Sana'a University
Faculty of Engineering
Mechanical Engineering Department
Mechanical Engineering Program

46. Course Specification of Heat and Mass Transfer

I. Course Identification and General Information:						
1.	Course Title:	Heat and Mass Transfer.				
2.	Course Code & Number:	ME353.				
3.	Credit Hours:	C.H				TOTAL CR. HRS.
		Th.	Seminar/Tu.	Pr	Tr.	
		3	2	-	-	4
4.	Study level/ semester at which this course is offered:	Fourth Year - First Semester.				
5.	Pre –requisite (if any):	(Differential Equations, (Numerical Methods), (Thermodynamics-I).				
6.	Co –requisite (if any):	ME353 (Thermal / Fluid Lab.)				
7.	Program (s) in which the course is offered:	Mechanical Engineering Program.				
8.	Language of teaching the course:	English Language.				
9.	Location of teaching the course:	Mechanical Engineering Department.				
10.	Prepared By:	Asst. Prof. Dr. Eng. Hamoud A. Al-Nahari.				
11.	Date of Approval:					

II. Course Description:

This course is designed to introduce a basic study of the phenomena of heat and mass transfer, to develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes. A knowledge-based design problem requiring the formulations of solid conduction and fluid convection and the technique of numerical computation will be studied in details.

III. Alignments of the Course Intended learning outcomes (CILOs)		Referenced PILOs
a1	Describe the basic laws of heat and mass transfer.	A1
a2	Recognize the fundamentals of conduction, convective and radiation heat transfer processes.	A4
b1	Analyze problems involving steady state heat conduction in simple geometries.	B1

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

b2	Compare between various types of heat transfer processes.	
b3	Explore appropriate heat transfer processes and components to design thermal systems.	
c1	Apply solutions for transient heat conduction in simple geometries.	C1
c2	Compute numerical solutions for conduction and convection heat transfer problems.	
c3	Calculate radiation heat transfer between black body surfaces and between surfaces of simple geometries.	
c4	Calculate gradient driven species mass fluxes.	
d1	Cooperate coherently and successfully with teams in assignments.	D1
d2	Review results and defend his ideas.	D4

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
a1- Describe the basic laws of heat and mass transfer. **a2-** Recognize the fundamentals of conduction, convective and radiation heat transfer processes.	• Lectures. • Tutorials. • Interactive Class Discussion.	• Written Tests and Quizzes. • Oral Discussion. • Presentations.

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
b1- Analyze problems involving steady state heat conduction in simple geometries. **b2-** Compare between various types of heat transfer processes.	• Lectures. • Tutorials.	• Written Tests and Quizzes. • Oral Discussion.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

b3- Explore appropriate heat transfer processes and components to design thermal systems.	• Interactive Class Discussion.	• Presentations.

© **Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:**		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
c1- Apply solutions for transient heat conduction in simple geometries.	• Lectures. • Exercise and Homework • Simulation Software.	• Written Tests and Quizzes. • Presentations. • Project Reports.
c2- Compute numerical solutions for conduction and convection heat transfer problems.		
c3- Calculate radiation heat transfer between black body surfaces and between surfaces of simple geometries.		
c4- Calculate gradient driven species mass fluxes.		

(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
d1- Cooperate coherently and successfully with teams in assignments.	• Lectures. • Presentations. • Projects Presentation.	• Written Tests. • Presentation.
d2- Review results and defend his ideas.		

IV. Course Content:

A – Theoretical Aspect:

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction to the Heat Transfer.	a1	• General Background. • Conduction. • Convection. • Radiation.	1	3
2.	Conduction Heat Transfer.	a1, a2	• Conduction Rate Equation. • Thermal Properties of Matter. • Thermal Conductivity. • Heat Diffusion Equation. • Boundary and Initial Conditions.	1	3
3.	One-Dimensional, Steady-State Conduction.	a1, a2	• The Plane Wall. • An Alternative Conduction Analysis. • Radial Systems. • Conduction with Thermal Energy Generation. • Heat Transfer from Extended Surfaces.	2	6
4.	Two-Dimensional, Steady-State Conduction.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	• Alternative Approaches. • The Conduction Shape Factor. • Finite-Difference Equations. • Solving the Finite-Difference Equations. • Solution using Simulation Software.	2	6
5.	Transient Conduction	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	• Alternative Approaches. • Lumped Capacitance Method. • Solving Transient Systems using Simulation Software.	1	3

