Materials		**54**	
*	*		*	*	*	*	C	Control systems		**56**	
*	*	*			*	*	C	Vehicle Design II		**57**	
	*		*	*	*	*	C	CAE II		**58**	
*	*	*			*	*	C	Automobile Air Conditioning II		**60**	

First Year

1st Semester

Second Year
2nd Semester

Level – UGI
Semester – One

Module 1

Code	Course/Module Title	ECTS	Semester
UOBAB0302011	English Language	4	1
Class (hr/w)	**Pr / semi**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	44	56

Description

Vocabulary: Academic English employs a wide range of vocabulary, including discipline-specific terminology. It is important to use precise and accurate terms to convey ideas effectively.
Grammar and Syntax: Academic English follows standard grammar rules and syntax. It emphasizes clear and coherent sentence structure, appropriate verb tenses, and accurate word order.
Formality: Academic English tends to be more formal than everyday spoken English. It avoids colloquial language, slang, and contractions. Instead, it employs more formal expressions and academic register.
Objectivity: Academic writing and speaking often require an objective tone. Personal opinions should be supported by evidence and presented in a balanced manner. Impersonal language is frequently used, such as passive voice and third-person pronouns. Cohesion and Coherence: Academic English emphasizes logical organization and coherence in writing and speaking. Clear connections between ideas, the use of transitional words and phrases, and well-structured paragraphs are essential.
Citations and References: In academic writing, proper citation and referencing are crucial. Academic English uses specific citation styles, such as APA (American Psychological Association) or MLA (Modern Language Association), to acknowledge and give credit to the sources used.
Academic Conventions: Different academic disciplines may have specific conventions and expectations regarding writing styles and formats. Understanding and adhering to these conventions is important in academic English.

Module 2

Code	Course/Module Title	ECTS	Semester
UOBAB0302012	Human Rights & Democracy	2	1
Class (hr/w)	**Lect**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	1	30	20

Description

Human Rights: Human rights are inherent rights and freedoms to which every individual is entitled simply by virtue of being human. They are universal, inalienable, and indivisible. Human rights include civil, political, economic, social, and cultural rights. Some examples of human rights include the right to life, liberty, equality, freedom of speech, education, and healthcare.
The concept of human rights is rooted in the belief that every person deserves dignity, respect, and protection from abuse and discrimination. International human rights instruments, such as the Universal Declaration of Human Rights (UDHR) and various treaties and conventions, provide a framework for the promotion and protection of

human rights worldwide.
Democracy: Democracy is a system of government in which power is vested in the people, who exercise it directly or through elected representatives. It is characterized by political participation, equality, and the protection of individual freedoms. In a democratic society, citizens have the right to participate in decision-making processes, choose their leaders through free and fair elections, and enjoy civil liberties and human rights. Key principles of democracy include the rule of law, accountability, transparency, and respect for minority rights. Democracy provides a platform for diverse voices and opinions, promotes civic engagement, and ensures checks and balances to prevent the concentration of power. It allows for peaceful transitions of power, fosters social stability, and encourages the protection of human rights. The Relationship between Human Rights and Democracy: Human rights and democracy are closely interconnected and mutually reinforcing. Democracy provides the institutional framework and mechanisms to protect and promote human rights. It enables citizens to exercise their rights and freedoms, participate in decision-making processes, and hold their governments accountable. Human rights, in turn, serve as the foundation for democratic principles by safeguarding individual freedoms, equality, and dignity. Democracy without respect for human rights can lead to authoritarianism, oppression, and the marginalization of certain groups. On the other hand, the absence of democracy can hinder the full realization of human rights and limit the ability of individuals to voice their concerns and shape the policies that affect their lives.

Module 3

Code	**Course/Module Title**	**ECTS**	**Semester**
UOBAB0302013	Physics	6	1
Class (hr/w)	**Lab/ tur**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	76	76
Description			

Classical Mechanics: Classical mechanics deals with the motion of objects under the influence of forces. It includes the study of concepts such as motion, forces, energy, momentum, and gravitation.
Thermodynamics: Thermodynamics focuses on the study of heat, temperature, and energy transfer. It explores the behavior of systems in terms of concepts like entropy, work, and the laws of thermodynamics.
Electromagnetism: Electromagnetism is concerned with the study of electric and magnetic fields and their interactions. It encompasses topics like electrostatics, magnetism, electromagnetic waves, and electromagnetic induction.
Optics: Optics examines the behavior and properties of light. It covers the study of reflection, refraction, diffraction, interference, and polarization of light.
Quantum Mechanics: Quantum mechanics is a branch of physics that describes the behavior of particles at the atomic and subatomic levels. It introduces the concept of wave-particle duality, quantization of energy, and probabilistic nature of quantum systems.
Relativity: Relativity theory, both special and general relativity, explores the behavior of objects at high speeds or in strong gravitational fields. It revolutionized our understanding of space, time, and gravity.
Particle Physics: Particle physics focuses on the study of elementary particles and their interactions. It involves investigating the fundamental building blocks of matter and the forces that govern their behavior.

Astrophysics and Cosmology: Astrophysics deals with the physics of celestial objects, such as stars, galaxies, and black holes. Cosmology, on the other hand, studies the origins, evolution, and large-scale structure of the universe.

Module 4

Code	**Course/Module Title**	**ECTS**	**Semester**
UOBAB0302014	Engineering Drawing with AutoCAD I	7	1
Class (hr/w)	**Lab./Prac**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	5	90	85
Description			
This course focuses on definition of the Methods of Isometric drawing. Study the Methods of finding missing views. Learn how to draw sectional views. Study types of sectional views, learning about Parts that cannot be sectioned. Studying of Exercises in sectional views. This course offers you an advance learning skill of the operation of Computer Aided Design (CAD) software. It is ideal for anyone looking for professional training to AutoCAD 3D with an interest in using the software to produce 3D drawings for architectural, engineering or design purposes. This course is made for students who want to learn all about AutoCAD 3D in an easy to follow self-paced way. The major highlights of this course are as follows. Almost all topics of AutoCAD 3D are covered in detail including isometric drawing, conclusion of projection of the engineering geometry and sectional views for engineering geometries. Practical example-based tutorials.			

Module 5

Code	**Course/Module Title**	**ECTS**	**Semester**
UOBAB0302015	Electrical Engineering	6	1
Class (hr/w)	**Lab./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	74	76
Description			
Power Systems: Power systems engineering focuses on the generation, transmission, and distribution of electrical power. It involves designing and optimizing electrical grids, power plants, renewable energy systems, and power distribution networks. Electronics: Electronics deals with the design and application of electronic circuits and devices. It includes areas such as analog and digital circuit design, integrated circuits, microelectronics, and electronic components. Control Systems: Control systems engineering involves the design and analysis of systems that regulate			

and control the behavior of other systems. It includes topics such as feedback control, automation, robotics, and industrial process control.
Signal Processing: Signal processing involves the analysis, manipulation, and interpretation of signals. It includes areas such as digital signal processing (DSP), image and video processing, audio processing, and data compression.
Communications: Communications engineering focuses on the design and optimization of communication systems and networks. It includes areas such as wireless communication, digital communication, network protocols, and information theory.
Computer Engineering: Computer engineering combines electrical engineering and computer science to design and develop computer systems and hardware components. It involves areas such as computer architecture, digital logic design, microprocessors, and embedded systems.
Electronics and Power Electronics: Electronics engineering encompasses the design and development of electronic circuits, devices, and systems. Power electronics specifically focuses on the conversion and control of electrical power, such as in power supplies, motor drives, and renewable energy systems.
Electromagnetics: Electromagnetics deals with the study of electromagnetic fields and their interactions with matter. It includes topics such as electromagnetic theory, antenna design, electromagnetic compatibility (EMC), and electromagnetic wave propagation.

Module 6

Code	**Course/Module Title**	**ECTS**	**Semester**
UOBAB0302016	Manufacturing Processes and Engineering Workshops	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	59	66
Description			
The course aims to identify the different methods of manufacturing engineering materials, such as welding and its various types, how to obtain the necessary heat to accomplish welding, and the difference between the different methods.			

Level – UGI
Semester – Two

Module 7

Code	Course/Module Title	ECTS	Semester
UOBAB0302021	Arabic language	2	2
Class (hr/w)	**Lect**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	1	30	20

Description

تهدف مواد تخصص اللغة العربية إلى تمكين الطالب من مهارات اللغة العربية في مختلف مستوياتها الصوتية، والصرفية، والنحوية، والدلالية، والأسلوبية والكتابية، ولذلك تتنوع مواد تخصص اللغة العربية بتنوع مستويات اللغة..

تعدّ اللغة العربية من أكثر اللغات المحكية والأكثر انتشارًا في العالم، إذ يتحدّث بها ما يقارب ٤٧٦ مليون نسمة، يتوزعون في أماكن متفاوتة في العالم، وعليه تحتل اللغة العربية المركز الرابع أو الخامس من العالم من حيث الانتشار، تعدّ اللغة العربية لغة مهمة بالنسبة للمسلمين خاصة إذ هي لغة كتابهم المقدس ألا وهو القرآن بالإضافة إلى أنها لغة الصلاة والكثير من العبادات والشعائر الدينية الأخرى، ولم يقتصر دورُها هنا بل هي أيضا لغة شعائرية لدى العديد من الكنائس المسيحية في الوطن العربي. وعند الحديث عن اللغة العربيّة لا بدّ من ذِكر أنّ لهذه اللغة محبّين ودارسين يدرسونها كتخصص جامعيّ، وتتنوع مواد تخصص اللغة العربية ما بين الأدب والنحو وغيرها

Module 8

Code	Course/Module Title	ECTS	Semester
UOBAB0302022	computer science	3	2
Class (hr/w)	**Lab**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	46	29

Description

Algorithms and Data Structures: Algorithms are step-by-step procedures or instructions for solving problems or performing tasks. Data structures are the ways in which data is organized and stored in computer memory. Understanding algorithms and data structures is essential for efficient problem-solving and software development.

Programming Languages: Programming languages are used to write instructions that a computer can understand and execute. Understanding programming languages and their syntax, semantics, and features is fundamental for software development and coding.

Computer Architecture: Computer architecture involves the design and organization of computer systems, including the structure and function of components such as processors, memory, input/output devices, and storage. It provides an understanding of the underlying hardware on which software operates.

Operating Systems: Operating systems are software systems that manage computer hardware and provide an interface for other software applications. Concepts like process management, memory management, file systems, and device drivers are fundamental to understanding operating systems.

Module 9

Code	Course/Module Title	ECTS	Semester
UOBAB0302023	Mathematics	7	2
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	89	86

Description

After completing the course, students should be able to
1. Describe the characteristics and properties of number sets, and obtain the number systems,
2. Describe and State the concept of function, draw the graph of functions, the lists types of functions.
3. To understands the meaning of limit and continuous function.
4. To knows the meaning of derivative function and applications.
5. Describe the transcendental function.
6. Describe the Unit vector, vector equation, cross product, dot product.
7. To understands the meaning of complex number.
8. Describe the matrix and its operations and to know the determent of its
8- Elementary, transcendental, Exponential, hyperbolic & logarithmic functions of a real variable
9- Differential calculus: Differential of functions of one and several variables: the derivative (definitions & theorems); Rules
of differentiation, the differentiability theorem; Differentiation of functions with exponential functions, logarithmic functions, or hyperbolic functions; Some consequences of differentiability; Maxima and minima; Indeterminate forms – hospital's rule; Identification of extrema using second derivative; Partial &Total differentiation; Differentiation by chain rule; Change of variables; implicit functions & the derivatives of inverse circular functions. Higher order partial derivatives.
10- The Engineering Mathematics major offered through the Engineering Science Program offers students an opportunity to study applied mathematics as essential components of modern engineering. By combining courses in pure mathematics, applied mathematics, statistics, the physical sciences, and engineering, a student may individualize a program of study, of theory, or of applications of both. It provides a broad foundation for graduate studies in theoretical branches of engineering, as well as in mathematics, and can prepare students for a career in specific sectors of industry or business.

Module 10

Code	Course/Module Title	ECTS	Semester
UOBAB0302024	Engineering Mechanics (Statics)	6	2
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	89	61

Description

Forces: Forces are the interactions between objects that can cause changes in their motion or deformation. In statics, forces are represented as vectors and described by their magnitude, direction, and point of application. Common types of forces include gravitational forces, applied forces, and reaction forces.
Equilibrium: Equilibrium is a state in which the forces acting on an object or system are balanced, resulting in zero net force and zero net torque. Understanding equilibrium conditions is essential in analyzing the stability and balance of structures and objects.
Free Body Diagrams: Free body diagrams are graphical representations that show the isolated object or system under consideration and the forces acting on it. They help visualize and analyze the forces involved and are valuable tools in solving statics problems.

Moments and Torques: Moments and torques are rotational forces that can cause objects to rotate around a point or axis. They are related to the force and the distance from the point of rotation. Understanding moments and torques is crucial in analyzing the balance and stability of objects and structures.

Trusses and Frames: Trusses and frames are structures composed of interconnected members that carry loads and forces. Analyzing the internal forces and reactions in trusses and frames is a fundamental application of statics.

Friction: Friction is the resistance to relative motion between two surfaces in contact. Static friction prevents motion between surfaces that are not sliding, while kinetic friction acts when surfaces are in motion. Analyzing friction forces is important in understanding the stability and equilibrium of objects on inclined surfaces or in contact with other surfaces.

Center of Gravity: The center of gravity is the point at which the entire weight of an object can be considered to act. It is the point where the gravitational forces acting on all the particles of an object can be balanced. Analyzing the center of gravity is crucial for understanding the stability and balance of objects.

Structural Analysis: Structural analysis involves determining the internal forces and deformations in structures under the action of external loads. Statics provides the foundation for structural analysis and plays a critical role in designing safe and stable structures.

Module 11

Code	**Course/Module Title**	**ECTS**	**Semester**
UOBAB0302025	Engineering Drawing with AutoCAD II	7	2
Class (hr/w)	**Lab./Prac.**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	5	90	85

Description
This course focuses on definition of the Methods of Isometric drawing. Study the Methods of finding missing views. Learn how to draw sectional views. Study types of sectional views, learning about Parts that cannot be sectioned. Studying of Exercises in sectional views. This course offers you an advance learning skill of the operation of Computer Aided Design (CAD) software. It is ideal for anyone looking for professional training to AutoCAD 3D with an interest in using the software to produce 3D drawings for architectural, engineering or design purposes. This course is made for students who want to learn all about AutoCAD 3D in an easy-to-follow self-paced way. The major highlights of this course are as follows. Almost all topics of AutoCAD 3D are covered in detail including isometric drawing, conclusion of projection of the engineering geometry and sectional views for engineering geometries. Practical example-based tutorials.

