11- Course Dynamics Specification of Advanced of Machinery
Course Code (ME 514)

• General Information About the Course:

1.	Course Title:	Advanced Dynamics of Machinery			
2.	Course Code and Number:	ME514.			
3.	Credit Hours:	Contact Hours			Total (Credit Hours)
		Lecture	Practical	Seminar/Tutorial	
		2	-	2	3
4.	Study Level and Semester:	2nd Semester.			
5.	Pre-requisites (if any):	ME 222, ME 501			
6.	Co-requisites (if any):				
7.	Program (s) in which the course is offered:	MSc. In Mechanical Engineering Program.			
8.	Language of teaching the course:	English Language.			
9.	Study System:	Courses & Thesis.			
10.	Prepared By:	Assist. Prof. Dr. Abdulsalam Naji.			
11.	Reviewed by:	Dr. ……			
12.	Date of Approval:				

• Course Description:

Dynamics of machinery is denned as the study of motions and forces in machines. The course is designed to give advanced knowledge of behavior of machines under dynamic condition. Dynamic problems first occurred in power and work machines. Torsional vibrations were observed in reciprocating engines, and bending vibrations put turbine components at risk. Explaining such phenomena has long been the only task of the dynamics of machinery. Knowledge of the dynamics of machinery is also required for designing machines that are based on dynamic principles. This includes hammers, robots, stemmers، oscillating conveyors, screens, vibrators, textile mandrils, centrifuges, etc.

• Course Intended Learning Outcomes (CILOs):

Upon successful completion of Advanced Dynamics of Machinery Course, the graduates will be able to:

a1- Illustrate the basic knowledge of engineering sciences subjects concerning the motion of machine parts**.**

a2 - Describe the different parameters such as position, displacement, velocity, acceleration forces, torques and power within the dynamic machinery.

a3- Classify concepts and techniques to design mechanical machines with sustainable and environmentally friendly approach.

b1 - Develop mathematical equations and computers software to solve dynamic machinery problems.

b2- optimize machine parts to meet desired needs within realistic machines assembly constraints and constructions.

c1- Demonstrate suitable manufacturing processes for the actual design of the machinery components.

c2- Perform dynamic solutions for the motions of different mechanical parts in the machines.

d1- Justify in both orally and writing forms for different audiences.

d2- Assess latest knowledge for life-long learning in the area of the dynamic machinery.

• Alignment of Course Intended Learning Outcomes (CILOs) to Program Intended Learning Outcomes (PILOs)

CILOs		PILOs	
• **Knowledge and Understanding:** Upon successful completion of the Advanced Dynamics of Machinery Course , the graduates will be able to:		• **Knowledge and Understanding:** Upon successful completion of the **MSc. In Mechanical Engineering Program**, the graduates will be able to:	
a1.	Illustrate the basic knowledge of engineering sciences subjects concerning the motion of machine parts.	**A1.**	Acquire advanced concepts and knowledge of mathematics, scientific, mechanical engineering and associated technologies as well as across the boundaries of interdisciplinary disciplines.
a2.	Describe the different parameters such as position, displacement, velocity, acceleration forces, torques and power within the dynamic machinery.	**A2.**	Identify and critically evaluate contemporary engineering technologies, current developments and emerging trends within the mechanical engineering contexts.
a3.	Classify concepts and techniques to design mechanical machines with sustainable and environmentally friendly approach.	**A3.**	Provide a holistic description of principles, concepts, approaches, techniques and analysis tools to design and development of existing and novel mechanical systems, while taking a sustainable and environmentally-friendly approach.