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

6.	Mid-Term Exam.	a1, a2, b1, b2, b3, c1, c2, c3, c4	• The First 5 Chapters.	1	3
7.	Convection Heat Transfer- Forced and Natural Convection.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	• Physical Mechanism of Convection. • Classification of Fluid Flows. • Drag Force and Heat Transfer in an External Flow. • Parallel Flow over Flat Plates. • Flow across Cylinders, Spheres, and Tube Banks. • The Governing Equations for Laminar Boundary Layers. • Laminar Free Convection on a Vertical Surface. • The Effects of Turbulence. • Empirical Correlations: External Free Convection Flows (Vertical Plate, Inclined and Horizontal Plates, Long Horizontal Cylinder, Spheres).	2	6
8.	Radiation Heat Transfer: Processes and Properties.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	• Introduction and Basic Concepts. • Radiation Heat Fluxes. • Radiation Intensity. • Black-Body Radiation. • Emission from Real Surfaces. • Absorption, Reflection, and Transmission by Real Surfaces.	2	6
9.	Radiation Exchange	a1, a2, b1, b2, b3,	• View Factor	2	6

	Between Surfaces.	c1, c2, c3, c4, d1, d2	• Blackbody Radiation Exchange • Radiation Exchange Between Opaque, Diffuse, Gray Surfaces in an Enclosure. • Net Radiation Exchange at a Surface. • Radiation Exchange Between Surfaces. • Two-Surface Enclosure. • Radiation Shields. • Reradiating Surface.		
10.	Diffusion Mass Transfer.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	• Physical Origins. • Mixture Composition. • Fick's Law of Diffusion. • Mass Diffusivity.	1	3
11.	Final Exam	a1, a2, b1, b2, b3, c1, c2, c3, c4	• All the Chapters.	1	3
Number of Weeks /and Units Per Semester				**16**	**48**

B: Tutorial Aspects

No.	Tutorial topics	Number of Weeks	Contact Hours	Learning Outcomes
1.	Introduction to the Heat Transfer.	1	2	a1
2.	Conduction Heat Transfer.	1	2	a1, a2
3.	One-Dimensional, Steady-State Conduction.	2	4	a1, a2
4.	Two-Dimensional, Steady-State Conduction.	2	4	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
5.	Transient Conduction.	1	2	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

6.	Convection Heat Transfer-Forced and Natural Convection.	2	4	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
7.	Radiation Heat Transfer: Processes and Properties.	2	4	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
8.	Radiation Exchange Between Surfaces.	2	4	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
9.	Diffusion Mass Transfer.	1	2	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
Total number of weeks and hours		**14**	**28**	

V. Teaching strategies of the course:

- Lectures.
- Tutorials.
- Exercises and Homework.
- Interactive Class Discussion.
- Simulations using Software.

VI. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Assignment 1: Conduction Heat Transfer.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	2nd	1
2.	Assignment 2: One-Dimensional, Steady State Conduction.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	4th	2
3.	Assignment 3: Two-Dimensional, Steady State Conduction.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	6th	2
4.	Assignment 4: Transient Conduction.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	7th	2
5.	Assignment 5: Convection Heat Transfer-Forced and Natural Convection.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	9th	2

6.	Assignment 6: Radiation Heat Transfer: Processes and Properties.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	11th	2
7.	Assignment 7: Radiation Exchange Between Surfaces.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	13th	2
8.	Assignment 8: Diffusion Mass Transfer.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	14th	2
Total				**15**

VII. Schedule of Assessment Tasks for Students during the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Homework/Tasks/Assignments.	Weekly	15	10 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
2.	Project (Single/Groups).	12	15	10 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
3.	Quiz 1.	4	7.5	5 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
4.	Mid-Term Exam.	8	15	10 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
5.	Quiz 2.	9	7.5	5 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
6.	Final Exam.	16	90	60 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
Total			**150**	**100%**	