Module 12

Code	Course/Module Title	ECTS	Semester
UOBAB0302026	Metallurgy & Automobile Materials	5	2
Class (hr/w)	**Lab.**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	2	75	50

Description
Metallurgy is a domain of materials science and engineering that studies the physical and chemical behavior of metallic elements, their inter-metallic compounds, and their mixtures, which are known as alloys. Metallurgy encompasses both the science and the technology of metals; that is, the way in which science is applied to the production of metals, and the engineering of metal components used in products for both consumers and manufacturers. This course deals with study the following subject: Internal Structure of Metals , Equilibrium states of binary systems, Phases in alloy system Properties of Metals and Alloy: Mechanical deformation and recrystallization Ferrous Alloy (Iron-Carbon): Fe-C equilibrium diagram, Carbon steel classification and applications, Cast iron and applications, Heat treatment of Metals, TTT, CCT diagrams, Fracture, classification and types, creep, Characteristics of Materials . Also this course covers study Composite materials, proper Selection of materials to automotive components, Coating and corrosion resistance.

Level – UGII
Semester – Thee

Module 13

Code	Course/Module Title	ECTS	Semester
UOBAB0302031	English Language II	4	3
Class (hr./w)	**Lect/semn**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	44	56

Description

History and Global Reach: English originated from the Germanic tribes in England and has evolved over centuries through various influences, including Latin, French, and other languages. Due to the expansion of the British Empire and later the global influence of the United States, English has become the most widely spoken second language worldwide.
Vocabulary and Grammar: English vocabulary is vast and diverse, drawing from different sources and languages. It consists of words, phrases, idioms, and expressions that are constantly evolving and adapting. English grammar follows a subject-verb-object word order, although it does have exceptions and flexible structures.
Phonetics and Pronunciation: English has a complex phonetic system with a wide range of sounds and accents. Pronunciation varies among different English-speaking regions, such as American English, British English, Australian English, etc. There are also variations in intonation and stress patterns.
Writing Systems: English uses the Latin alphabet, consisting of 26 letters. It employs a combination of uppercase and lowercase letters, punctuation marks, and other symbols for writing and communication. Spelling can be challenging due to inconsistencies in English orthography.
Varieties and Dialects: English exhibits a great deal of variation, both regionally and culturally. Different countries and regions have their own distinct dialects, accents, and vocabulary. Examples include American English, British English, Canadian English, Indian English, and many more.
Business and Academic Language: English is commonly used in the business world and academia. Many international conferences, research publications, and academic programs are conducted in English. Proficiency in English is often a requirement for global employment opportunities and higher education.
Influence on Other Languages: English has had a significant impact on other languages through loanwords, cultural exchanges, and the dominance of English-speaking media. Many non-English languages incorporate English terms and expressions in their vocabulary.
Global Communication: English serves as a common language for international communication, enabling people from different linguistic backgrounds to interact and understand one another. It facilitates cross-cultural understanding, trade, and diplomacy.
Literature and Cultural Significance: English literature has a rich tradition and includes renowned authors and works from different periods. English-language literature has made substantial contributions to world literature and is studied and appreciated globally.
Online and Digital Communication: The rise of the internet and digital technology has further increased the prevalence and influence of the English language. English dominates online platforms, social media, and digital content, making it an essential skill for participating in the digital age

Module 14

Code	Course/Module Title	ECTS	Semester
UOBAB0302032	Engineering Mathematics I	4	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	47	53

Description

Calculus: Calculus forms the basis of engineering mathematics. It includes differential calculus, which deals with rates of change and derivatives, and integral calculus, which focuses on accumulation and integration. Concepts such as limits, derivatives, integrals, and differential equations are used to model and analyze engineering systems.
Linear Algebra: Linear algebra is the study of vector spaces, matrices, and linear transformations. It is widely used in engineering for solving systems of linear equations, eigenvalue problems, and matrix operations. Linear algebra provides tools for analyzing and manipulating multidimensional data and systems
Differential Equations: Differential equations are equations that involve derivatives or differentials of an unknown function. They are extensively used in engineering to model and solve problems related to dynamic systems, vibrations, fluid flow, heat transfer, and more. Engineering mathematics covers both ordinary differential equations (ODEs) and partial differential equations (PDEs).
Complex Analysis: Complex analysis deals with functions of complex numbers. It is employed in engineering for analyzing and solving problems related to electric circuits, signal processing, control systems, and fluid dynamics. Complex analysis provides insights into the behavior of functions in the complex plane.
Probability and Statistics: Probability theory and statistics are essential in engineering for analyzing uncertainty, making predictions, and designing experiments. Concepts such as probability distributions, statistical inference, hypothesis testing, and regression analysis are used to analyze data, assess risk, and make informed decisions.
Numerical Methods: Numerical methods involve using computational algorithms to solve mathematical problems that cannot be solved analytically. Numerical techniques, such as numerical integration, numerical differentiation, and numerical solution of differential equations, are used to obtain approximate solutions to engineering problems.
Fourier Analysis: Fourier analysis is used to decompose complex waveforms into simpler sinusoidal components. It has applications in signal processing, image processing, data compression, and communication systems. Fourier series and Fourier transforms are utilized to analyze and manipulate signals and data in the frequency domain.
Optimization: Optimization techniques are employed to find the best possible solution among a set of alternatives. Engineering mathematics covers optimization algorithms and methods, such as linear programming, nonlinear programming, and constrained optimization. Optimization is used to optimize system performance, resource allocation, and decision-making in engineering.
Numerical Linear Algebra: Numerical linear algebra focuses on solving linear algebraic problems using numerical methods and algorithms. It includes techniques for solving large systems of linear equations, eigenvalue problems, least squares problems, and matrix factorizations. Numerical linear algebra is crucial for engineering simulations and computations.

Module 15

Code	Course/Module Title	ECTS	Semester
UOBAB0302033	Strength of Materials	7	3
Class (hr/w)	**Lab/ Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	3	103	72

Description
Stress and Strain: Understand the concepts of stress and strain, which are fundamental parameters used to describe the internal behavior of materials under loading. Study different types of stresses, such as axial, shear, and bending, and their corresponding strains. Mechanical Properties of Materials: Gain knowledge of the mechanical properties of materials, including elasticity, plasticity, yield strength, ultimate strength, modulus of elasticity, and ductility. Learn how these properties influence the material's response to applied loads. Axial Loading: Study the behavior of materials subjected to axial loads, such as tension and compression. Analyze the stress and strain distribution, deformation, and failure mechanisms in simple structural members, such as rods, columns, and cables. Bending and Flexural Analysis: Learn about the behavior of materials under bending loads, such as beams and shafts. Analyze the stress and strain distribution, deflection, and failure modes in beams of different cross-sectional shapes and support conditions. Torsion: Study the behavior of materials subjected to torsional loads, such as shafts and twist rods. Analyze the stress and strain distribution, deformation, and failure mechanisms in torsion ally loaded members. Shear and Bearing Stress: Understand the behavior of materials under shear and bearing loads. Analyze the stress and strain distribution, shear flow, and failure modes in various structural elements, such as rivets, bolts, and welds. Buckling and Stability: Explore the stability of structural members and the phenomenon of buckling. Understand the critical load at which a member may buckle and the different modes of buckling, such as Euler buckling and column buckling. Stress Transformation and Mohr's Circle: Learn about stress transformation in two and three dimensions and the graphical representation of stress states using Mohr's circle. Understand how to determine principal stresses, maximum shear stress, and stress invariants. Failure Theories: Study different failure theories used to predict the failure of materials under specific loading conditions. Explore theories such as maximum normal stress theory, maximum shear stress theory, and the von Mises yield criterion. Strain Energy and Deflection: Analyze the energy absorbed by a material and the deflection of structural members under load. Understand the concept of strain energy and its relationship to the material's behavior and the work done on the structure.

Module 16

Code	Course/Module Title	ECTS	Semester
UOBAB0302034	Fluid Mechanics	6	3
Class (hr/w)	**Lab/ Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	89	61
Description			
Fluid Properties: Understand the fundamental properties of fluids, including density, viscosity, pressure, temperature, and surface tension. Study how these properties affect fluid behavior and flow characteristics. Fluid Statics: Explore the behavior of fluids at rest and analyze the distribution of pressure within a fluid. Learn about hydrostatic forces, buoyancy, stability of floating bodies, and applications such as dams and			

manometers.
Fluid Dynamics: Study the motion and behavior of fluids in motion. Analyze fluid flow patterns, velocity distribution, and pressure gradients. Understand the principles of conservation of mass, momentum, and energy in fluid flow.
Fluid Flow Measurements: Learn about various techniques and instruments used to measure fluid flow rates, velocities, and pressures. Explore devices such as flowmeters, Pitot tubes, and pressure transducers.
Bernoulli's Equation: Understand Bernoulli's equation, which describes the relationship between fluid pressure, velocity, and elevation. Apply the equation to analyze fluid flow in pipes, nozzles, and other flow systems.
Reynolds Number and Flow Regimes: Study the concept of Reynolds number, which characterizes the type of flow (laminar or turbulent) based on fluid velocity, density, viscosity, and characteristic length. Understand the transition between laminar and turbulent flow regimes.
Pipe Flow: Analyze the behavior of fluids in pipes and ducts. Study topics such as flow resistance, friction losses, head loss, and pipe network analysis. Explore flow distribution, flow measurement, and pump selection in pipe systems.
Boundary Layer Theory: Understand the concept of boundary layers, which form near solid surfaces in fluid flow. Study laminar and turbulent boundary layers, boundary layer separation, and their effects on drag and heat transfer.
Fluid Forces on Immersed Bodies: Explore the forces exerted by fluids on objects immersed in them. Study topics such as drag, lift, and their applications in designing vehicles, aircraft, and other objects moving through fluids.
Computational Fluid Dynamics (CFD): Gain knowledge of numerical methods and computer simulations used to analyze and predict fluid flow behavior. Learn to use CFD software to model and simulate complex fluid flow phenomena.

Module 17

Code	**Course/Module Title**	**ECTS**	**Semester**
UOBAB0302034	Mechanical Drawing, I with Solid Works	6	3
Lab (hr/w)	**Prac.**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	76	74
Description			
2D Sketching: In SolidWorks, the design process often begins with 2D sketching. The software provides tools to create 2D sketches by drawing lines, arcs, circles, and other basic geometric shapes. These sketches serve as the foundation for creating 3D models. Parametric Modeling: SolidWorks is a parametric modeling software, which means that it allows you to create models that are driven by dimensions and relationships. You can define dimensions, constraints, and relationships within the sketch to control the size, shape, and behavior of the model. 3D Modeling: Using SolidWorks, you can extrude, revolve, sweep, loft, and perform other operations to			

transform 2D sketches into 3D models. The software provides a wide range of tools and features to create complex geometries, add fillets and chamfers, and incorporate features like holes, threads, and ribs.
Assemblies: SolidWorks enables the creation of assemblies, which are collections of multiple components that fit together to form a mechanical system. You can define relationships between parts, such as mates (e.g., coincident, concentric, parallel), to ensure proper fit and movement between components.
Exploded Views: With SolidWorks, you can easily create exploded views of assemblies to illustrate the relationship and positioning of components. Exploded views help in understanding the assembly process and identifying individual parts.
Detailed Drawings: SolidWorks allows the creation of detailed engineering drawings from 3D models. You can generate 2D drawings with accurate dimensions, annotations, and tolerances. The software provides tools for adding dimensions, geometric tolerances, section views, and other annotations to the drawing.
Bill of Materials (BOM): SolidWorks can automatically generate a bill of materials (BOM) from an assembly. The BOM lists the components and quantities required to build the assembly. It provides a structured overview of the parts needed and can be used for procurement and manufacturing purposes.
Rendering and Visualization: SolidWorks offers rendering capabilities to create realistic images of your 3D models. You can apply materials, textures, lighting, and background settings to enhance the visual representation of your designs.
Simulation and Analysis: SolidWorks includes simulation tools that allow you to analyze the behavior and performance of your designs. You can perform structural analysis, motion analysis, thermal analysis, and more to evaluate factors like stress, deformation, and motion within your mechanical systems.
File Formats and Collaboration: SolidWorks supports various file formats for sharing and collaboration, including native SolidWorks files, STEP, IGES, and STL. This enables you to work with other CAD software users and exchange designs with manufacturing and prototyping facilities.

Module 18

Code	**Course/Module Title**	**ECTS**	**Semester**
UOBAB0302036	Automobiles Technology I	3	3
Class (hr/w)	**Prac**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	45	30
Description			
1. Engine and Powertrain: The heart of an automobile is its engine, which converts fuel (usually gasoline or diesel) into mechanical energy. Engine technology has evolved significantly over the years, with advancements in efficiency, power output, and emission control. Powertrain systems encompass components such as transmissions, differentials, and drivelines that transfer power from the engine to the wheels. 2. Fuel Systems: Automobiles use various fuel systems to deliver fuel to the engine, including carburetors and fuel injection systems. Fuel efficiency and emission control have become crucial aspects of modern fuel systems, leading to the development of electronic fuel injection systems and hybrid/electric vehicle technologies.			

3. Chassis and Suspension: The chassis provides the framework and structural support for the vehicle. It includes components such as the frame, body panels, and suspension systems that ensure stability, handling, and comfort. Suspension systems consist of springs, shock absorbers, and linkages that absorb road shocks and maintain tire contact for improved control and ride quality.
4. Braking Systems: Braking technology is essential for vehicle safety. Traditional braking systems utilize hydraulic mechanisms to transfer force from the driver's input to the wheels. Anti-lock braking systems (ABS) and electronic stability control (ESC) are advanced technologies that enhance braking performance and vehicle stability during emergency maneuvers.
5. Electrical and Electronics: Automobiles increasingly rely on sophisticated electrical and electronic systems for various functions. These include ignition systems, lighting (headlights, taillights, etc.), instrument clusters, entertainment systems, navigation systems, and advanced driver-assistance systems (ADAS) like adaptive cruise control, lane-keeping assist, and collision warning.
6. Safety Systems: Automobile technology prioritizes safety features such as seatbelts, airbags, crumple zones, and reinforced structures to protect occupants in the event of a collision. Advanced safety technologies like lane departure warning, blind-spot detection, and automatic emergency braking contribute to accident prevention and mitigation.
7. Connectivity and Telematics: Modern vehicles often incorporate connectivity features that enable integration with smartphones, wireless communication, and internet-based services. Telematics systems provide functionalities like GPS navigation, remote diagnostics, vehicle tracking, and emergency services.
8. Environmental Considerations: Automobile technology aims to reduce the environmental impact of vehicles. This involves developing cleaner and more efficient engines, promoting alternative fuel options (electric, hybrid, hydrogen), and implementing emission control measures such as catalytic converters and particulate filters.