• **Cognitive/ Intellectual Skills:** Upon successful completion of the Advanced Dynamics of Machinery Course **,** the graduates will be able to:		• **Cognitive/ Intellectual Skills:** Upon successful completion of the **MSc. In Mechanical Engineering Program,** the graduates will be able to:	
b1.	Develop mathematical equations and computers software to solve dynamic machinery problems.	**B2.**	Creatively thinking and apply analysis tools to formulate and solve complex engineering problems in the mechanical engineering context using modern techniques and tools.
b2.	optimize machine parts to meet desired needs within realistic machines assembly constraints and constructions.	**B3.**	Design and optimize mechanical components, systems and process to meet desired needs within realistic constraints.
• **Professional and Practical Skills:** Upon successful completion of the Advanced Dynamics of Machinery Course **,** the graduates will be able to:		• **Professional and Practical Skills:** Upon successful completion of the **MSc. In Mechanical Engineering Program,** the graduates will be able to:	
c1.	Demonstrate suitable manufacturing processes for the actual design of the machinery components.	**C1.**	Use modern manufacturing processes and materials, experimental tests, appropriate software packages and other modern tools for the design analysis and manufacture of mechanical components and systems.
c2.	Perform dynamic solutions for the motions of different mechanical parts in the machines.	**C2.**	Conduct research and studies to solve mechanical engineering problems professionally, ethically and responsibly within realistic constraints.
• **Transferable Skills:** Upon successful completion of the Advanced Dynamics of Machinery Course **,** the graduates will be able to:		• **Transferable Skills:** Upon successful completion of the **MSc. In Mechanical Engineering Program,** the graduates will be able to:	
d1.	Justify in both orally and writing forms for different audiences.	**D2.**	Communicate, present, challenge and defend research ideas, results and conclusions in both orally and writing forms to different audiences in contexts.
d2.	Assess latest knowledge for life-long learning in the area of the dynamic machinery.	**D3.**	Identify a need for the latest relevant knowledge and technologies and undertake life-long learning.

• Alignment of CILOs to Teaching and Assessment Strategies

• Alignment of Knowledge and Understanding CILOs:

	Knowledge and Understanding CILOs	Teaching Strategies	Assessment Strategies
a1.	Illustrate the basic knowledge of engineering sciences subjects concerning the motion of machine parts.	▪ Lectures, ▪ Seminars, ▪ Self-Learning	▪ Oral & Written Exams. ▪ Reports, ▪ Survey,

		Problems/Studies, ▪ Case study, ▪ Group/Individual Projects and Studies, ▪ Field Work ▪ Active learning, ▪ Computer hands-on sessions.	▪ Written Exam, ▪ Assignments
a2.	Describe the different parameters such as position, displacement, velocity, acceleration forces, torques and power within the dynamic machinery.	▪ Lectures, ▪ Seminars, ▪ Self-Learning Problems/Studies, ▪ Case study, ▪ Group/Individual Projects and Studies, ▪ Field Work ▪ Active learning, ▪ Computer hands-on sessions.	▪ Oral & Written Exams ▪ Reports, ▪ Survey, ▪ Written Exam, ▪ Assignments.
a3.	Classify concepts and techniques to design mechanical machines with sustainable and environmentally friendly approach.	▪ Lectures, ▪ Seminars, ▪ Self-Learning Problems/Studies, ▪ Case study, ▪ Group/Individual Projects and Studies, ▪ Field Work ▪ Active learning, ▪ Computer hands-on sessions.	▪ Oral & Written Exams. ▪ Reports, ▪ Survey, ▪ Written Exam, ▪ Assignments.

- **Alignment of Intellectual Skills CILOs:**

Intellectual Skills CILOs		Teaching Strategies	Assessment Strategies
b1.	Develop mathematical equations and computers software to solve dynamic machinery problems.	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving, ▪ Brainstorming, ▪ Presentations.	▪ Oral & Written Exams, ▪ Reports, ▪ Report, ▪ Survey, ▪ Written Exam, ▪ Assignments.
b2.	optimize machine parts to meet desired needs within realistic machines assembly constraints and constructions.	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem	▪ Oral & Written Exams, ▪ Reports, ▪ Report, ▪ Survey, ▪ Written Exam, ▪ Assignments.

		Solving, ▪ Brainstorming, ▪ Presentations.	

- **Alignment of Professional and Practical Skills CILOs:**

Professional and Practical Skills CILOs		Teaching Strategies	Assessment Strategies
c1.	Demonstrate suitable manufacturing processes for the actual design of the machinery components.	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving, ▪ Brainstorming, ▪ Presentations.	▪ Seminar Report, ▪ Written Research Proposal, ▪ Thesis and Publication.
c2.	Perform dynamic solutions for the motions of different mechanical parts in the machines.	▪ Lectures, ▪ Project Supervision, ▪ Self-Learning, ▪ Case Study, ▪ Simulation Exercises, ▪ Independent Study, ▪ Analysis and Problem Solving, ▪ Brainstorming, ▪ Presentations.	▪ Seminar Report, ▪ Written Research Proposal, ▪ Thesis and Publication.

