هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title: Plasma Physics
Course Code: PHYS 0446
Program: BSc in PHYSICS
Department: PHYSICS
College: Science
Institution: Majmaah University
Version: 1
Last Revision Date: 30/12/2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3,0,0)					
3					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered:					
4. Course General Description:					
This course introduces the basic concept of plasma, providing collisions in plasmas, particle and fluid Theory of Plasma, different plamsa waves, and application of plasma.					
5. Pre-requirements for this course (if any)**:**					
Atomic and Molecular Physics PHYS 0443					
6. Co-requisites for this course (if any)**:**					
Nill					
7. Course Main Objective(s):					
This course introduces the basic concept of plasma, aim to: 1. **Introduce the basic concepts of plasma physics.** 2. **Describe the different collisions in plasma.** 3. **Extend student knowledge in plasma approximation methods involving the fluid theory and kinetic theory of plasma.** 4. **Study the different waves in plasma.** 5. **Providing plasma applications in different fields.**					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	45	100
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		

No	Mode of Instruction	Contact Hours	Percentage
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)**	
Total		45

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.2	Explain single charged particle motions in electric and magnetic fields, collisions in plasma, and waves in plasma.	**K2**	**Direct teaching:** Lectures Presenataions discussions **Indirect teaching:** Peer Learning	**Quiz Assignment Mid-term exams Final exams**
2.0	**Skills**			
2.1	Apply the appropriate mathematical tools to derive the fluid equations: Vlasov, 2-fluid, MHD	**S2**	**Direct teaching:** Lectures Presentations discussions **Indirect teaching:** Peer Learning	**Quiz Assignment Mid-term exams Final exams**
2.4	Solve problems in single charged particle motion, collisions in plasma, waves in plasma.	**S4**	**Direct teaching:** Lectures Presentations discussions **Indirect teaching:** Peer Learning	**Quiz Assignment Mid-term exams Final exams**
...				

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.3	Work collaboratively and constructively and lead diverse teams to perform a wide range of tasks with responsibility and play a major role in joint work planning and evaluation.	**V3**	**Direct teaching:** Lectures Presenataions discussions **Indirect teaching:** Peer Learning	**Quiz Assignment Mid term exams Final exams**
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C. Course Content

No	List of Topics	Contact Hours
1.	**Introduction (Plasma in nature, Definition of Plasma, The Plasma Parameter, Plasma Shielding: Debye shielding, Quasi-neutrality)**	**3**
2.	**Collisions in plasmas (Small vs. large angle collisions in plasmas, Electron and ion collision frequencies, Collisions with neutrals).**	**6**
3.	**Single charged Particle Motions in Field (Uniform magnetic field with zero electric field, Uniform magnetic field with non-zero electric field, gravitational field, non-uniform magnetic field, non-uniform electric field, Time-varying electric field, time-varying magnetic field, Adiabatic Invariants)**	**6**
4.	**Fluid Theory of Plasma (Relation of Plasma Physics to Ordinary Electromagnetics- Classical Treatment of Magnetic Materials-Classical Treatment of Dielectrics- The Dielectric Constant of a Plasma, The Fluid Equation of Motion - The Convective Derivative-The Stress Tensor-Collisions-Comparison with Ordinary Hydrodynamics-Equation of Continuity-Equation of State-The Complete Set of Fluid Equations, Fluid Drifts Perpendicular to magnetic field, Fluid Drifts Parallel to magnetic field,The Plasma Approximation)**	**12**
5.	**The kinetic theory of plasma (Distribution function and Vlasov equation)**	**3**
6.	**Magnetohydrodynamic equations**	**3**
7.	**Waves in Plasmas (Plasma Oscillations, Electron Plasma Waves, Ion Waves, Comparison of Ion and Electron Waves, Electrostatic Electron**	**9**

	Oscillations Perpendicular to magnetic field, Electrostatic Ion Waves Perpendicular to magnetic field, Electromagnetic Waves in Plasma)	
8.	Plasma Applications (Fusion Energy, Plasma Accelerators, Inertial Fusion, Semiconductor Etching, Spacecraft Propulsion)	3
9.		

Total		45

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz	2 & 8	10%
2.	Mid 1	7	20%
3.	Assignment	2-10	10%
4.	Mid 2	10	20%
5.	Final exam	15	40%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	Introduction to Plasma Physics and Controlled Fusion, Third Edition, Francis F. Chen, 2016.
Supportive References	Fundamentals of Plasma Physics, Paul M. Bellan, 2008.
Electronic Materials	
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (projector, smart board, software)	Projector, smart board
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students (Indirect)	Course Evaluation Survey
Effectiveness of Students assessment	Faculty (Direct)	Learning Source
Quality of learning resources	Peer Reviewers (Direct)	Verification
The extent to which CLOs have been achieved	Faculty (Direct)	Teaching
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	**DEPARTMENT COUNCIL**
REFERENCE NO.	**16**
DATE	**30/12/2024**