Level – UGII
Semester – Four

Module 19

Code	Course/Module Title	ECTS	Semester
UOBAB0302041	Computer Programming	3	4
Class (hr/w)	**Lab**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	44	31

Description

Programming Languages: Programming languages are used to write code and communicate instructions to computers. There are various programming languages available, each with its own syntax and rules. Popular programming languages include Python, Java, C++, JavaScript, Ruby, and many more. Different languages are suited for different types of applications and have different levels of complexity.
Syntax and Semantics: Programming languages have specific syntax and rules that govern how code should be written. Syntax refers to the structure and grammar of the language, while semantics define the meaning and behavior of the code. Following the correct syntax and semantics is essential for writing valid and functional code.
Variables and Data Types: Variables are used to store and manipulate data in computer programs. They can hold different types of data, such as numbers, strings (text), Boolean values (true/false), and more. Each programming language has its own set of data types and rules for declaring and using variables.
Control Structures: Control structures allow programmers to control the flow of execution in a program. Common control structures include conditionals (if-else statements, switch statements), loops (for loops, while loops), and branching (function calls, return statements). Control structures determine which sections of code are executed based on certain conditions or criteria.
Functions and Procedures: Functions and procedures are reusable blocks of code that perform specific tasks. They help in organizing and modularizing code by breaking it down into smaller, manageable units. Functions can take inputs (parameters) and produce outputs (return values) to perform specific operations.
Algorithms and Problem Solving: Algorithms are step-by-step procedures or sets of rules for solving a specific problem. They form the core of computer programming by providing a logical and systematic approach to problem-solving. Understanding algorithms and applying problem-solving techniques is crucial for writing efficient and optimized code.
Debugging and Troubleshooting: Debugging is the process of finding and fixing errors or bugs in a program. Programming often involves testing and identifying issues in code, such as logical errors, syntax errors, or runtime errors. Debugging tools and techniques help programmers locate and resolve these issues to ensure the correct functioning of the program.
Software Development Tools: There are numerous software development tools available to assist programmers in writing, testing, and debugging code. Integrated Development Environments (IDEs) provide an integrated environment for writing, running, and managing code. They often include features such as code editors, syntax highlighting, debugging tools, and version control systems.
Object-Oriented Programming (OOP): Object-Oriented Programming is a programming paradigm that organizes code around objects and their interactions. It focuses on encapsulating data and behavior within objects, allowing for modular and reusable code. OOP principles include concepts such as classes, objects, inheritance, polymorphism, and encapsulation.
Continuous Learning and Adaptation: Computer programming is a rapidly evolving field, with new languages, frameworks, and technologies emerging regularly. Successful programmers embrace continuous learning and adaptation to stay up to date with the latest trends, best practices, and advancements in the field.

Module 20

Code	Course/Module Title	ECTS	Semester
UOBAB0302042	Modern Vehicle Technology	4	4
Class (hr/w)	**Prac.**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	59	41

Description

1. Advanced Driver Assistance Systems (ADAS): ADAS technologies are designed to assist drivers and enhance safety on the road. These systems include features such as adaptive cruise control, lane-keeping assist, automatic parking, forward collision warning, and pedestrian detection. ADAS technologies utilize sensors, cameras, radar, and sophisticated algorithms to detect and respond to potential hazards.
2. Infotainment Systems: Infotainment systems in automobiles provide a combination of information and entertainment features. These systems integrate audio, video, and communication functionalities to offer navigation, multimedia playback, hands-free calling, smartphone integration, and internet connectivity. Touchscreens, voice recognition, and gesture control interfaces are commonly used to interact with infotainment systems.
3. Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) Communication: V2V and V2I communication technologies enable vehicles to communicate with each other and with the surrounding infrastructure. This facilitates the exchange of important safety-related information, such as traffic conditions, potential hazards, and road alerts. V2V and V2I communication systems contribute to improved traffic management and collision prevention.
4. Lightweight Materials: Automobile technology strives to reduce the weight of vehicles to enhance fuel efficiency and reduce emissions. Lightweight materials such as high-strength steel, aluminum, carbon fiber composites, and polymer composites are used in vehicle construction. These materials offer a balance between strength, safety, and weight reduction.
5. Energy Efficiency and Alternative Propulsion: With a growing focus on sustainability, automobile technology explores alternative propulsion systems. Electric vehicles (EVs) use electric motors powered by batteries or fuel cells to achieve zero-emission mobility. Hybrid vehicles combine internal combustion engines with electric motors to enhance fuel efficiency. Additionally, advancements in regenerative braking and energy management systems contribute to energy conservation.
6. Autonomous Driving: The development of autonomous vehicles aims to enable self-driving cars capable of operating without human intervention. Autonomous driving technology involves a combination of sensors, cameras, lidar, radar, GPS, and advanced algorithms to perceive the environment, make decisions, and control the vehicle. Autonomous vehicles have the potential to enhance road safety, traffic flow, and mobility services.
7. Manufacturing and Automation: Automobile technology extends to the manufacturing process itself. Automated assembly lines and robotics play a significant role in efficient and precise vehicle production. Robotics and automation help improve manufacturing quality, reduce costs, and increase productivity

Module 21

Code	Course/Module Title	ECTS	Semester
UOBAB0302043	Engineering Mathematics II	7	4
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	47	53

Description

Vector Calculus: Vector calculus extends the concepts of differentiation and integration to vector-valued functions. It includes topics such as vector fields, line integrals, surface integrals, and the fundamental theorems of vector calculus (such as Green's theorem, Stokes' theorem, and the divergence theorem). Vector calculus is important for understanding and analyzing fields like electromagnetics, fluid dynamics, and heat transfer.
Differential Equations: Building on the basics of ordinary differential equations (ODEs) covered in Engineering Mathematics I, Engineering Mathematics II delves into more advanced topics. This may include higher-order linear ODEs, systems of linear ODEs, Laplace transforms, series solutions, and applications of differential equations in engineering, such as vibrations, circuits, and control systems.
Complex Analysis: Complex analysis focuses on functions of complex numbers. It covers topics such as complex differentiation, contour integration, Cauchy's theorem, and residue theory. Complex analysis is applicable in various engineering fields, including signal processing, control systems, and electrical engineering.
Fourier Series and Transforms: Fourier series and Fourier transforms are used to analyze periodic and non-periodic signals and functions. Engineering Mathematics II explores the Fourier series representation of periodic functions, Fourier transforms for non-periodic functions, and their applications in signal processing, communications, and image analysis.
Partial Differential Equations (PDEs): PDEs are equations involving partial derivatives and are used to describe phenomena involving multiple independent variables. Engineering Mathematics II introduces various types of PDEs, such as heat equations, wave equations, and Laplace's equation. It covers techniques for solving these equations, including separation of variables, Fourier series methods, and numerical methods.
Probability and Statistics: Probability and statistics play a crucial role in engineering for analyzing uncertainty, making predictions, and data analysis. Engineering Mathematics II may cover topics such as probability distributions, random variables, statistical inference, hypothesis testing, regression analysis, and design of experiments. These concepts are valuable for engineering research, quality control, and decision-making.
Numerical Methods: Numerical methods involve using computational algorithms to approximate solutions to mathematical problems that cannot be solved analytically. Engineering Mathematics II may introduce numerical techniques for solving differential equations, systems of equations, interpolation, numerical integration, and numerical optimization. These methods are essential for solving complex engineering problems and conducting simulations.
Linear Algebra: Linear algebra concepts may be further expanded in Engineering Mathematics II. This may include eigenvalues and eigenvectors, diagonalization of matrices, applications of linear algebra in solving differential equations and systems of equations, and advanced topics such as singular value decomposition and least squares methods.
Transform Methods: In addition to Fourier transforms, other transform methods may be covered in Engineering Mathematics II. This could include Laplace transforms, Z-transforms, and their applications in solving differential equations, analyzing control systems, and signal processing.

Module 22

Code	Course/Module Title	ECTS	Semester
UOBAB0302044	Engineering Mechanics (Dynamics)	7	4
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	2	89	86

Description

Kinematics: Kinematics is concerned with the description of motion without considering the causes of motion. It involves the study of position, velocity, and acceleration of particles and rigid bodies. Concepts such as displacement, speed, and trajectory are analyzed to understand the motion of objects.
Particle Dynamics: Particle dynamics deals with the motion of individual particles and involves the application of Newton's laws of motion. It focuses on analyzing the forces acting on particles and determining their resulting motion, including linear motion, projectile motion, and circular motion.
Newton's Laws of Motion: Newton's laws of motion form the foundation of Engineering Mechanics (Dynamics). These laws describe the relationship between the motion of an object and the forces acting upon it. Newton's first law states that an object at rest will remain at rest, and an object in motion will continue moving with a constant velocity unless acted upon by an external force. Newton's second law relates the net force acting on an object to its mass and acceleration. Newton's third law states that for every action, there is an equal and opposite reaction.
Equations of Motion: Equations of motion are mathematical expressions that relate the position, velocity, acceleration, and time for objects in motion. These equations, derived from Newton's laws, are used to solve problems involving the motion of particles and rigid bodies.
Work and Energy: Work and energy concepts are extended to Engineering Mechanics (Dynamics) to analyze the effects of forces and motion on the energy of a system. The work-energy principle states that the work done on an object is equal to the change in its kinetic energy. This principle is used to analyze the transfer and transformation of energy in mechanical systems.
Impulse and Momentum: Impulse and momentum principles are used to analyze the effects of forces acting over a period of time on the motion of objects. Impulse is the product of force and time, and the change in momentum of an object is equal to the impulse applied to it. These principles are applied to collisions and impact analysis.
Rotational Motion: Engineering Mechanics (Dynamics) also includes the study of rotational motion. It involves the analysis of forces, torques, moments of inertia, angular velocity, and angular acceleration of rotating bodies. Concepts such as rotational equilibrium, angular momentum, and conservation of angular momentum are examined.
Vibrations: Vibrations are the periodic oscillations or motions of bodies about their equilibrium positions. Engineering Mechanics (Dynamics) explores the principles of vibrations, including single-degree-of-freedom systems, natural frequencies, damping, and resonance.
Planar Motion: Planar motion refers to the motion that occurs in a single plane. Engineering Mechanics (Dynamics) focuses on analyzing the motion of objects in a two-dimensional plane, considering both translational and rotational motion.
Applications: Engineering Mechanics (Dynamics) is applied to various engineering fields, such as mechanical engineering, civil engineering, aerospace engineering, and robotics. It is used to analyze and design systems involving moving parts, such as machinery, vehicles, structures, and mechanisms.

Module 23

Code	Course/Module Title	ECTS	Semester
UOBAB0302045	Thermodynamics	7	4
Class (hr/w)	**Lect/Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	4	117	58

Description

Energy: Thermodynamics revolves around the concept of energy, which is the capacity to do work or cause change. The two main forms of energy in thermodynamics are kinetic energy (energy of motion) and potential energy (energy associated with position or state). Thermodynamics analyzes how energy is transferred and converted between different forms.

Laws of Thermodynamics: The laws of thermodynamics are fundamental principles that govern energy and heat transfer. They provide the foundation for understanding and analyzing thermodynamic systems. The laws of thermodynamics are:

a. First Law of Thermodynamics (Law of Energy Conservation): It states that energy cannot be created or destroyed; it can only be transferred or transformed from one form to another. The total energy of a system and its surroundings remains constant.

b. Second Law of Thermodynamics: The second law deals with the concept of entropy, which is a measure of the degree of disorder or randomness in a system. It states that in natural processes, the entropy of an isolated system tends to increase over time. It also defines the concept of heat flow from higher temperature regions to lower temperature regions (entropy increase).

c. Third Law of Thermodynamics: The third law states that as the temperature approaches absolute zero (0 Kelvin or -273.15 degrees Celsius), the entropy of a pure, perfect crystalline substance becomes zero. It provides a reference point for measuring entropy values.

Thermodynamic Systems and Processes: Thermodynamics examines systems, which can be defined as a specific region of space or a particular object or substance under consideration. Systems can be classified as open (exchanges both energy and matter with the surroundings), closed (exchanges energy but not matter with the surroundings), or isolated (no exchange of energy or matter with the surroundings).

Thermodynamic processes describe the transformations that a system undergoes. Common processes include isothermal (constant temperature), adiabatic (no heat transfer), isobaric (constant pressure), and isochoric (constant volume) processes.

Properties of Substances: Thermodynamics studies the properties of substances, including temperature, pressure, volume, and specific heat. These properties play a crucial role in determining the behavior and state of a system. Equations of state, such as the ideal gas law, relate these properties in different thermodynamic situations.

Heat and Work: Heat and work are two forms of energy transfer in thermodynamics. Heat transfer is the transfer of thermal energy between a system and its surroundings due to a temperature difference. Work is the transfer of energy that results from the application of a force over a distance. Thermodynamics examines the mechanisms and calculations involved in heat transfer and work done on or by a system.

Thermodynamic Equilibrium: Thermodynamic equilibrium refers to a state in which the properties of a system remain constant over time, indicating a balance between energy and matter. Equilibrium conditions provide valuable insights into the behavior and stability of thermodynamic systems.

Thermodynamic Cycles: Thermodynamic cycles are processes that return a system to its initial state after undergoing a series of transformations. Common examples include the Carnot cycle, Rankine cycle, and refrigeration cycles. These cycles are fundamental in energy conversion systems, such as heat engines and power plants.

Applications: Thermodynamics finds wide-ranging applications in engineering and science. It is crucial in areas

such as power generation, refrigeration and air conditioning, chemical reactions and processes, combustion engines, materials science, and environmental studies.

Module 24

Code	Course/Module Title	ECTS	Semester
UOBAB0302046	Mechanical Drawing II	5	4
Class (hr/w)	**Lab**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	3	62	63

Description

Orthographic Projection: Orthographic projection is a technique used to represent a three-dimensional object on a two-dimensional plane. Mechanical Drawing II further explores orthographic projection, including the creation of multiple views (front view, top view, side view, etc.) of an object and the use of projection lines, auxiliary views, and section views to provide additional information and details.
Dimensioning and Tolerancing: Dimensioning is the process of adding accurate and clear measurements to a technical drawing. Mechanical Drawing II delves into more complex dimensioning techniques, including the use of different types of dimensions (linear, angular, radial, etc.), tolerances, and geometric dimensioning and tolerancing (GD&T) symbols. Proper dimensioning is crucial for ensuring accurate manufacturing and assembly of the designed object.
Sectional Views: Sectional views are used to show the internal details of an object by cutting it along a plane and displaying the cross-sectional view. Mechanical Drawing II covers the creation and interpretation of sectional views, including full sections, half sections, offset sections, revolved sections, and broken-out sections.
Assembly Drawings: Assembly drawings are used to represent how multiple components come together to form a complete product or system. In Mechanical Drawing II, you may learn techniques for creating assembly drawings, including exploded views, detailed part drawings, and bill of materials (BOM) for identifying and labeling components.
Threads and Fasteners: Mechanical Drawing II explores the representation of threaded components, such as bolts, screws, and nuts. It covers the use of standard thread representation, thread callouts, and thread specifications. Additionally, the drawing of fasteners, such as washers, pins, and rivets, may be covered.
Surface Finish and Symbols: Surface finish symbols are used to indicate the desired surface texture or roughness of a part. Mechanical Drawing II may include the interpretation and application of surface finish symbols according to standard industry practices, such as the ISO 1302 standard.
Geometric Constructions: Mechanical Drawing II may involve geometric constructions and techniques for accurately creating complex shapes, curves, and angles using a compass, ruler, and other drafting tools. This includes constructing tangents, bisecting angles, dividing lines, and other geometric operations.
CAD (Computer-Aided Design): Mechanical Drawing II may introduce the use of computer-aided design (CAD) software for creating technical drawings. Students may learn how to use CAD tools and commands to create, modify, annotate, and manage technical drawings efficiently. This includes understanding layer management, dimensioning tools, and generating different views and sections automatically.