- **Alignment of Transferable (General) Skills CILOs:**

Transferable (General) Skills CILOs		Teaching Strategies	Assessment Strategies
d1.	Justify in both orally and writing forms for different audiences.	▪ Dissertation Defenses and Presentation, ▪ Independent Study, ▪ Presentation, ▪ Brainstorming, ▪ Presenting Researches, ▪ Publish Research Papers.	▪ Written Research Proposal, Thesis and Publication, ▪ Written Exam, ▪ Assignments, ▪ Field Work, ▪ Survey, ▪ Presentation, ▪ Written Report.
d2.	Assess latest knowledge for life-long learning in the area of the dynamic machinery.	▪ Dissertation Defenses and Presentation, ▪ Independent Study, ▪ Presentation, ▪ Brainstorming, ▪ Presenting Researches, ▪ Publish Research Papers.	▪ Written Research Proposal, Thesis and Publication, ▪ Written Exam, ▪ Assignments, ▪ Field Work, ▪ Survey, ▪ Presentation, ▪ Written Report.

• Course Content

1.Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours	Course CILOs
1.	Dynamics of Rigid Machines. (Kinematics of a Rigid Body)	▪ Introduction. ▪ Mechanisms of multi degree of freedoms ▪ Mechanism motion limits. ▪ Kinematics of Multi degree (multi drives) mechanisms	1	2	a1, a2,
2.	Kinetics of the Rigid Body	▪ Mechanisms with Multiple Drives ▪ Planar Mechanisms ▪ States of Motion of a Rigid Machine ▪ Solution of the Equations of Motion ▪ Calculating Joint Forces ▪ Calculation of the Forces Acting onto the Frame ▪ Joint Forces in the Linkage of a Processing Machine	2	4	a1, a2, a3, b1,b2,
3.	**Turning moment diagrams and flywheel**	▪ Turning moment diagram for various type of engines, fluctuation of energy, ▪ fluctuation of speed, flywheel, energy stored in flywheel, dimensions of flywheel rims, ▪ flywheel in punching presses	2	4	a1, a2, a3, b1,b2, c1, c2, d1, d2,
4.	**Balancing**:	▪ introduction, ▪ static balancing, ▪ dynamic balancing, ▪ transference of force from one plane to another plane, ▪ balancing of several masses in different planes, ▪ force balancing of linkages, ▪ balancing of reciprocating mass, ▪ balancing of locomotives, ▪ Effects of partial balancing in locomotives, ▪ secondary balancing, ▪ balancing of inline engines, ▪ balancing of v-engines, ▪ balancing of radial engines, ▪ balancing machines.	1	2	a2, a3, b1,b2, c1, c2, d1,d2
5.	**Gyroscope**:	▪ Angular velocity, ▪ angular acceleration, ▪ gyroscopic torque, ▪ gyroscopic effect on naval ships, ▪ aero plane, ▪ stability of an automobile, ▪ stability of two wheel vehicle	2	4	a1,a2, a3. b1, b2, c1, c2, d1, d2

6.	Free vibrations and damped free vibrations:	▪ Types of vibrations, elements constituting vibration, spring mass system, free undamped ▪ vibrations, equation of motion, equivalent spring stiffness, free damped vibrations, ▪ equation of motion for viscous damper, damping factor, under damped system, critically ▪ damped system, ▪ over damped system, ▪ logarithmic decrement, ▪ free torsional vibration of a two and three rotor system, ▪ torsionally equivalent shaft, torsional vibration of a geared system.	2	4	a2, a3. b1, b2, c1, c2, d1, d2
7	Forced damped vibrations:	▪ Analytical solution of forced damped vibration, ▪ vector representation of forced vibrations, ▪ Magnification factor, ▪ force transmissibility, ▪ forced vibration with rotating and reciprocating unbalance, ▪ forced vibration due to excitation of support, ▪ vibration frequency measurement.	2	4	a1, a2, a3. b1, b2, c1, c2, d1, d2
8.	Critical speeds of shafts:	▪ Critical speed of shaft carrying single rotor and having no damping, ▪ Critical speed of shaft carrying single rotor and having damping, secondary critical speeds in horizontal shafts, ▪ critical speed of shaft having multiple rotors.	2	4	a2, a3. b1, b2, b2, c1, c2, d1, d2
Number of Weeks /and Contact Hours Per Semester			**14**	**28**	