VIII. Learning Resources:

- Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

1. Theodore L. Bergman, et al, 2011,"Fundamentals of Heat and Mass Transfer", 7 th Ed John Wiley & Sons.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

	2. Cengel, Yunus, A., 2008, "Heat Transfer: A Practical Approach", 2 nd edition, McGraw U.S.A.
2- Essential References.	
	1. J.P. Holman (2001), "Heat Transfer", Ninth Edition. 2. Mills and Ganesan, (2009), " Heat Transfer", Pearson Education. 3. R K Rajput, S, (2019), " Heat and Mass Transfer ", 7 th edition, Chand Publication. 4. Dutta, Binay K, (2016), "Heat Transfer: Principles and Applications", PHI Publication
3- Electronic Materials and Web Sites *etc*.	
	1. List Recommended Textbooks and Reference Material (Journals, Reports, etc) □□http://www.springer.com/engineering/mechanical+engineering/journal/231 □□http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Heat%20and%20Mass%20Transfer/New_index1.html □□http://www.faculty.virginia.edu/ribando/modules/ 2. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.) • http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Heat%20and%20Mass%20Transfer/New_index1.html • http://www.faculty.virginia.edu/ribando/modules/

Reviewed By	**Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek A. Barakat** **President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi** **Name of Reviewer from the Department: Assoc. Prof. Dr. Abdul-Malik Momin**
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa **Assoc. Prof. Dr. Ahmed Mujahed** **Asst. Prof. Dr. Munasar Alsubri**

I. Course Policies:

1	**Class Attendance:** - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.
2	**Tardy:** - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.

3	**Exam Attendance/Punctuality:** - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	**Assignments & Projects:** - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	**Cheating**: - For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	**Plagiarism**: Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	**Other policies:** - The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time. - Lecture notes and assignments may be given directly to students using soft or hard copy.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

46. Template for Course Plan of Heat and Mass Transfer

I. Information about Faculty Member Responsible for the Course:

Name of Faculty Member	Asst. Prof. Dr. Eng. Hamoud A. Al-Nahari	**Office Hours**					
Location& Telephone No.		**SAT**	**SUN**	**MON**	**TUE**	**WED**	**THU**
E-mail	h_nahary@hotmail.com						

II. Course Identification and General Information:

1.	Course Title:	Heat and Mass Transfer				
2.	Course Number & Code:	ME353				
3.	Credit hours:	C.H				**Total**
		Th.	Seminar/Tu.	Pr	Tr.	
		3	2	-	-	4
4.	Study level/year at which this course is offered:	Fourth Year - First Semester.				
5.	Pre –requisite (if any):	(Differential Equations, (Numerical Methods), (Thermodynamics-I).				
6.	Co –requisite (if any):	ME353 (Thermal / Fluid Lab.)				
7.	Program (s) in which the course is offered	Bachelor of Mechanical Engineering.				
8.	Language of teaching the course:	English Language.				
9.	System of Study:	Semesters.				
10.	Mode of delivery:	Lectures and Tutorials.				
11.	Location of teaching the course:	Mechanical Engineering Department.				

III. Course Description:

This course is designed to introduce a basic study of the phenomena of heat and mass transfer, to develop methodologies for solving a wide variety of practical engineering problems, and to provide useful information concerning the performance and design of particular systems and processes. A knowledge-based design problem requiring the formulations of solid

conduction and fluid convection and the technique of numerical computation will be studied in details.

IV. Intended learning outcomes (ILOs) of the course:

- Brief summary of the knowledge or skill the course is intended to develop**:**

1. Understand the basic laws of heat and mass transfer.
2. Recognize the fundamentals of conduction, convective and radiation heat transfer processes.
3. Analyze problems involving steady state heat conduction in simple geometries.
4. Compare between various types of heat transfer processes.
5. Select appropriate heat transfer processes and components to design thermal systems.
6. Develop solutions for transient heat conduction in simple geometries.
7. Obtain numerical solutions for conduction and convection heat transfer problems.
8. Calculate radiation heat transfer between black body surfaces and between surfaces of simple geometries.
9. Calculate gradient driven species mass fluxes
10. Work coherently and successfully with team in assignments.
11. Discuss results and defend his ideas.