Level – UGIII
Semester – Five

Module 25

Code	Course/Module Title	ECTS	Semester
UOBAB0302051	Tribology and Automobiles lubricants	3	5
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	45	30

Description

Friction and Wear: Friction is the resistance encountered when two surfaces slide or attempt to slide against each other. Wear refers to the progressive loss of material from the surfaces in contact. Tribology studies the mechanisms of friction and wear, aiming to minimize their detrimental effects on automotive components. Understanding the factors influencing friction and wear allows engineers to design and select appropriate materials and lubrication systems.

Lubrication: Lubrication is the process of introducing a lubricant between two surfaces to reduce friction and wear. In the automotive context, lubrication is crucial for various components, including engines, transmissions, differentials, wheel bearings, and other moving parts. Lubricants form a thin film between surfaces, providing a protective barrier and allowing smooth sliding or rolling motion. They also help dissipate heat and carry away contaminants.

Types of Lubricants: Automobile lubricants come in various forms, such as oils, greases, and solid lubricants. Oil-based lubricants, including engine oils, transmission fluids, and hydraulic oils, are commonly used in automobiles. Greases, which are semi-solid lubricants consisting of a base oil thickened with a soap or other additives, find applications in wheel bearings, chassis components, and other areas requiring higher viscosity and extended lubrication intervals. Solid lubricants, such as graphite and molybdenum disulfide, are used in specialized applications or in combination with other lubricants to enhance performance.

Lubricant Properties: Lubricants possess specific properties that are critical for their performance. These properties include viscosity, which determines the lubricant's resistance to flow; viscosity index, indicating its resistance to viscosity changes with temperature; pour point, the lowest temperature at which the lubricant can flow; flash point, the temperature at which it emits vapors to form a flammable mixture; and oxidation resistance, which affects the lubricant's lifespan and degradation under high temperatures.

Lubricant Additives: Lubricants often contain additives to enhance their performance and provide additional benefits. Additives can improve lubricant stability, oxidation resistance, viscosity-temperature characteristics, anti-wear properties, corrosion protection, detergency, and dispersancy. They are carefully formulated to meet the specific requirements of automotive applications and optimize the lubrication performance of the lubricants.

Tribological Challenges in Automobiles: Automobiles face various tribological challenges due to the complex and dynamic nature of their components. For example, engine components, such as pistons, cylinders, and valves, experience high temperatures, pressures, and sliding speeds, requiring lubricants with exceptional heat resistance and anti-wear properties. Transmission systems require lubricants that offer good shear stability and protect against wear and pitting. Wheel bearings need greases with high load-carrying capacity and water resistance.

Advancements in Tribology: Ongoing research and advancements in tribology aim to improve automotive lubricants and reduce friction and wear in automobile components. This includes developing new lubricant formulations, exploring nano-scale lubrication techniques, studying surface coatings, and optimizing surface textures to enhance tribological performance and efficiency.

Module 26

Code	Course/Module Title	ECTS	Semester
UOBAB0302052	Engineering Analyses	5	5
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	60	65

Description

Problem Formulation: Engineering analysis begins with clearly defining the problem or objective. This involves understanding the system or component under investigation, identifying the key variables and parameters, and determining the desired outcomes or performance criteria. Proper problem formulation sets the foundation for the subsequent analysis.
Mathematical Modeling: Engineering analysis often involves creating mathematical models that describe the behavior and characteristics of the system or component. Models may be based on physical laws, empirical relationships, statistical data, or a combination of these. Mathematical modeling enables engineers to represent the system in a quantifiable form, allowing for analysis and prediction of its performance.
Analytical Methods: Analytical methods involve solving mathematical equations or applying analytical techniques to derive solutions or insights. These methods can include calculus, differential equations, linear algebra, probability theory, and statistics. Analytical approaches are particularly useful for solving well-defined problems with known mathematical relationships.
Computational Methods: Computational methods use computer algorithms and numerical techniques to solve complex engineering problems that may not have analytical solutions. These methods involve approximating the problem using numerical methods, such as finite element analysis (FEA), computational fluid dynamics (CFD), and optimization algorithms. Computational methods allow engineers to simulate and analyze the behavior of complex systems, perform parametric studies, and optimize designs.
Experimental Validation: Engineering analysis often involves validating the results obtained through mathematical or computational methods with experimental data. This includes conducting physical experiments, measurements, or testing on prototypes or real-world systems. Experimental validation helps ensure the accuracy and reliability of the analysis and provides valuable insights into the real-world behavior of the system.
Sensitivity Analysis: Sensitivity analysis assesses the impact of variations or uncertainties in the input parameters on the output or performance of the system. It helps identify the most influential parameters, evaluate the robustness of the design or solution, and make informed decisions based on the sensitivity of the system to different factors.
Optimization: Optimization techniques aim to find the best possible solution or design that meets specified objectives or constraints. It involves systematically exploring the design space, varying the parameters, and evaluating the performance to identify the optimal combination. Optimization methods can be used to improve efficiency, minimize cost, maximize performance, or meet specific design requirements.
Decision Making: Engineering analysis provides valuable information and insights that support decision making in engineering design and operations. By analyzing different alternatives, evaluating trade-offs, and considering performance, cost, and other factors, engineers can make informed decisions to achieve desired outcomes.

Module 27

Code	Course/Module Title	ECTS	Semester
UOBAB0302053	Internal Combustion Engines	6	5
Class (hr/w)	**Lab./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	3	103	47

Description

Basic Operation: Internal combustion engines operate by burning a mixture of fuel and air inside a combustion chamber. The combustion process releases energy in the form of high-pressure gases, which expand and drive a piston within a cylinder. This motion is then converted into rotary motion through a crankshaft, generating mechanical work.
Types of Internal Combustion Engines: There are two primary types of internal combustion engines: a. Spark-Ignition Engines (SI): In SI engines, commonly known as gasoline engines, the fuel-air mixture is ignited by an electric spark from a spark plug. The fuel is typically gasoline, but alternative fuels such as ethanol and compressed natural gas (CNG) can also be used.
b. Compression-Ignition Engines (CI): CI engines, also called diesel engines, compress the air in the combustion chamber to a high pressure and temperature. Fuel is injected into the hot, compressed air, causing spontaneous ignition due to the heat of compression.
Engine Components: a. Cylinder: The cylinder is a cylindrical chamber where combustion occurs. It houses the piston, valves, and spark plug or fuel injector.
b. Piston: The piston is a cylindrical component that moves up and down inside the cylinder. It is connected to the crankshaft via a connecting rod and converts the pressure from combustion into reciprocating motion.
c. Valves: Valves control the flow of air and fuel into the cylinder and the exhaust gases out of the cylinder. They include intake valves for air and fuel mixture intake and exhaust valves for expelling combustion byproducts.
d. Crankshaft: The crankshaft is a rotating shaft that converts the reciprocating motion of the piston into rotary motion. It transfers the rotational energy to the transmission or other external devices.
e. Fuel System: The fuel system supplies the engine with the appropriate amount of fuel. It includes components such as fuel pumps, injectors (for direct injection engines), carburetors (for older gasoline engines), and fuel tanks.
f. Ignition System: The ignition system generates the spark required to ignite the air-fuel mixture in SI engines. It consists of components such as spark plugs, ignition coils, and control modules.
Combustion Process: In SI engines, the fuel-air mixture is ignited by a spark from the spark plug, leading to a flame front that propagates across the combustion chamber. In CI engines, fuel is injected into the hot, compressed air, leading to autoignition. The combustion process releases energy, resulting in an increase in pressure and temperature, which forces the piston downward and drives the crankshaft.
Engine Efficiency and Emissions: Internal combustion engines are continually being optimized to improve their efficiency and reduce emissions. Efficiency improvements are achieved through technologies like direct fuel injection, turbocharging, variable valve timing, and downsizing. Emission control technologies, such as catalytic converters and exhaust gas recirculation (EGR), help reduce harmful pollutants like nitrogen oxides (NOx) and carbon monoxide (CO).
Alternative Powertrains: The rise of environmental concerns has led to the development of alternative powertrains for transportation. These include hybrid vehicles, electric vehicles, and hydrogen fuel cell vehicles, which offer reduced emissions and improved fuel efficiency compared to conventional internal combustion engines.

Module 28

Code	Course/Module Title	ECTS	Semester
UOBAB0302054	Machine Elements Design I (with CAD)	6	5
Class (hr/w)	**Lab./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	88	62

Description

Design Methodology: The course introduces the fundamental principles and methodologies for designing machine elements. This includes understanding design requirements, functional specifications, material selection, safety factors, and design constraints. The design process involves identifying the loads and forces acting on the components, analyzing stress and deflection, and ensuring the component meets performance criteria.
Design of Mechanical Components: The course covers the design of various machine elements commonly found in mechanical systems, such as shafts, bearings, gears, belts, chains, springs, fasteners, and couplings. Students learn about the selection criteria, design considerations, and sizing calculations for these components. The focus is on designing components that can withstand the applied loads and provide the desired functionality and reliability.
Strength and Failure Analysis: Machine Elements Design I includes the analysis of stresses, strains, and deformations in machine components. Students learn to calculate stresses under different loading conditions and apply appropriate failure theories, such as the maximum shear stress theory or the von Mises criterion, to assess the structural integrity of the components. The goal is to ensure that the components can handle the expected loads without failure or excessive deformation.
Finite Element Analysis (FEA): The course may introduce the use of FEA software to analyze and validate the design of machine elements. FEA allows for more detailed stress and deformation analysis by dividing the component into smaller elements and solving the governing equations numerically. Students learn how to create finite element models, apply boundary conditions, and interpret the results obtained from the analysis.
Computer-Aided Design (CAD): The integration of CAD software is a significant component of the course. Students learn to use CAD tools to create 3D models of machine elements and assemble them into complete systems. They learn techniques for creating parametric models, applying appropriate geometric and dimensional constraints, generating engineering drawings, and performing virtual simulations to evaluate component performance.
Design Documentation and Communication: Machine Elements Design I emphasizes the importance of effective documentation and communication in engineering design. Students learn how to create clear and accurate engineering drawings, including dimensioning, tolerancing, and detailing. They also develop skills in presenting and communicating their design ideas and solutions effectively to technical audiences.
Design Considerations and Constraints: The course covers various design considerations and constraints, including manufacturability, cost-effectiveness, serviceability, sustainability, and safety. Students learn to incorporate these factors into their design decisions to create practical and viable solutions.

Module 29

Code	Course/Module Title	ECTS	Semester
UOBAB0302055	Theory of Machines	6	5
Class (hr/w)	**Lab/Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	88	62

Description

Kinematics: Kinematics is concerned with the study of motion, without considering the forces or torques that cause it. In the Theory of Machines, kinematics deals with the analysis of the relative motion between machine components, such as linkages, gears, cams, and mechanisms. It involves studying concepts such as displacement, velocity, acceleration, and the relationship between these parameters for different machine elements.
Dynamics: Dynamics focuses on the study of forces and torques that cause motion. In the Theory of Machines, dynamics involves the analysis of the forces and moments acting on machine components during their operation. It includes the study of balancing, vibrations, impact, and power transmission. Understanding dynamics is crucial for ensuring the proper functioning and stability of machines.
Mechanisms: Mechanisms are fundamental building blocks in machine design. They are combinations of rigid bodies (links) connected by joints (kinematic pairs) that enable desired motion. The Theory of Machines studies various types of mechanisms, such as four-bar linkages, gears, cam and follower systems, and slider-crank mechanisms. Students learn about their configurations, kinematic analysis, and applications in practical machine design.
Analysis and Design: The Theory of Machines provides tools and techniques for the analysis and design of mechanical systems. Students learn methods to analyze and predict the motion, forces, and torques within machines. This includes graphical techniques, such as velocity and acceleration diagrams, as well as analytical methods, including the use of equations and mathematical models. The aim is to design machines that operate efficiently, reliably, and safely.
Power Transmission: Power transmission is a critical aspect of machine design, and the Theory of Machines explores various methods of transferring power from a source to the desired output. This includes the study of gears, belt and pulley systems, chain drives, and other mechanisms used to transmit motion and torque. Students learn about the selection, sizing, and design considerations for these power transmission elements.
Machine Dynamics and Vibrations: The Theory of Machines covers the analysis and control of machine dynamics and vibrations. This involves studying the effects of unbalanced forces, harmonic motion, resonance, and damping. Students learn techniques to minimize vibrations, enhance system stability, and reduce the potential for failure due to dynamic forces.
Machine Performance and Optimization: The Theory of Machines also considers the performance and optimization of machines. Students learn how to analyze machine efficiency, evaluate power losses, and optimize designs for improved performance. This includes studying factors such as mechanical advantage, gear ratios, energy conservation, and overall system efficiency.
Practical Applications: The Theory of Machines finds practical applications in various mechanical systems, such as engines, vehicles, robotics, manufacturing equipment, and automation systems. Understanding the principles and concepts of the Theory of Machines enables engineers to design, analyze, and optimize these systems to meet specific requirements and achieve desired performance objectives.

Module 30

Code	Course/Module Title	ECTS	Semester
UOBAB0302056	Automotive Hydraulics and Pneumatics Systems	4	5
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	59	41

Description

Hydraulics Systems: Hydraulics systems use fluids, typically oil or hydraulic fluid, to transmit and control power. They rely on the incompressibility of fluids to generate and transmit forces. In automotive applications, hydraulics systems are commonly used in braking systems, power steering systems, and suspension systems.
a. Braking Systems: Hydraulic braking systems are widely used in automobiles. They use hydraulic pressure to transfer force from the driver's input to the brakes, resulting in deceleration or stopping of the vehicle. The system includes components such as master cylinders, brake lines, brake calipers, and wheel cylinders.
b. Power Steering Systems: Hydraulic power steering systems assist the driver in turning the wheels by using hydraulic pressure. These systems employ a hydraulic pump driven by the engine to supply pressurized fluid to a steering gear or rack, which helps reduce the effort required to turn the wheels.
c. Suspension Systems: Some automotive suspension systems, such as hydraulic suspension systems, use hydraulic fluid to control the damping and provide a comfortable ride. These systems include hydraulic shock absorbers or dampers that regulate the movement of the suspension components in response to road conditions.
Pneumatics Systems: Pneumatics systems use compressed air as the working fluid to transmit power and control mechanical operations. Although less commonly used in automotive applications compared to hydraulics systems, they are found in some specific functions.
a. Pneumatic Braking Systems: Pneumatic braking systems, also known as air brakes, are primarily used in heavy-duty vehicles such as trucks and buses. Compressed air is used to actuate the braking system, providing reliable and efficient braking performance.
b. Pneumatic Suspension Systems: Pneumatic suspension systems utilize compressed air to control the ride height and stiffness of the vehicle's suspension. These systems can adjust the vehicle's height based on load conditions and provide a smoother ride.
Components and Control: Both hydraulics and pneumatics systems in automotive applications consist of various components to facilitate fluid power transmission and control.
a. Fluid Reservoirs: Reservoirs store the hydraulic fluid or compressed air used in the system.
b. Pumps or Compressors: Pumps or compressors generate the required fluid pressure or air pressure.
c. Valves: Valves control the flow and direction of fluid or air within the system. They can be used to activate or deactivate specific functions.
d. Actuators: Actuators convert the fluid or air pressure into mechanical motion to perform desired tasks. In automotive applications, actuators can be hydraulic cylinders or pneumatic cylinders that provide the required force or movement.
e. Control Systems: Control systems, including sensors, electronic controllers, and human interfaces, are used to monitor and regulate the operation of hydraulic and pneumatic systems in vehicles.