2.Practical Aspect				
Order	**Practical / Tutorials topics (None)**	**Number of Weeks**	**Contact Hours**	**Course ILOs**
1	▪ **The displacement of sliding mechanism for different crank angle.**	6	**2**	**c1, c2, d2, d3**
2	▪ **Determine the relationship between the angle and the torque in the crank slide mechanism.**	7	**2**	c1, c2, d2, d3
3	▪ balancing of several masses in different planes,	9	**2**	c1, c2, d2, d3
4	▪ gyroscopic effect on naval ships	11	**2**	c1, c2, d2, d3
5	▪ vibration frequency measurement	12	**2**	c1, c2, d2, d3
6	▪ Critical speed of shaft carrying single rotor and having no damping	13	**2**	c1, c2, d2, d3

Number of Weeks /and Contact Hours Per Semester	6	12	

3.Tutorial Aspect:

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1.	Tutorial 1 ☐ Kinematics of Multi degree (multi drives) mechanisms	1	2	b2, b3, c1, c2, d2, d3
2.	Tutorial 2 ☐ Kinetics of the Rigid Body	2	4	b2, b3, c1, c2, d2, d3
3.	Tutorial 3 ☐ Turning moment diagram for various type of engines, fluctuation of energy	2	4	b2, b3, c1, c2, d2, d3
4.	Tutorial 4 ☐ balancing machines.	2	4	b2, b3, c1, c2, d2, d3
5.	Tutorial 5 ☐ gyroscopic effect on naval ships,	2	4	b2, b3, c1, c2, d2, d3
6.	Tutorial 6 ☐ Free vibrations and damped free vibrations	2	4	b2, b3, c1, c2, d2, d3
7.	Tutorial 7 ☐ Forced damped vibrations:	2	4	b2, b3, c1, c2, d2, d3
	Tutorial 8 ☐ Critical speeds of shafts:	1	2	b2, b3, c1, c2, d2, d3
Number of Weeks /and Units Per Semester		14	28	

• Teaching Strategies:

- Lectures.
- Seminars.
- Group/ Individual Projects and Studies.
- Field Work.
- Computer Hands-on Session.
- Simulation Exercise.

- Analysis and Problem Solving.
- Dissertation Defenses and Presentation.
- Publish Research Papers.

• Assessment Methods of the Course:

- Oral and Written Exams.
- Reports.
- Assignments.
- Seminar Report.
- Written Research Proposal.
- Thesis and Publication.
- Field Work.
- Presentation.
- Written Report.

• Tasks and Assignments:

No	Assignments/ Tasks	Individual/ Group	Mark	Week Due	CILOs (symbols)
1.	Homework and Assignments.	Individual	15	Every Week	a1,a2, a3,b2, b3, c1, c2, d2, d3
2.	Mini/Major Project .	Group	40	At the End of the Semester	a1,a2, a3,b2, b3, c1, c2, d2, d3
	Total Score		**55**	==	===

• Learning Assessment:

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment	CILOs
1.	Tasks and Assignments.	Every Week	55	55	a1,a2, a3,b2, b3, c1, c2, d2, d3

2.	Quizzes (4 quizzes).	Every 3 weeks	10	10	a1,a2, a3,b2, b3, c1, c2, d2, d3
3.	Mid-Term Exam.	W9	10	10	a1,a2, a3,b2, b3, c1, c2, d2, d3
4.	Final Exam (Practical).	-	-	-	
5.	Final Exam (Theoretical).	Last Week (Week No. 16)	25	25	a1,a2, a3,b2, b3, c1, c2, d2, d3
Total				**100%**	**===**

• Learning Resources :

1. **Required Textbook(s) :**

1. Uicker, John, Pennock, Gordon, and Shigley, Joseph, " Theory of Machines and Mechanisms", 4th ed., Oxford University Press, New York, 2010..
2. Norton, Robert, "Design of Machinery", 4th ed., McGraw-Hill Book Company, New York, 2008.
3. Waldron, Kenneth and Kinzel, Gary, "Kinematics, Dynamics, and Design of Machinery", 2nd ed., John Wiley and Sons Inc., Hoboken, NJ, 2004.