V. Course Content:

A – Theoretical Aspect:

Order	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1.	Introduction to the Heat Transfer.	• General Background. • Conduction. • Convection. • Radiation.	1st	3
2.	Conduction Heat Transfer.	• Conduction Rate Equation. • Thermal Properties of Matter. • Thermal Conductivity. • Heat Diffusion Equation. • Boundary and Initial Conditions.	2nd	3
3.	One-Dimensional, Steady-State Conduction.	• The Plane Wall. • An Alternative Conduction Analysis. • Radial Systems. • Conduction with Thermal Energy Generation. • Heat Transfer from Extended Surfaces.	3rd , 4th	6
4.	Two-Dimensional, Steady-State Conduction.	• Alternative Approaches. • The Conduction Shape Factor. • Finite-Difference Equations. • Solving the Finite-Difference Equations. • Solution using Simulation Software.	5th ,6th	6
5.	Transient Conduction	• Alternative Approaches. • Lumped Capacitance Method. • Solving Transient Systems using Simulation Software.	7th	3

6.	Mid-Term Exam.	• The First 5 Chapters.	8th	3
7.	Convection Heat Transfer-Forced and Natural Convection.	• Physical Mechanism of Convection. • Classification of Fluid Flows. • Drag Force and Heat Transfer in an External Flow. • Parallel Flow over Flat Plates. • Flow across Cylinders, Spheres, and Tube Banks. • The Governing Equations for Laminar Boundary Layers. • Laminar Free Convection on a Vertical Surface. • The Effects of Turbulence. • Empirical Correlations: External Free Convection Flows (Vertical Plate, Inclined and Horizontal Plates, Long Horizontal Cylinder, Spheres).	9th ,10th	6
8.	Radiation Heat Transfer: Processes and Properties.	• Introduction and Basic Concepts. • Radiation Heat Fluxes. • Radiation Intensity. • Black-Body Radiation. • Emission from Real Surfaces. • Absorption, Reflection, and Transmission by Real Surfaces.	11th ,12th	6
9.	Radiation Exchange Between Surfaces.	• View Factor • Blackbody Radiation Exchange • Radiation Exchange Between Opaque, Diffuse, Gray Surfaces in an Enclosure. • Net Radiation Exchange at a Surface.	13th ,14th	6

		• Radiation Exchange Between Surfaces. • Two-Surface Enclosure. • Radiation Shields. • Reradiating Surface.		
10.	Diffusion Mass Transfer.	• Physical Origins. • Mixture Composition. • Fick's Law of Diffusion. • Mass Diffusivity.	15th	3
11.	Final Exam	• All the Chapters.	16th	3
Number of Weeks /and Units Per Semester			**16**	**48**

B: Tutorial Aspects

No.	Tutorial topics	Number of Weeks	Contact hours
1.	Introduction to the Heat Transfer.	1st	2
2.	Conduction Heat Transfer.	2nd	2
3.	One-Dimensional, Steady-State Conduction.	3rd, 4th	4
4.	Two-Dimensional, Steady-State Conduction.	5th, 6th	4
5.	Transient Conduction.	7th	2
6.	Convection Heat Transfer-Forced and Natural Convection.	8th, 9th	4
7.	Radiation Heat Transfer: Processes and Properties.	10th, 11th	4
8.	Radiation Exchange Between Surfaces.	12th, 13th	4
9.	Diffusion Mass Transfer.	14th	2
Total number of weeks and hours		**14**	**28**

VI. Teaching strategies of the course:

- Lectures.
- Tutorials.
- Exercises and Homework.
- Interactive Class Discussion.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

- Simulations using Software.