Level – UGIII
Semester – Six

Module 31

Code	Course/Module Title	ECTS	Semester
UOBAB0302061	Numerical Analysis (with computer applications)	6	6
Class (hr/w)	**Lab./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75

Description

Numerical Methods: Numerical Analysis explores various numerical methods for solving mathematical problems that are difficult or impossible to solve analytically. These methods include techniques for solving linear and nonlinear equations, interpolation and approximation, numerical integration, numerical differentiation, and solving ordinary and partial differential equations. Students learn the underlying principles, algorithms, and implementation strategies for these methods.

Approximation and Interpolation: Numerical Analysis focuses on approximating functions or data sets using interpolation techniques. Students learn methods such as polynomial interpolation, spline interpolation, and least squares approximation. These techniques are used to estimate values between known data points or to represent functions with simpler mathematical expressions.

Numerical Integration and Differentiation: The course covers numerical methods for approximating definite integrals and derivatives of functions. Students learn techniques such as numerical quadrature (e.g., Simpson's rule, Trapezoidal rule) and numerical differentiation schemes (e.g., finite difference approximations) to estimate these mathematical operations.

Solving Systems of Equations: Numerical Analysis explores methods for solving systems of linear and nonlinear equations. Students learn techniques such as Gaussian elimination, LU decomposition, iterative methods (e.g., Jacobi, Gauss-Seidel), and Newton-Raphson method for finding roots of equations. These methods are used to solve complex mathematical models or engineering problems.

Ordinary and Partial Differential Equations: The course covers numerical techniques for solving ordinary differential equations (ODEs) and partial differential equations (PDEs). Students learn methods such as Euler's method, Runge-Kutta methods, finite difference methods, and finite element methods to approximate solutions of differential equations that arise in various scientific and engineering fields.

Error Analysis: Numerical Analysis includes the study of error analysis and the evaluation of numerical methods. Students learn about sources of error in numerical computations, such as truncation error and rounding error. They understand techniques for assessing the accuracy and stability of numerical algorithms and how to quantify and control errors in numerical solutions.

Computer Programming and Implementation: Numerical Analysis with computer applications emphasizes the implementation of numerical methods using computer programming languages. Students learn to write computer programs to apply numerical algorithms and solve mathematical problems. Common programming languages used include MATLAB, Python, or C/C++. They gain hands-on experience in implementing numerical methods, analyzing results, and visualizing data.

Application Areas: Numerical Analysis finds applications in various scientific and engineering fields. It is used to solve complex mathematical models, simulate physical phenomena, optimize designs, perform data analysis, and make predictions. The course may include examples and exercises from areas such as physics, engineering, finance, and computer graphics.

Module 32

Code	Course/Module Title	ECTS	Semester
UOBAB0302062	Heat Transfer	5	1
Class (hr/w)	**Lab./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	88	62

Description

Conduction: Conduction is the transfer of heat through direct molecular collisions within a solid or between solids in contact. In a solid material, heat flows from higher temperature regions to lower temperature regions. The rate of heat conduction depends on the thermal conductivity of the material, the temperature gradient, and the cross-sectional area. For example, a metal rod heated at one end will conduct heat along its length, gradually raising the temperature throughout the rod.
Convection: Convection involves the transfer of heat through the movement of a fluid (liquid or gas). Convection can be natural or forced. In natural convection, heat transfer occurs due to density differences caused by temperature variations, leading to fluid movement. Forced convection, on the other hand, involves the use of external means such as fans or pumps to circulate the fluid and enhance heat transfer. Convection plays a significant role in applications such as cooling of electronic components, air conditioning systems, and fluid flow in pipes.
Radiation: Radiation is the transfer of heat through electromagnetic waves. Unlike conduction and convection, radiation does not require a medium and can occur in a vacuum. All objects with a temperature above absolute zero emit thermal radiation. The rate of heat transfer by radiation depends on the temperature, surface area, and emissivity of the objects involved. Examples of radiation heat transfer include the sun radiating heat to the Earth, heat transfer between two objects separated by space, and thermal radiation emitted by heated surfaces.

Module 33

Code	Course/Module Title	ECTS	Semester
UOBAB0302063	Aerodynamics	3	6
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	45	30

Description

Fluid Mechanics: Aerodynamics is a branch of fluid mechanics that specifically focuses on the behavior of air. It involves studying the properties of air, such as density, pressure, temperature, and velocity, and their interactions with solid objects. Fluid mechanics principles, such as conservation of mass, momentum, and energy, are applied to analyze the flow of air around objects.
Drag and Lift: Two fundamental forces in aerodynamics are drag and lift. Drag is the force that opposes the motion of an object through the air, while lift is the force that acts perpendicular to the direction of motion and supports the object against gravity. Understanding the factors that affect drag and lift is crucial for optimizing the performance of vehicles and aircraft.
Bernoulli's Principle: Bernoulli's principle is a fundamental concept in aerodynamics. It states that as the speed of a fluid (such as air) increases, its pressure decreases, and vice versa. This principle is often used to explain the

generation of lift on aircraft wings. The curved shape of the wing, known as an airfoil, creates a pressure difference between the upper and lower surfaces, resulting in upward lift forces.
Boundary Layer: The boundary layer is the thin layer of air adjacent to a solid surface where the airflow is affected by viscous effects. It plays a significant role in determining the drag experienced by objects. Engineers study the boundary layer to optimize the surface design and minimize the drag.
Flow Characteristics: Aerodynamics involves the analysis of different flow regimes around objects, including laminar flow, turbulent flow, and transitional flow. Laminar flow is smooth and organized, while turbulent flow is characterized by chaotic motion and mixing. The transition between these flow regimes can significantly affect the drag and lift forces experienced by objects.
Wind Tunnel Testing and Computational Fluid Dynamics (CFD): To study and analyze aerodynamic behavior, engineers use wind tunnels and computational fluid dynamics simulations. Wind tunnels provide controlled conditions to measure the forces and flow characteristics on scaled models. CFD involves using numerical methods and computer simulations to solve the governing equations of fluid flow, allowing for detailed analysis of complex aerodynamic phenomena.
Applications: Aerodynamics has broad applications in various fields, including aerospace engineering, automotive design, wind turbine design, sports equipment design (such as cycling helmets and racing cars), and building design (to optimize energy efficiency and airflow around structures). Understanding aerodynamics is crucial for designing efficient, stable, and safe vehicles, aircraft, and structures.

Module 34

Code	Course/Module Title	ECTS	Semester
UOBAB0302064	Theory of Automobiles	6	6
Class (hr/w)	**Lab/Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	88	62

Description

Vehicle Dynamics: Vehicle dynamics focuses on the behavior and motion of automobiles. It involves studying the forces and moments acting on a vehicle during acceleration, braking, and cornering. Concepts such as weight transfer, traction, stability, and handling characteristics are analyzed to optimize the performance and safety of the vehicle.
Powertrain Systems: The powertrain of an automobile includes the engine, transmission, and drivetrain components responsible for generating and transmitting power to the wheels. Understanding the principles of internal combustion engines, hybrid systems, or electric motors, as well as various types of transmissions (e.g., manual, automatic, continuously variable), is crucial in the theory of automobiles.
Suspension and Chassis Design: The suspension system and chassis of an automobile play a significant role in providing comfort, stability, and handling characteristics. Topics such as suspension geometry, spring and damper characteristics, anti-roll bars, and chassis stiffness are studied to optimize ride quality, handling, and vehicle stability.
Braking Systems: Brakes are vital for the safety and control of automobiles. The theory of automobiles covers the principles and components of braking systems, such as hydraulic systems, brake pads, discs, and drum brakes. Topics include brake performance, braking distance, and technologies like anti-lock braking systems (ABS) and electronic stability control (ESC).
Steering Systems: Steering systems allow the driver to control the direction of the vehicle. The theory of automobiles explores different types of steering systems, such as rack and pinion, recirculating ball, or electronic power steering (EPS). Concepts related to steering geometry, steering effort, and maneuverability are studied to

ensure precise and responsive steering.
Safety Systems: The theory of automobiles emphasizes the importance of safety systems to protect occupants in the event of accidents. Topics include seat belt systems, airbags, crashworthiness, and vehicle crash simulations. Understanding safety regulations and design principles is crucial for engineers involved in vehicle safety.
Vehicle Aerodynamics: Aerodynamics plays a significant role in the efficiency, performance, and stability of automobiles. Concepts such as drag reduction, lift optimization, and airflow management around the vehicle are studied. Streamlining the vehicle's shape, optimizing airflow around components, and minimizing aerodynamic drag are crucial considerations in automobile design.
Vehicle Electronics and Control Systems: Modern automobiles incorporate a wide range of electronic systems and control modules for various functions, including engine management, vehicle stability control, infotainment, and driver-assistance systems. The theory of automobiles covers topics such as electronic control units (ECUs), sensors, actuators, and communication networks.

Module 35

Code	Course/Module Title	ECTS	Semester
UOBAB0302065	Design of Mechanical Systems (with Solid - Works)	6	6
Class (hr/w)	**Lab/Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	75	75

Description

Design Methodology: The course emphasizes the systematic design process, which includes problem definition, conceptual design, detailed design, analysis, and validation. Students learn to identify design requirements, generate design concepts, and evaluate them based on factors such as functionality, performance, safety, and cost.
Machine Components: The course covers the design and selection of various machine elements that are commonly used in mechanical systems. These elements include gears, bearings, shafts, couplings, springs, fasteners, belts, chains, brakes, clutches, and other components. Students learn about the design principles, material selection, and manufacturing considerations for these elements.

Stress Analysis: Stress analysis is an integral part of machine element design. Students learn how to analyze and calculate the stresses, deformations, and failure modes in machine components subjected to different loads, such as static, dynamic, and impact loads. They use tools like finite element analysis (FEA) to assess the structural integrity and optimize the designs for strength and durability.
Fatigue and Fracture: Fatigue and fracture considerations are crucial in the design of mechanical systems. Students learn about fatigue life estimation, fatigue failure modes, and factors that influence fatigue strength, such as stress concentration, surface finish, and material properties. Fracture mechanics principles are also covered to analyze crack propagation and predict the failure of machine elements.
Tolerance and Fits: Tolerance analysis and fit selection play a significant role in ensuring proper assembly and functionality of machine components. Students learn about geometric dimensioning and tolerancing (GD&T) standards and techniques for specifying tolerances. They also study different types of fits, such as clearance fits, interference fits, and transition fits, and their implications on assembly and performance.
Design for Manufacturing and Assembly (DFMA): The course emphasizes designing machine elements considering manufacturing and assembly processes. Students learn to optimize designs for efficient and cost-effective production, including considerations for material selection, machining, casting, forming, and assembly techniques.

They explore strategies for reducing part count, simplifying assembly, and minimizing manufacturing tolerances.
Computer-Aided Design (CAD): The use of CAD software, such as SolidWorks, is an integral part of the course. Students gain hands-on experience in creating 3D models, performing simulations, conducting virtual testing, and generating engineering drawings. They learn how to integrate CAD tools with design analysis and optimization techniques.
Design Projects: Machine Elements Design courses often involve design projects where students apply the concepts and skills learned throughout the course to solve real-world design challenges. These projects may include designing complete mechanical systems or focusing on specific machine elements, allowing students to gain practical experience and enhance their problem-solving abilities.

Module 36

Code	Course/Module Title	ECTS	Semester
UOBAB0302066	Industrial Engineering	3	6
Class (hr/w)	**Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1	45	30

Description

Systems Analysis and Optimization: Industrial engineers analyze and optimize systems as a whole. They study and understand the components, interactions, and relationships within a system, whether it's a manufacturing plant, supply chain, healthcare facility, or service organization. By analyzing data, conducting simulations, and applying mathematical models, they identify bottlenecks, inefficiencies, and areas for improvement.
Work Methods and Ergonomics: Industrial engineers focus on designing efficient work methods and ensuring ergonomic considerations in the workplace. They analyze tasks, workflows, and human factors to enhance productivity, reduce fatigue, prevent injuries, and improve worker satisfaction. This may involve optimizing workstations, tools, equipment, and job rotations to create safe and efficient work environments.
Operations Management: Industrial engineers are involved in managing and optimizing operational processes. They study production systems, inventory management, supply chain logistics, scheduling, and capacity planning to minimize lead times, reduce costs, and increase throughput. They use techniques like lean manufacturing, Six Sigma, and operations research to improve process efficiency and quality.
Quality Control and Assurance: Industrial engineers play a role in quality control and assurance by implementing quality management systems, statistical process control, and quality improvement methodologies. They develop and analyze metrics, conduct audits, and implement corrective and preventive actions to ensure consistent product or service quality.
Industrial Automation and Robotics: Industrial engineers explore the integration of automation technologies, such as robotics, artificial intelligence, and machine learning, into industrial processes. They design and optimize automated systems to increase productivity, improve safety, and reduce human error. They may also focus on human-robot collaboration and the design of efficient man-machine interfaces.
Supply Chain and Logistics: Industrial engineers contribute to the design and optimization of supply chain networks and logistics operations. They analyze transportation, warehousing, inventory management, and distribution strategies to improve efficiency, reduce costs, and enhance customer satisfaction. They use techniques like network optimization, inventory modeling, and demand forecasting to streamline supply chain operations.
Simulation and Modeling: Industrial engineers employ computer-based simulation and modeling techniques to analyze and optimize systems. They create mathematical models and simulations to study different scenarios, test hypotheses, and make informed decisions. These tools allow them to evaluate system performance, identify improvement opportunities, and predict the impact of changes before implementation.

Project Management: Industrial engineers often lead or contribute to project management efforts. They apply project management principles to plan, execute, and control projects, ensuring they are delivered on time, within budget, and according to specifications. They manage resources, assess risks, and employ project management tools and methodologies to drive successful project outcomes.