2. Essential References:

1. Baumeister, Theodore III, Avallone, Eugene, and Sadegh, Ali, Mark's "Standard Handbook for Mechanical Engineers", 11th ed., McGraw-Hill Book Company, New York, 2006.
2. Chironis, Nicholas and Sclater, Neil, "Mechanisms and Mechanical Drives Sourcebook", 4th ed., McGraw-Hill Book Company, New York, 2007.
3. Erdman, Aurthur, Sandor, George, and Kota, Sridhar, "Mechanism Design", Vol 1: Analysis and Synthesis, 4th ed., Prentice Hall, Upper Saddle River, NJ, 2001

3. **Electronic Materials and Web Sites *etc.***

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• **الضوابط والسياسات المتبعة في المقرر Course Policies**	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
1	**سياسة حضور الفعاليات التعليمية Class Attendance:** **- يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك.** **- يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.**
2	**الحضور المتأخر Tardy:** **- يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.**
3	**ضوابط الامتحان Exam Attendance/Punctuality:** **- لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان** **- إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.**
4	**التعيينات والمشاريع Assignments & Projects:** **- يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها.** **- إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.**
5	**الغش Cheating:** **- في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب.** **- في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.**
6	**الانتحال Plagiarism:** **– في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك**
7	**سياسات أخرى Other policies:** **- أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ**

Academic Year:2021/2022

Course Plan of Advanced Dynamics of Machinery

Course Code (ME 514)

• Information about Faculty Member Responsible for the Course:

Name	Assist. Prof. Dr. Abdulsalam Naji	**Office Hours**					
Location &Telephone No.	Sana'a, Faculty of Engineering 771292117	**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	Drabdulsalam2@gmail.com						

• General information about the course:

	Course Title	Advanced Dynamics of Machinery			
2.	Course Code and Number	ME514			
3.	Credit Hours	Contact Hours			Total (Credit Hours)
		Lecture	Practical	Seminar/Tutorial	
		2	-	2	3
4.	Study Level and Semester	First Semester.			
5.	Pre-requisites	ME 222, ME 501.			
6.	Co –requisite	-			
7.	Program (s) in which the course is offered	MSc. In Mechanical Engineering Program.			
8.	Language of teaching the course	English Language.			
9.	Location of teaching the course	Faculty of Engineering, Mechanical Engineering Department.			

• Course Description:

Dynamics of machinery is denned as the study of motions and forces in machines. The course is designed to give advanced knowledge of behavior of machines under dynamic condition. Dynamic problems first occurred in power and work machines. Torsional vibrations were observed in reciprocating engines, and bending vibrations put turbine components at risk. Explaining such phenomena has long been the only task of the dynamics of machinery. Knowledge of the dynamics of machinery is also required for designing machines that are based on dynamic principles. This includes hammers, robots, stemmers, oscillating conveyors, screens, vibrators, textile mandrils, centrifuges, etc.

• Course Intended Learning Outcomes (CILOs):

Upon successful completion of the Advanced Dynamics of Machinery Course, graduate students will be able to:

Upon successful completion of Advanced Dynamics of Machinery Course, the graduates will be able to:

a1-	Illustrate the basic knowledge of engineering sciences subjects concerning the motion of machine parts.
a2 -	Describe the different parameters such as position, displacement, velocity, acceleration forces, torques and power within the dynamic machinery.
a3-	Classify concepts and techniques to design mechanical machines with sustainable and environmentally friendly approach.
b1 -	Develop mathematical equations and computers software to solve dynamic machinery problems.
b2-	optimize machine parts to meet desired needs within realistic machines assembly constraints and constructions.
c1-	Demonstrate suitable manufacturing processes for the actual design of the machinery components.
c2-	Perform dynamic solutions for the motions of different mechanical parts in the machines.
d1-	Justify in both orally and writing forms for different audiences.
d2-	Assess latest knowledge for life-long learning in the area of the dynamic machinery.