VII. Assignments:

No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Assignment 1: Conduction Heat Transfer.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	2nd	1
2.	Assignment 2: One-Dimensional, Steady State Conduction.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	4th	2
3.	Assignment 3: Two-Dimensional, Steady State Conduction.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	6th	2
4.	Assignment 4: Transient Conduction.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	7th	2
5.	Assignment 5: Convection Heat Transfer-Forced and Natural Convection.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	9th	2
6.	Assignment 6: Radiation Heat Transfer: Processes and Properties.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	11th	2
7.	Assignment 7: Radiation Exchange Between Surfaces.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	13th	2
8.	Assignment 8: Diffusion Mass Transfer.	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2	14th	2
Total				**15**

VIII. Schedule of Assessment Tasks for Students during the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas

1.	Homework/Tasks/Assignments.	Weekly	15	10 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
2.	Project (Single/Groups).	12	15	10 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
3.	Quiz 1.	4	7.5	5 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
4.	Mid-Term Exam.	8	15	10 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
5.	Quiz 2.	9	7.5	5 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
6.	Final Exam.	16	90	60 %	a1, a2, b1, b2, b3, c1, c2, c3, c4, d1, d2
Total			**150**	**100%**	

IX. Learning Resources:

- *Written in the following order: (Author - Year of publication – Title – Edition – Place of publication – Publisher).*

1- Required Textbook(s) (maximum two).

1. Theodore L. Bergman, et al, 2011,"Fundamentals of Heat and Mass Transfer", 7 th Edition, John Wiley & Sons.
2. Cengel, Yunus, A., 2008, "Heat Transfer: A Practical Approach", 2 nd edition, McGraw Hill, U.S.A.

2- Essential References.

1. J.P.Holman (2001) , "Heat Transfer" ,Ninth Edition.
2. Mills and Ganesan, (2009), " Heat Transfer", Pearson Education.
3. R K Rajput, S, (2019), " Heat and Mass Transfer ", 7 th edition, Chand Publication.
4. Dutta, Binay K, (2016), "Heat Transfer: Principles and Applications", PHI Publication.

3- Electronic Materials and Web Sites *etc*.

1. List Recommended Textbooks and Reference Material (Journals, Reports, etc)

□□http://www.springer.com/engineering/mechanical+engineering/journal/231
□□http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-

	2. BANG/Heat%20and%20Mass%20Transfer/New_index1.html □□http://www.faculty.virginia.edu/ribando/modules/ List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.) http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Heat%20and%20Mass%20Transfer/New_index1.html • http://www.faculty.virginia.edu/ribando/modules/

II. Course Policies:

1	**Class Attendance:** - The student should be attending not less than 75% of total contact hours of the subject, otherwise he will not able to take exam and be considerd as an exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic.
2	**Tardy:** - For lateness in attending the class, the student will be initially notified. If he repeates late in attending class he will be considered absent.
3	**Exam Attendance/Punctuality:** - The student should attend the exam on time. He is permitted to attend the exam half one hour from exam beginning, after that he/she will not be permitted to take exam and he/she is considered absent in the exam.
4	**Assignments & Projects:** - In general one assignment is given after each chapter of a course. The student should submit the assignment on time, mostly one week after giving the assignment
5	**Cheating**: - For cheating in exam, the student is considered as failure. In case the cheating is repeated three times during study the student will be disengaged from the Faculty
6	**Plagiarism**: Plagiarism is the attending of the student the exam of a course instead of other student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Affair Council of the university.
7	**Other policies:** - The mobile phone is not allowable to be used during class lecture. It must be switched off, otherwise the student will be ordered to leave the lecture room. - The mobile phone is not allowed to be taken during the examination time. - Lecture notes and assignments may be given directly to students using soft or hard copy.

Head of Department	Quality Assurance Unit	Dean of the Faculty	Academic Development Center & Quality Assurance	Rector of Sana'a University
Asst. Prof. Dr. Adel Ahmed Al-Shakiri	Assoc. Prof. Dr. Mohammad Algorafi	Prof. Dr. Mohammed AL-Bukhaiti	Assoc. Prof. Dr. Huda Al-Emad	Prof. Dr. Al-Qassim Mohammed Abbas