Four Years
1st Semester

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Mechanical Vibration I
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	First / 2022- 2023
7. Number of hours of study (total	75 Hours
8. The date of preparing this description-	5-9-2022

9. Course objectives

1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering
2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3- applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.
5- Participation in promoting engineering awareness, conducting scientific courses and site visits

to manufacturing facilities, and recognizing the need for ongoing self-development of professional knowledge and how to locate, evaluate, compile, and correctly apply it.

6- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational programmer.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyses the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) The ability to evaluate control systems and their efficiency in all car systems, evaluate the automobile's operating system, exhaust emission rates, and their impact on environmental pollution by creating and implementing appropriate measurements and tests to ensure quality requirements are met, analyzing the results, and using engineering judgment to draw conclusions.
4) The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes.
5) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
6) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.
5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1- exams
2- Continuous evaluation
3- Reports
4- stimulation
5- Feedback from students

11- Course Structure					
Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
,٣,٤,	1,2,3,6	Basic concepts of vibration	5%	3	1
,3,4,5	٣,٦,	Introduction to oscillatory motion	5%	3	2
, 3,4,5	4,5,6	Free vibration of an undamped single degree of freedom	5%	3	3
1,2,3,4,	1,2,3	Simple energy method (Raleigh principle)	5%	3	4
3,4,5	1,2,3,6	Free vibration viscous damped single degree of freedom system	8%	3	5
1,,4,5	1,2,5,6	Equivalent springs and dampers	8%	3	6
1,2,3,4,5	1,2,3,4,5,6	Logarithmic decrement	7%	3	7
,3,4,5	1,2,6	Forced vibration of single degree of freedom	7%	3	8
1,4,5	1,2,3	Forced vibration for constant force	8%	3	9
1,2,5	1,2,3	Forced Vibration for sinusoidal force	7%	3	10
1,2,3,4,5	1,5,6	Rotating unbalance	8%	3	11
1,2,3,4,5	1 ,6	Support motion example	7%	3	12
1,2,3,4,5	3,4,5,6	Vibration isolation	6%	3	13
1,2,5	1,2,5,6	Vibration measuring instrument	7%	3	14
1,2,3	1,2,3,4	Two degree of freedom	7%	3	15

12-Infrastructure	
	-Required readings: Basic Texts
	Main references (sources)
Special requirements (including, for example, workshops, periodicals, (software and websites	Recommended books and references (scientific (.journals, reports, etc
	Electronic references, ...websites

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Automobile Air-conditioning, I
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	First / 2022- 2023
7. Number of hours of study (total)	75 Hours
8. The date of preparing this - description	5-9-2022

9. Course objectives

1. Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering
2. Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3. applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4. Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area

of specialty.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyses the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes.
4) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
5) 6) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.
5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1) exams
2) Continuous evaluation
3) Homework
4) Stimuli
5) Feedback from students

11- Course Structure

Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
,3,4,5	1,2,3,6	Introduction in Air-condition	5%	6	١

٢	6	5%	Air and Humidity Calculations	4,5,6	,3,4,5
٣	6	5%	Psychrometric Chart	1,2,3	, 3,4,5
٤	6	5%	Air-Conditioning Processes	١,٢,٥,٦	1,2,3,4,
٥	6	7%	Heat transfer cross wall	1,2,3,6	3,4,5
٦	6	7%	Heat load	1,2,5,6	1,,4,5
٧	6	7%	Cooling load	1,2,3,4,5,6	1,2,3,4,5
٨	6	7%	Mid-term Exam	1,2,6	,3,4,5
٩	6	8%	Duct Design	1,2,3	1,4,5
١٠	6	8%	Refrigerant Systems, Carnot Cycle,	1,2,3	1,2,5
١١	6	8%	Ideal single stage Cycles	1,5,6	1,2,3,4,5
١٢	6	8%	Liquid Sub cooling & Vapour Superheating Cycles	1 ,6	1,2,3,4,5
١٣	6	8%	Compressor Work	1,2,5,6	1,2,5
١٤	6	7%	Volumetric Efficiency	1,2,3,4	1,2,3
١٥	6	5%	Maintenance of an automobile air-conditioning system	1,4,5,6	1,2,5

12-Infrastructure

Refrigeration of Air-conditioning / R.S. Khurmi & J.K. Gupta	-Required readings: Basic Texts
Environmental Engineering Analysis and Practice / B.H. Jennings (1970)	**Main references (sources)**
Automotive Heat and Air-Conditioning System / K. Mitchell (1989)	Recommended books and references (.(scientific journals, reports, etc
متطلبات خاصة (وتشمل على سبيل المثال ورش العمل والدوريات والبرمجيات والمواقع الالكترونية)	Electronic references, ...websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Hydraulics and Pneumatics Systems
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	First/ 2022- 2023
7. Number of hours of study (total)	45 Hours
8. The date of preparing this description-	٢٠٢٢-٩-٥
9. Course objectives	
1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering	
2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.	
3- applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System,	

ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.
5- Participation in promoting engineering awareness, conducting scientific courses and site visits to manufacturing facilities, and recognizing the need for ongoing self-development of professional knowledge and how to locate, evaluate, compile, and correctly apply it.
6- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational program.

10-Learning outcomes and methods of teaching, learning and assessment
1) The ability to analyze the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) The ability to evaluate control systems and their efficiency in all car systems, evaluate the automobile's operating system, exhaust emission rates, and their impact on environmental pollution by creating and implementing appropriate measurements and tests to ensure quality requirements are met, analyzing the results, and using engineering judgment to draw conclusions.
4) The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes.
5) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
6) Knowledge and familiarity with the work and design of automobiles, as

well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.
7) Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.
Teaching and learning methods
1- The method of giving lectures. 2- Student groups 3- Workshops 4- Scientific trips to follow up the practical reality of the relevant companies. 5- E-learning inside and outside the university campus 6- Experiential learning
Evaluation methods
1- exams 2- Continuous evaluation 3- Reports 4- stimulation 5- Feedback from students

11- Course Structure					
Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
1- exams 2- Continuous evaluation	1,2	Introduction to Hydraulics and Pneumatics	4%	3	١
1- exams 2- Continuous evaluation 3- Reports 4- stimulation 5- Feedback from students	2,3	Applications of fluid power system. A brief comparison - Electrical system – Hydraulic system – Pneumatic system.	6%	3	٢
1- exams 2- Continuous evaluation 3- Reports 4- stimulation 5- Feedback from students	5,6	Pascal's law - Boyle's law. Types of fluid power system - Properties of hydraulic fluids - Properties of air.- Hydraulic and Pneumatic symbols.	5%	3	٣
1- exams 2- Continuous evaluation 3- Reports 4- stimulation 5- Feedback from students	3,4	Hydraulic pumps: Pump classification – Gear pump, Vane pump, Piston pump, construction and working of pumps – Variable	5%	3	٤
1- exams 2- Continuous evaluation 3- Reports 4- stimulation 5- Feedback from students	5,6	Displacement pumps. Hydraulic actuators: Classification – Linear hydraulic actuators – Types of hydraulic cylinders – single acting,	7%	3	٥
1- exams 2- Continuous evaluation 3- Reports	5,6	Double acting and telescopic – Cushioning mechanism. Rotary actuators-Fluid motors, Gear, Vane and Piston motors. Hydraulic valves: Classification – Pressure – Flow – Direction controls.	8%	3	٦
1- exams 2- Continuous evaluation	5,6	Hydraulic circuits – Reciprocating - Quick return – Sequencing – Synchronizing – Intensifier circuit	8%	3	٧

3- Reports 4- stimulation					
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	Accumulator circuits – Safety circuits –Milling Machine circuits	8%	3	٨
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	Press – Planner – Forklift. Electro hydraulic circuits	7%	3	٩
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	Fundamentals of Pneumatics	7%	3	١٠
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	Control Elements - Logic Circuits - Position - Pressure Sensing - Switching – Electro Pneumatic Circuits - Robotic Circuits.	7%	3	١١
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	Design of Pneumatic circuits	7%	3	١٢
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	Classic-Cascade-Step counter - Combination -Methods -	7%	3	١٣
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	PLC Microprocessors	7%	3	١٤
1- exams 2- Continuous evaluation 3- Reports 4- stimulation	5,6	Installation and Maintenance of Hydraulic and Pneumatic power packs - Fault finding - Principles of Low Cost Automation	7%	3	١٥

12-Infrastructure	
Anthony Esposito, ―Fluid Power with Applications‖, Pearson Education 2000.	Required readings:- Basic Texts Course Books Other
1. Andrew Parr, " Hydraulics and Pneumatics (HB) ", Jaico Publishing House, 1999. 2. Anthony Esposito, ―Fluid Power with Applications‖, Pearson Education 2000.	**Main references (sources)**
Special requirements (including, for example, workshops, periodicals, software and websites)	Recommended books and references (scientific journals, reports, etc(.
1. Dudleyt, A. Pease and John J. Pippenger, " Basic Fluid Power ", Prentice Hall, 1987. 2. Anthony Esposite, " Fluid Power with Applications ", Prentice Hall, 1980. 3. Majumdar S.R., ―Oil Hydraulics‖, Tata McGraw-Hill, 2000. 4. Majumdar S.R., ―Pneumatic systems – Principles and maintenance‖, Tata McGraw Hill, 1995 5. Anthony Lal, ―Oil hydraulics in the service of industry‖, Allied publishers, 1982. 6. Dudelyt, A. Pease and John T. Pippenger, ―Basic Fluid Power‖, Prentice Hall, 1987.	Electronic references, websites...
13- Course development plan	
improvement plans Realistic improvement plans derived from consideration of available evidence and assessments. It may be applied for more than one year, but it is prepared and reviewed every year at the level of courses, academic programs and the educational institution.	

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Measuring Systems
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	First 2022- 2023
7. Number of hours of study (total	75 Hours
8. The date of preparing this - description	٢٠٢٢-٩-٥
9. Course objectives	
1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering	
2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.	
3- applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)	
4- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.	

5- Participation in promoting engineering awareness, conducting scientific courses and site visits to manufacturing facilities, and recognizing the need for ongoing self-development of professional knowledge and how to locate, evaluate, compile, and correctly apply it.
6- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational program.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyze the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) The ability to evaluate control systems and their efficiency in all car systems, evaluate the automobile's operating system, exhaust emission rates, and their impact on environmental pollution by creating and implementing appropriate measurements and tests to ensure quality requirements are met, analyzing the results, and using engineering judgment to draw conclusions.
4) The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes.
5) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
6) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.
5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1- exams
2- Continuous evaluation
3- Reports
4- stimulation
5- Feedback from students

11- Course Structure					
Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
1,2,3,6	5,6	Characteristics of measuring devices: Classifications of measuring devices	5%	3	١
,3,4,51,2	5,6	Characteristics of static and kinematic measuring devices	5%	3	٢
, 3,4,51	5,6	Experimental error analysis - systematic and random	5%	3	٣
1,2,3,4,	5,6	Statistical analysis - imprecision	5%	3	٤
3,4,5,1	5,6	Experimental planning and selection of measuring instruments	7%	3	٥
1,,4,,6,9	5,6	Hardware dependency	8%	3	٦
1,2,3,4,5	5,6	Unit Two: Measurements of Natural Quantities: Thermometer - Physical Properties	8%	3	٧
,3,4,5	5,6	Thermometers	8%	3	٨
1,4,5,8,9	5,6	Pressure and flow measuring devices	7%	3	٩
1,2,5,7	5,6	Module Three: -Advance Metrics Techniques: Shadow Graphing	7%	3	١٠
1,2,3,4,5	5,6	internal magnetic forces	7%	3	١١
1,2,3,4,5	5,6	Schileren	7%	3	١٢
1,2,3,4,5	5,6	Laser Doppler Accelerometer	7%	3	١٣
1,2,,6,85	5,6	Hot wire speedometer	7%	3	١٤
1,2,9,3	5,6	Telemetry measures	7%	3	١٥

12-Infrastructure	
1. Engineering Metrology, R.K. Jain, Khanna Publishers, 1994. 2. Mechanical Measurements, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006	Required readings:- Basic Texts Course Books Other
1.Engineering Metrology, I.C. Gupta, Dhapat Rai Publications, Delhi. 2. Mechanical Measurements, R.K. Jain 3. Industrial Instrumentation, Alsutko, Jerry. D. Faulk, Thompson Asia Pvt. Ltd.2002.	**Main references (sources)**
Mechanical Measurements, Beckwith Marangoni and Lienhard, Pearson Education, 6th Ed., 2006.	Recommended books and references (scientific journals, reports, etc(.

1- Control Systems Principles and Design, M. Gopal, Tata McGraw Hill Publishing Co. Ltd., New Delhi Copyright Year: 2020, dissidents. 2- https://archive.nptel.ac.in/courses/112/106/112106139/	Electronic references, websites...
13- Course development plan	
improvement plans Realistic improvement plans derived from consideration of available evidence and assessments. It may be applied for more than one year, but it is prepared and reviewed every year at the level of courses, academic programs and the educational institution.	

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Vehicle design I
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	Second / 2022- 2023
7. Number of hours of study (total)	30 Hours
8. The date of preparing this description-	2023-05-30

9. Course objectives

1. Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering
2. Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3. applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4. Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyse the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.
5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1) exams
2) Continuous evaluation
3) Homework
4) Stimuli
5) Feedback from students

11- Course Structure					
Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
2,3	2,3,5	Introduction Components of IC engine & its Function.	5%	6	١
2,4,3	3,4,5	Body design • Car Body Details: types • 1. Saloon Car	5%	6	٢
1,2,3	3,5	• 2. Convertibles Car • 3. Estate Van Car • 4.Racing and Sports Car	5%	6	٣
2,3,4	2,4,5	Design of Cylinder liners, cylinder head, number of studs	5%	6	٤
2,3	2,3,5	Connecting Rod: Thrust in connecting rod	7%	6	٥
2,3,4	1,2,5	stress due to whipping action on connecting rod ends	7%	6	٦
2,3,4	2,4,5	Cranks and Crank shafts	7%	6	٧
2,3	4,5	strength and proportions of over hung and center cranks– Crank pins,	7%	6	٨
3,4	2,5	Crank shafts	8%	6	٩
1,2,5	1,2,5	Pistons, Forces acting on piston – Construction. Examles	8%	6	١٠
2,3,5	2,5	Design and proportions of piston,	8%	6	١١
2,5	2,3,5	Cylinder and Cylinder liners	8%	6	١٢
3,5	2,5	Valve gear mechanism	8%	6	١٣
2,3,5	2,3,5	Examples	7%	6	١٤
2	1,2,5	Introduction : Power Transmissions Systems	5%	6	١٥

12-Infrastructure	
The Motor Vehicle Thirteenth Edition T.K. GARRETT CEng, FIMechE, MRAeS	-Required readings: Basic Texts Course Books Other
Machine Design. A Textbook for the Students of B.E. / B.Tech	**Main references (sources)**
Special requirements (including, for example, workshops, periodicals, software and websites	Recommended books and references (.(scientific journals, reports, etc
	...Electronic references, websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	CAE I
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	First / 2022- 2023
7. Number of hours of study (total)	60 Hours
8. The date of preparing this description-	٢٠٢٢-٩-٥
9. Course objectives	
1. Educating and training students to obtain a Bachelor of Science in Engineering degree in	

Automotive Engineering

2. Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3. applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4. Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.

5- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational program.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyse the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
4) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.
5) Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies
5- - Experiential learning

Evaluation methods

1) exams
2) Continuous evaluation
3) Homework
4) Stimuli
5) Feedback from students

11- Course Structure

Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
,3,4,5	1,2,3,6	- Introduction to CAE I	5%	3	١
,3,4,5	٤,٥,٦	-why we use CAE I	5%	3	٢
, 3,4,5	4,5,6	-Difference between experimental and theoretical work	5%	3	٣
1,2,3,4,	1,2,3	-Error percentage	5%	3	٤
3,4,5	1,2,3,6	-how to convert mathematical issues to programming (numerical) issues	7%	3	٥
1,,4,5	1,2,5,6	-Static structural analysis	7%	3	٦
1,2,3,4,5	1,2,3,4,5,6	-How to apply boundary conditions	7%	3	٧
,3,4,5	1,2,6	-Types of applied stress and its applications	7%	3	٨
1,4,5	1,2,3	-Import the issue geometry or draw it in the design modeler	8%	3	٩
1,2,5	1,2,3	-Solve the problem and find all required results	8%	3	١٠
1,2,3,4,5	1,5,6	- Buckling analysis simulation	8%	3	١١
1,2,3,4,5	1 ,6	-Draw the required geometry	8%	3	١٢
1,2,3,4,5	3,4,5,6	-Apply boundary conditions	8%	3	١٣
1,2,5	1,2,5,6	- - Find critical buckling load, load multiplier, and safety factor	7%	3	١٤
1,2,3	1,2,3,4	- Transient Thermal analysis simulation	5%	3	١٥

12-Infrastructure

Introduction to ansys workbench ,MAE 656, Advanced computer aided design Dr. Xavier Martinez, 2012	-Required readings: Basic Texts

Various Internet Resources & New Head way plus serial	Main references (sources)
Ansys, Theory Reference, release 5.6, by peter kohnke	Recommended books and (.references
	Electronic references, ...websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Industrial Engineering
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	First 2022- 2023
7. Number of hours of study (total	30 Hours
8. The date of preparing this - description	5-9-2022
9. Course objectives	
1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering. 2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders. 3- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.	

4. Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational program.

10- Learning outcomes and methods of teaching, learning and assessment

1) The ability to understand and deal with most of the terms of industrial engineering and industrial management, its objectives and applications, get acquainted with production management and planning, cost accounting, production control, second and variable cost calculation, break-even blister calculation, gross sales, gross and net profit calculation, identification of fixed and current assets, cash assets, and how to do, plan and design production lines And calculate the number of machines required.
2) The ability to understand and manage industrial projects and service projects, the method of managing and operating companies, government institutions and the private sector by using modern methods of management such as using linear programming in managing state projects and identifying modern ways and means in calculating the costs of transporting products and planning to reduce these costs and knowing how to do detection and determination Quality control tasks on products, how to manage time and deal with it, and how to perform maintenance on used machines.
3) The ability to produce engineering designs that meet the required needs represented by the requirements of international specifications for the management of production operations for cars, the requirements of the labor market and stakeholders within the restrictions of the type of use and other determinants through the processes of analysis and installation in the design, manufacturing and production process.

4- The ability to realize ethical and professional responsibilities in engineering issues and issue sound judgments that take into account the consequences in the financial, environmental and societal fields at the global level.

Subject-specific skills

Learn how to study the design, manufacture, assembly and determine the number of production lines required for the production of cars and calculate the estimated and estimated costs in the light of market data and the desire of the consumer and in light of the amount of sales for previous years and how to calculate the time through which the wages of manpower, skilled hands, wages of advanced staff and experts and the cost of raw materials can be calculated Determining their quantities, which in turn helps to give estimated and estimated values for the main production costs in order to ensure that companies and factories obtain profits and avoid losses that may eventually lead to the halting of the production process.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.

5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1- exams
2- Continuous evaluation
3- Reports
4- stimulation
5- Feedback from students

11- Course Structure

Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
1, 3,4,5	1,2,3,6	Some basic definitions of industrial engineering	5%	3	1
,3,4,5	2, 3,4,5	Depreciation and methods of calculating depreciation	5%	3	2
, 3,4,5	4,5,6	Calculating the number of machines required	5%	3	3
1,2,3,4,	1,2,3	break-even analysis	5%	3	4
3,4,5	1,2,3,6	General Notes on Break-Even Point	7%	3	5
1,,4,5	1,2,5,6	Annual profit and volume chart	6%	3	6
1,2,3,4,5	1,2,3,4,5, 6	New design economics	7%	3	7
,3,4,5	1,2,6	Sales forecasts and guesswork	7%	3	8
1,4,5	1,2,3	linear programming	8%	3	9
1,2,3,6	1,2,3,6	Network analysis of projects	7%	3	10
,3,4,5	1,2,3,6	Trnsport problems	8%	3	11
, 3,4,5	4,5,6	Business Personalization Forms	7%	3	12
1,2,3,4,	1,2,3	Movement study	8%	3	13
3,4,5	1,2,3,6	Study of time	7%	3	14
1,4,5	1,2,5,6	Quality control	8%	3	15

12-Infrastructure

Introduction to industrial management Fundamentals of industrial engineering	-Required readings: Basic Texts
Papers from the network	**Main references (sources)**
Special requirements (including, for example, workshops, (periodicals, software and websites	Recommended books and references (scientific (.journals, reports, etc
	Electronic references,

Four year
2nd semester

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Mechanical vibration II
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	Second/ 2022- 2023
7. Number of hours of study (total	75 Hours
8. The date of preparing this description-	5-9-2022

9. Course objectives

1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering
2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3- applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.
5- Participation in promoting engineering awareness, conducting scientific courses and site visits to

manufacturing facilities, and recognizing the need for ongoing self-development of professional knowledge and how to locate, evaluate, compile, and correctly apply it.

6- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational programmer.

10-Learning outcomes and methods of teaching, learning and assessment

1- The ability to analyses the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.

2- The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.

3- The ability to evaluate control systems and their efficiency in all car systems, evaluate the automobile's operating system, exhaust emission rates, and their impact on environmental pollution by creating and implementing appropriate measurements and tests to ensure quality requirements are met, analyzing the results, and using engineering judgment to draw conclusions.

4-The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes.

5-Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.

6- Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.

Teaching and learning methods

1- The method of giving lectures.

2- Student groups

3- Workshops

4- Scientific trips to follow up the practical reality of the relevant companies.

5- E-learning inside and outside the university campus

6- Experiential learning

Evaluation methods

1- exams

2- Continuous evaluation

3- Reports

4- stimulation

5- Feedback from students

11- Course Structure					
Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
٣,٤,٥,	1,2,3,6	Two degree of freedom - Coordinate couplings - Semi definite system - Study and analyze the equation of motion for 2-Degree system. Estimating the natural frequencies and their mode shapes, Also studying the coordinal coupling and semi definite system with some examples	5%	٣	١
,3,4,5	١,٢,٣,٦	Mode shapes - Study the mode shapes fore different system of two Degree of freedom with examples	5%	٣	٢
, 3,4,5	4,5,6	Lagrange equation - Examples - Study Lagrange ,eq. for damped & undamped system free and forced Vib . and applying it for several times according to the coordinate under consideration with examples	5%	٣	٣
1,2,3,4,	1,2,3	Dynamic absorber (undamped) - Study and formulate the eq. of dynamic absorber and its caracterstic w ithout damping in addition to some examples	5%	٣	٤
3,4,5	1,2,3,6	- Study and formulate the eq. of dynamic absorber and its caracterstic with damping in addition to some examples	8%	٣	٥
1,,4,5	1,2,5,6	Multiple degree of freedom - Studying and formulating the eq, of motion for multiple degree of freedom and finding the natural freq and their mode shapes	8%	٣	٦
1,2,3,4,5	1,2,3,4,5,6	Influence coefficient matrix and stiffness matrix - Studying and finding the eigen values and hence the natural frequencies and the eigen vector (mode shape) for multiple degree of freedom system with some examples	7%	٣	٧
,3,4,5	1,2,6	Eigen values and eigen vectors - Example - Studying and finding the eigen values and hence the natural frequencies and the eigen vector (mode shape) for multiple degree of freedom system with some examples	7%	٣	٨
1,4,5	1,2,3	Torsional vibration -Single degree,Two degree and Multiple degree - Studying	8%	٣	٩

		the Tordsional Vib. for Single,Two ,and multiple degree of freedom system using holzer method and finding the equivallent of stepped shaft and Gear shaft			
1,2,5	1,2,3	Torsional vibration -Single degree,Two degree and Multiple degree - Studying the Tordsional Vib. for Single,Two ,and multiple degree of freedom system using holzer method and finding the equivallent of stepped shaft and Gear shaft	7%	٣	١٠
1,2,3,4,5	1,5,6	Torsional vibration for stepped shaft - Torsional vibration for shaft with gears - Studying the Tordsional Vib. for Single,Two ,and multiple degree of freedom system using holzer method and finding the equiva of stepped shaft and Gear shaft	8%	٣	١١
1,2,3,4,5	1 ,6	Vibration of continuous system - Studying and formulating the eq. for continuous system for different end Boundary condition and constrains with. - examples	7%	٣	١٢
1,2,3,4,5	3,4,5,6	Vibration of continuous system - Studying and formulating the eq. for continuous system for different end Boundary condition and constrains with. - examples	6%	٣	١٣
1,2,5	1,2,5,6	Rayleigh method for estimation the fundamental natural frequency - Studying Ruyliegh eq. to estimate the fundamental natural freq . of a system with examples	7%	٣	١٤
1,2,3	1,2,3,4	Dunkerley method to find 1st natural frequency - Studying Ruyliegh eq. to estimate the fundamental natural freq . of a system with examples	7%	٣	١٥

12-Infrastructure	
	-Required readings: Basic Texts
	Main references (sources)
Special requirements (including, for example, workshops, (periodicals, software and websites	Recommended books and references (.(scientific journals, reports, etc
	...Electronic references, websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	.University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Design-and-Materials-Selection
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	Second /2022-2023
7. Number of hours of study (total	30 Hours
8. The date of preparing this description-	5-9-2022

9. Course objectives

1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering

2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.

3- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyses the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labor market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
4) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.
5) Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty. Different types of vehicles, Material properties, mechanical properties, design calculations, and transmission system components for different types of vehicles

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.
5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1- exams
2- Continuous evaluation
3- Reports
4- stimulation
5- Feedback from students

11- Course Structure					
Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
و٢٣	و١٢و٣و١٥	Introduction: The Families of Engineering Materials	5%	٢	١
و٣و٢٤	و١٢	Materials Information for Design	5%	٢	٢
و٢و١٣	3,5	Materials in Design, The Evolution of Engineering Materials	5%	٢	٣
و٢و١٤	و٢و١٥	The Design Process: Types of Design, Design Tools and Materials Data Case Study;	5%	٢	٤
و٢٣	2,3,5	Case Study; Engineering Materials and Their Properties.	7%	٢	٥
و٣و٢٤	1,2,5	Design and selection for Static Strength, Design and selection for Fatigue Strength	7%	٢	٦
و٣و٤و٢٥	2,4,5	Design and selection for Creep Strength,	7%	٢	٧
و٢٣	و٢و١٣	Design and selection for Hardness and Wear Strength,	7%	٢	٨
و٣٤	2,5	Design and Materials Selection using Ashby Method: The materials property Charts, Materials Indices	8%	٢	٩
و٢و١٥	1,2,5	The selection Procedure; Case Studies: Multiple Constraints and	8%	٢	١٠
و٣و٢٥	و2,5	Conflicting Objective	8%	٢	١١
و٢٥	2,3,5	Selection with Multiple Constraints Conflicting Objective;	8%	٢	١٢
و٢و٣و١٥	2,5	Design and Materials Selection with Shape: Shape Factors Limits to Shape Efficiency,	8%	٢	١٣
و٢٣	2,3,5	Exploring Materials-Shape Combinations,	7%	٢	١٤
و٣و٢٤	1,2,5	Materials Indices Including Shape, Graphical	5%	٢	١٥

12-Infrastructure	
Text Book: Materials Selection in Mechanical Design / Michael F. Ashby. 4th ed., 2011.	-Required readings: Basic Texts
Machine Design. A Textbook for the Students of B.E. / B.Tech	**Main references (sources)**
Special requirements (including, for example, workshops, (periodicals, software and websites	Recommended books and references (.(scientific journals, reports, etc
	...Electronic references, websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Control Systems
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	Second 2022- 2023
7. Number of hours of study (total	45 Hours
8. The date of preparing this description-	5-9-2022
9. Course objectives	
1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering	
2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.	
3- applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)	
4- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.	
5- Participation in promoting engineering awareness, conducting scientific courses and site visits to manufacturing facilities, and recognizing the need for ongoing self-development of	

professional knowledge and how to locate, evaluate, compile, and correctly apply it.

6- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational program.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyze the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) The ability to evaluate control systems and their efficiency in all car systems, evaluate the automobile's operating system, exhaust emission rates, and their impact on environmental pollution by creating and implementing appropriate measurements and tests to ensure quality requirements are met, analyzing the results, and using engineering judgment to draw conclusions.
4) The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes.
5) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.
6) Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.
5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1- exams
2- Continuous evaluation
3- Reports
4- stimulation
5- Feedback from students

11- Course Structure					
Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
4,5,1	1,2	Introduction: Definitions and concept of automatic controls, classification of control system.	5%	3	١
,3,4,5	3,4	Open and closed loop systems, concepts of feedback, requirements of an ideal control system.	5%	3	٢
, 3,4,5	5,6	Mathematical Modeling: Transfer function, modeling of mechanical systems, electrical systems, elctromechanical systems, thermal systems, hydraulic and pneumatic systems, and Analogous systems: Force voltage, Force current.	5%	3	٣
1,2,3,4,	3,4	Block Diagrams and Signal Flow Graphs: Block diagram representation, functional block, block diagram reduction, Signal flow graphs, and Mason's gain formula.	5%	3	٤
3,4,5	5,6	Transient and Steady State Response Analysis: Introduction, Standard test inputs, concept of time constant and its importance in speed of response, analysis of first order and second order systems, Transient response specifications, System stability analysis - Routh-Hurwitz Criterion.	7%	3	٥
1,,4,5	5,6	Frequency Response Analysis using Nyquist Plots: Polar plots	8%	3	٦
1,2,3,4,5	5,6	Nyquist Stability Criterion, Stability Analysis, Relative stability concepts	8%	3	٧
,3,4,5	5,6	Phase and gain margin, M & N circles.	8%	3	٨
1,4,5	5,6	Frequency Response Analysis using Bode Plots: Bode attenuation diagrams, Stability Analysis using Bode plots, and Simplified Bode Diagrams, phase and gain margin.	7%	3	٩
1,2,3	5,6	Root locus plots: Definition of root loci, general rules for constructing root loci, Analysis using root locus plots.	7%	3	١٠
,3,4,5	5,6	Control Action and System	7%	3	١١

		Compensation: Types of controllers – Proportional, Integral, Proportional Integral, Proportional Derivative			
, 3,4,5	5,6	Proportional Integral Derivative controllers (Basic concept only), Series and feedback compensation, Physical devices for system compensation.	7%	3	١٢
1,2,3,4,	5,6	Introduction and Mathematical Representation of Robots History of Robots, Types of Robots, Notation, Position and Orientation of a Rigid Body.	7%	3	١٣
3,4,5	5,6	Some Properties of Rotation Matrices, Successive Rotations, Euler Angles For fixed frames X-Y-Z and	7%	3	١٤
1,,4,5	5,6	Moving frame ZYZ. Transformation between coordinate system, Homogeneous coordinates.	7%	3	١٥

12-Infrastructure	
1- Control Engineering, Uday A. Bakshi and Varsha U. Bakshi. 2- Control Engineering, D. Ganesh Rao and K. Channa Venkatesh.	Required readings:- Basic Texts Course Books Other
Feedback and Control Systems, Joseph J. Distefano, Allen R. Stubberud and Ivan J. Williams,	**Main references (sources)**
. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., New Delhi	Recommended books and references (scientific journals, reports, etc(.
2. Control Systems Principles and Design, M. Gopal, Tata McGraw Hill Publishing Co. Ltd., New Delhi	Electronic references, websites...
13- Course development plan	
improvement plans Realistic improvement plans derived from consideration of available evidence and assessments. It may be applied for more than one year, but it is prepared and reviewed every year at the level of courses, academic programs and the educational institution.	

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	.University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Vehicles Design II
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	Second / 2022-2023
7. Number of hours of study (total	30 Hours
8. The date of preparing this description-	5-9-2022

9. Course objectives

1. Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering
2. Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders
3. Providing the student to be able to study the technology of metals and alloys, as well as a basis for the engineer through which he can work on employing what he has studied in practical life
4. Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty

10-Learning outcomes and methods of teaching, learning and assessment

1. The ability to analyses the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2. The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3. Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide
4. Definitions and general concepts in vehicle design and manufacturing process of each part of the engine in different types of vehicles. Material properties, mechanical properties, design calculations, and transmission system components for different types of vehicle.
5. Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- Scientific trips to follow up the practical reality of the relevant companies.
5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1- exams
2- Continuous evaluation
3- Reports
4- stimuli
5- Feedback from students

11- Course Structure

Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
و٢و٣و١٥	و٢و٣	Design, Construction, of Flywheel		٢	١
و٣و٤	و١٢	1. Introduction. 2. Coefficient of Fluctuation of Speed. 3. Fluctuation of Energy. 4. Maximum Fluctuation of Energy. 5. Coefficient of Fluctuation of Energy.		٢	٢
و٢و٣	3,5	6. Energy Stored in a Flywheel. 7. Stresses in a Flywheel		٢	٣
و٢و٤	و٢و١٥	Rim. 8. Stresses in Flywheel Arms. 9. Design of Flywheel Arms. 10. Design of Shaft, Hub and Key. 11. Construction of Flywheels		٢	٤
و٣	2,3,5	1. Introduction. 2. Types of Clutches. 3. Positive		٢	٥
و٣و٤	1,2,5	Clutches. 4. Friction Clutches. 5. Material for Friction		٢	٦
و٣و٤و٥	2,4,5	Surfaces. 6. Considerations in Designing a Friction		٢	٧
و٣	و٢و١٣	Clutch. 7. Types of Friction Clutches		٢	٨
و٤	2,5	8. Single Disc or Plate Clutch. 9. Design of a Disc or Plate Clutch. 10. Multiple Disc Clutch. 11. Cone Clutch. 12. Design of a Cone Clutch. 13. Centrifugal Clutch. 14. Design of a Centrifugal Clutch.		٢	٩
و٢و١٥	1,2,5	1. Introduction. 2. Friction Wheels. 3. Advantages and		٢	١٠
و٣و٥	و2,5	Disadvantages of Gear Drives. 4. Classification of		٢	١١
و٥	2,3,5	Gears.5. Terms used in Gears. 6. Condition for Constant		٢	١٢
و٢و٣و١٥	2,5	Velocity Ratio of Gears–Law of Gearing.		٢	١٣
و٢و١٥	2,3,5	examples		٢	١٤
2	1,2,5	GEARS, Classification of Gears		٢	١٥

12-Infrastructure

The Motor Vehicle Thirteenth Edition T.K. GARRETT ▪ CEng, FIMechE, MRAeS	-Required readings: Basic Texts Course Books Other
Machine Design. A Textbook for the Students of B.E. / B.Tech	**Main references (sources)**
Special requirements (including, for example, workshops, (periodicals, software and websites	Recommended books and references (.(scientific journals, reports, etc
	...Electronic references, websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	Automotive Air-Conditioning System II
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	second / 2022- 2023
7. Number of hours of study (total)	60 Hours
8. The date of preparing this description-	5-9-2022
9. Course objectives	
1. Educating and training students to obtain a Bachelor of Science in Engineering degree	

in Automotive Engineering

2. Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3. applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4. Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyses the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and installation processes in the design process.
3) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
4) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.
5) Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.

Teaching and learning methods

1- The method of giving lectures.

2- Student groups

3- Workshops

4- Scientific trips to follow up the practical reality of the relevant companies.

5- E-learning inside and outside the university campus
6- Experiential learning

Evaluation methods

1) exams
2) Continuous evaluation
3) Homework
4) Stimuli
5) Feedback from students

11- Course Structure

Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
,3,4,5	2,3,5	unit 1 : automotive air-conditioning fundamentals	5%	6	١
, 3,4,5	3,4,5	Basic Air conditioning system- Location of Air conditioning components in a car – schematic layout of a Refrigeration system. Compressor	5%	6	٢
1,2,3,4,	3,5	Thermostatic expansion valve and Orific tube – expansion valve calibration – evaporator temperature controls for TXV and CCOT systems.	5%	6	٣
3,4,5	2,4,5	UNIT 2 : AIRCONDITIONER – HEATING SYSTEM	5%	6	٤
1,,4,5	2,3,5	Manually controlled air conditioner- Heater system- ford automatically controlled air conditioner- Heater systems- Chrysler automatically controlled air conditioner-	8%	6	٥
1,2,3,4,5	1,2,5	heater system, general motors automatically controlled Air conditioner- heater system- Flushing and evacuating	8%	6	٦
,3,4,5	2,4,5	UNIT 3 : REFRIGERANT	7%	6	٧
1,4,5	4,5	Containers- handling refrigerant – discharging, charging and leak detection – refrigeration system	7%	6	٨
1,2,5	2,5	Diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.	8%	6	٩
1,2,3,4,5	1,2,5	AIR ROUTING AND TEMPERATURE CONTROL	7%	6	١٠
1,2,3,4,5	2,5	Objectives – Evaporators case air flow through the Dash recalculating unit – Automatic Temperature control	8%	6	١١
1,2,3,4,5	2,3,5	– Duct system- Controlling flow – vacuum reserve – testing the air control and handling systems	7%	6	١٢

1,2,5	2,5	UNIT 5 : HEATER- AIR CONDITIONER TROUBLE SHOOTING& SERVICE	6%	6	١٣
1,2,3	2,3,5	Air conditioner maintenance and service- servicing heater system. removing and replacing components. trouble shooting of air conditioner- heating system- compressor service.	7%	6	١٤
1,2,5	1,2,5	Effect of Pressure and Temperature on the Rankine Cycle, The Reheat Cycle, the Regenerative Cycle,	7%	6	١٥

12-Infrastructure	
1 Mitchell information services, Inc., Mitchell Automotive Heating and Air conditioning systems, prentice Hall Inc, 1989.	-Required readings: Basic Texts
2. Paul Weisler, Automotive Air conditioning, Reston Publishing Co. Inc., 1990.	**Main references (sources)**
3. McDonald K.L., Automotive Air conditioning., Theodore Audel series., 1978.	Recommended books and references
https://www.amazon.com/Heating-Ventilating-Conditioning-Analysis-Design/dp/0471470154	...Electronic references, websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	University of Babylon
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	CAE II

4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly
6. Semester/year	Second / 2022- 2023
7. Number of hours of study (total)	60 Hours
8. The date of preparing this description-	5-9-2022

9. Course objectives

1. Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering
2. Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.
3. applying national standards for engineering accreditation, specialized international standards, standards of good educational laboratory (GLP), and national standards for laboratories to the development of curricula and the other requirements of the other educational process to ensure the quality of education and Knowledge and understanding of occupational standards (ISO 45001 Occupational Health and Safety Management System, ISO 14001 Environmental Management System, and ISO 50001 Energy Management System)
4. Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.

5- Applying the principle of self-evaluation and benefiting from feedback enables the department to achieve continuous improvement in all aspects of its educational program.

10-Learning outcomes and methods of teaching, learning and assessment

1) The ability to analyse the performance of engines and determine car malfunctions and maintenance costs by distinguishing, identifying, defining, formulating, and solving engineering problems by employing engineering, science, and mathematics principles.
2) The ability to produce engineering designs that meet the required needs is represented by the requirements of international specifications for automobile production, the needs of the labour market and stakeholders within the constraints of the type of use, and other determinants through the analysis and

installation processes in the design process.

3) Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide.
4) Knowledge and familiarity with the work and design of automobiles, as well as the use of the most important technologies in the design and manufacture of automobiles, through the ability to recognize the need for ongoing self-development of professional knowledge and how to locate, evaluate, collect, and correctly implement it.
5) Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.

Teaching and learning methods

1- The method of giving lectures.
2- Student groups
3- Workshops
4- E-learning inside and outside the university campus
5- Experiential learning

Evaluation methods

1) exams
2) Continuous evaluation
3) Homework
4) Stimuli
5) Feedback from students

11- Course Structure

Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
	1,2,3,6	Introduction to CAE	5%	٢	١
,3,4,5		Static Structure	5%	٢	٢
, 3,4,5	4,5,6	Buckling	5%	٢	٣
1,2,3,4,	1,2,3	Transient Thermal	5%	٢	٤
3,4,5	1,2,3,6	Steady State Thermal	8%	٢	٥
1,,4,5	1,2,5,6	Explicit Dynamic	8%	٢	٦
1,2,3,4,5	1,2,3,4,5,6	Static structure &Steady state interaction	7%	٢	٧
,3,4,5	1,2,6	Static structure & Transient thermal interaction	7%	٢	٨

1,4,5	1,2,3	Fluid flow (fluent)	8%	٢	٩
1,2,5	1,2,3	Fluid CFX	7%	٢	١٠
1,2,3,4,5	1,5,6	optimization	8%	٢	١١
1,2,3,4,5	1 ,6	Modal	7%	٢	١٢
1,2,3,4,5	3,4,5,6	Harmonic response	6%	٢	١٣
1,2,5	1,2,5,6	EXAM.1	7%	٢	١٤
1,2,3	1,2,3,4	EXAM.2	7%	٢	١٥

12-Infrastructure	
Introduction to ansys workbench ,MAE 656, Advanced computer aided design Dr. Xavier Martinez, 2012	-Required readings: Basic Texts
Ansys, Theory Reference, release 5.6, by peter kohnke	**Main references (sources)**
	Recommended books and references (.(scientific journals, reports, etc
	...Electronic references, websites

Course description

This course description provides a brief summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made maximum use of the available learning opportunities. It must be linked to the description of the program.

1. Educational Institution	Babylon University
2. University Department / Center Scientific Department	Automobiles Engineering Department
3. Course name/code	English Language, IIII
4. Programs in which it enters	Bachelor
5. Forms of attendance available	Weekly

6. Semester/year	Second 2022/2023
7. Number of hours of study (total	30 Hours
8. The date of preparing this - description	٢٠٢٣/٥/٩

9. Course objectives
1- Educating and training students to obtain a Bachelor of Science in Engineering degree in Automotive Engineering **2- Preparing qualified automotive engineers that meet both the local specialized standards (the national standards for engineering accreditation) and the international standards (ABET standards), as well as the requirements of stakeholders.** **3- Contribute effectively to the growth of the engineering management system and scientific capabilities in the fields of design, manufacturing, and quality control through the production of scientific research and graduation projects in the department's area of specialty.**

10-Learning outcomes and methods of teaching, learning and assessment
1- The ability to communicate effectively orally with a variety of individuals and in writing with various management levels and purposes. 2- Ability to understand ethical and professional responsibilities in engineering issues and make ethical choices that take into account the effects on the financial, environmental, and societal fields worldwide. 3- Ability to effectively lead and manage work teams, set objectives based on capabilities, plan to achieve them correctly, meet deadlines, and manage risk and uncertainty.
Teaching and learning methods
1- The method of giving lectures. 2- Student groups 3- Workshops 4- Scientific trips to follow up the practical reality of the relevant companies. 5- E-learning inside and outside the university campus 6- Experiential learning
Evaluation methods

1- exams
2- Continuous evaluation
3- Reports
4- stimuli
5- Feedback from students

12-Infrastructure	
▪ New Headway Plus by John & Liz Soars for Beginners ▪ Various Internet Resources & New Head way plus serial	-Required readings: Basic Texts Course Books
The Cambridge Encyclopedia of the English Language by David Crystal	Main references (sources)
	Recommended books and references (scientific journals, (.reports, etc
	...Electronic references, websites

11- Course Structure

Evaluation method	education method	Unit name/course or topic	Required learning outcomes	Theoretical hours	Week
2و٣	1و٢و٣و٥	Introduction – Giving a general information about English Language	5%	٢	١
2و٣و٤	1و٢	Greetings	5%	٢	٢
1و٢و٣	3,5	Listening & speaking	5%	٢	٣
1و٢و٤	1و٢و٥	Possessives adjectives	5%	٢	٤
2و٣	2,3,5	Present simple tense	7%	٢	٥
2و٣و٤	1,2,5	Present continuous tense	7%	٢	٦
2و٣و٤و٥	2,4,5	Mid-term Exam	7%	٢	٧
2و٣	1و٢و٣	Past & past continuous tense	7%	٢	٨
3و٤	2,5	Making question	8%	٢	٩
1و٢و٥	1,2,5	Future tense	8%	٢	١٠
2و٣و٥	2,5و	Pronouns	8%	٢	١١
2و٥	2,3,5	Practice language	8%	٢	١٢
1و٢و٣	2,5	Correcting English mistakes	8%	٢	١٣
1وو٥	2,3,5	Countable & un countable nouns	7%	٢	١٤
2	1,2,5	Adjectives	5%	٢	١٥