VI.Course Content

1.Theoretical Aspect

Order	Topic List / Units	Sub -Topics List	Number of Weeks	Contact Hours
1.	Dynamics of Rigid Machines. (Kinematics of a Rigid Body)	▪ Introduction. ▪ Mechanisms of multi degree of freedoms ▪ Mechanism motion limits. ▪ Kinematics of Multi degree (multi drives) mechanisms	W1	2
2.	Kinetics of the Rigid Body	▪ Mechanisms with Multiple Drives ▪ Planar Mechanisms ▪ States of Motion of a Rigid Machine ▪ Solution of the Equations of Motion ▪ Calculating Joint Forces ▪ Calculation of the Forces Acting onto the Frame ▪ Joint Forces in the Linkage of a Processing Machine	W2,W3	4
3.	**Turning moment diagrams and flywheel**	▪ Turning moment diagram for various type of engines, fluctuation of energy, ▪ fluctuation of speed, flywheel, energy stored in flywheel, dimensions of flywheel rims, ▪ flywheel in punching presses	W4,w5	4
4.	**Balancing**:	▪ introduction, ▪ static balancing, ▪ dynamic balancing, ▪ transference of force from one plane to another plane, ▪ balancing of several masses in different planes, ▪ force balancing of linkages, ▪ balancing of reciprocating mass, ▪ balancing of locomotives, ▪ Effects of partial balancing in locomotives, ▪ secondary balancing, ▪ balancing of inline engines, ▪ balancing of v-engines, ▪ balancing of radial engines, ▪ balancing machines.	W6	2
5.	**Gyroscope**:	▪ Angular velocity, ▪ angular acceleration, ▪ gyroscopic torque, ▪ gyroscopic effect on naval ships, ▪ aero plane, ▪ stability of an automobile, ▪ stability of two wheel vehicle	W7,w8	4

6.	Mid-Term Exam	▪ The First Five Chapters.	W9	2
7.	Free vibrations and damped free vibrations:	▪ Types of vibrations, elements constituting vibration, spring mass system, free undamped ▪ vibrations, equation of motion, equivalent spring stiffness, free damped vibrations, ▪ equation of motion for viscous damper, damping factor, under damped system, critically ▪ damped system, ▪ over damped system, ▪ logarithmic decrement, ▪ free torsional vibration of a two and three rotor system, ▪ torsionally equivalent shaft, torsional vibration of a geared system.	W10,W11	4
8.	Forced damped vibrations:	▪ Analytical solution of forced damped vibration, ▪ vector representation of forced vibrations, ▪ Magnification factor, ▪ force transmissibility, ▪ forced vibration with rotating and reciprocating unbalance, ▪ forced vibration due to excitation of support, ▪ vibration frequency measurement.	W12,W13	4
9.	Critical speeds of shafts:	▪ Critical speed of shaft carrying single rotor and having no damping, ▪ Critical speed of shaft carrying single rotor and having damping, secondary critical speeds in horizontal shafts, ▪ critical speed of shaft having multiple rotors.	W14,W15	4
10.	The Final Exam.	▪ All the Chapters.	W16	2
Number of Weeks /and Contact Hours Per Semester			**16**	**32**

2.Practical Aspect

Order	Practical / Tutorials topics (None)	Number of	Contact	Course ILOs

		Weeks	Hours	
1	▪ **The displacement of sliding mechanism for different crank angle.**	6	**2**	**c1, c2, d2, d3**
2	▪ **Determine the relationship between the angle and the torque in the crank slide mechanism.**	7	**2**	c1, c2, d2, d3
3	▪ balancing of several masses in different planes,	9	**2**	c1, c2, d2, d3
4	gyroscopic effect on naval ships	11	**2**	c1, c2, d2, d3
5	▪ vibration frequency measurement	12	**2**	c1, c2, d2, d3
6	▪ Critical speed of shaft carrying single rotor and having no damping	13	**2**	c1, c2, d2, d3
Number of Weeks /and Contact Hours Per Semester				

3.Tutorial Aspect:			
No.	**Tutorial**	**Number of Weeks**	**Contact Hours**
1.	Tutorial 1 Kinematics of Multi degree (multi drives) mechanisms	1	2
2.	Tutorial 2 Kinetics of the Rigid Body	2	4
3.	Tutorial 3 Turning moment diagram for various type of engines, fluctuation of energy	2	4
4.	Tutorial 4 balancing machines.	2	4
5.	Tutorial 5 gyroscopic effect on naval ships,	2	4
6.	Tutorial 6 Free vibrations and damped free vibrations	2	4
7.	Tutorial 7 Forced damped vibrations:	2	4
8	Tutorial 8 Critical speeds of shafts:	1	2
Number of Weeks /and Units Per Semester		14	28

VII.Teaching Strategies:

- Lectures.
- Seminars.
- Group/ Individual Projects and Studies.
- Field Work.
- Computer Hands-on Session.
- Simulation Exercise.
- Analysis and Problem Solving.
- Dissertation Defenses and Presentation.
- Publish Research Papers.

VIII.Assessment Methods of the Course:

- Oral and Written Exams.
- Reports.
- Assignments.

VIII.Assessment Methods of the Course:

- Seminar Report.
- Written Research Proposal.
- Thesis and Publication.
- Field Work.
- Presentation.
- Written Report.

IX.Tasks and Assignments:

No	Assignments/ Tasks	Individual/ Group	Mark	Week Due
1.	Homework and Assignments.	Individual	15	Every Week
2.	Mini/Major Project .	Group	40	At the End of the Semester
3.	Case studies.	-	-	-
4.				
	Total Score		**55**	==

X.Learning Assessment:

No.	Assessment Tasks	Week due	Mark	Proportion of Final Assessment
1.	Tasks and Assignments.	Every Week	55	55
2.	Quizzes (4 quizzes).	Every 3 weeks	10	10
3.	Mid-Term Exam.	W9	10	10
4.	Final Exam (Practical).	-	-	-
5.	Final Exam (Theoretical).	Last Week (Week No. 16)	25	25
Total				**100%**

XI .Learning Resources :

1.Required Textbook(s) :

1. Uicker, John, Pennock, Gordon, and Shigley, Joseph, " Theory of Machines and Mechanisms", 4th ed., Oxford University Press, New York, 2010..
2. Norton, Robert, "Design of Machinery", 4th ed., McGraw-Hill Book Company, New York, 2008.

3. Waldron, Kenneth and Kinzel, Gary, "Kinematics, Dynamics, and Design of Machinery", 2nd ed., John Wiley and Sons Inc., Hoboken, NJ, 2004.

2,Essential References:

1. Baumeister, Theodore III, Avallone, Eugene, and Sadegh, Ali, Mark's "Standard Handbook for Mechanical Engineers", 11th ed., McGraw-Hill Book Company, New York, 2006.
2. Chironis, Nicholas and Sclater, Neil, "Mechanisms and Mechanical Drives Sourcebook", 4th ed., McGraw-Hill Book Company, New York, 2007.
3. Erdman, Aurthur, Sandor, George, and Kota, Sridhar, "Mechanism Design", Vol 1: Analysis and Synthesis, 4th ed., Prentice Hall, Upper Saddle River, NJ, 2001

3.Electronic Materials and Web Sites *etc.*

1.
2.
3.
4.

• **الضوابط والسياسات المتبعة في المقرر Course Policies**	
بعد الرجوع للوائح الجامعة يتم كتابة السياسة العامة للمقرر فيما يتعلق بالآتي:	
1	**سياسة حضور الفعاليات التعليمية Class Attendance:** **- يلتزم الطالب بحضور 75% من المحاضرات ويحرم في حال عدم الوفاء بذلك.** **- يقدم أستاذ المقرر تقريرا بحضور وغياب الطلاب للقسم ويحرم الطالب من دخول الامتحان في حال تجاوز الغياب 25% ويتم اقرار الحرمان من مجلس القسم.**
2	**الحضور المتأخر Tardy:** **- يسمح للطالب حضور المحاضرة إذا تأخر لمدة ربع ساعة لثلاث مرات في الفصل الدراسي، وإذا تأخر زيادة عن ثلاث مرات يحذر شفويا من أستاذ المقرر، وعند عدم الالتزام يمنع من دخول المحاضرة.**
3	**ضوابط الامتحان Exam Attendance/Punctuality:** **- لا يسمح للطالب دخول الامتحان النهائي إذا تأخر مقدار (20) دقيقة من بدء الامتحان** **- إذا تغيب الطالب عن الامتحان النهائي تطبق اللوائح الخاصة بنظام الامتحان في الكلية.**
4	**التعيينات والمشاريع Assignments & Projects:** **- يحدد أستاذ المقرر نوع التعيينات في بداية الفصل ويحدد مواعيد تسليمها وضوابط تنفيذ التكليفات وتسليمها.** **- إذا تأخر الطالب في تسليم التكليفات عن الموعد المحدد يحرم من درجة التكليف الذي تأخر في تسليمه.**
5	**الغش Cheating:** **- في حال ثبوت قيام الطالب بالغش في الامتحان النصفي أو النهائي تطبق عليه لائحة شؤون الطلاب.** **- في حال ثبوت قيام الطالب بالغش او النقل في التكليفات والمشاريع يحرم من الدرجة المخصصة للتكليف.**
6	**الانتحال Plagiarism:** **– في حالة وجود شخص ينتحل شخصية طالب لأداء الامتحان نيابة عنه تطبق اللائحة الخاصة بذلك**
7	**سياسات أخرى Other policies:** **- أي سياسات أخرى مثل استخدام الموبايل أو مواعيد تسليم التكليفات ..... الخ**