Course Specification

(Postgraduate Programs)

Course Title: :	**Plasma Physics**
Course Code:	**PHYS622**
Program:	**Master of Science in Physics**
Department:	**Physical Sciences**
College:	**Science**
Institution:	**Jazan University**
Version:	
Last Revision Date:	20/4/2024

Table of Contents

A. General information about the course:

1. Course Identificationn:

1. Credit hours: (3)				
2. Course type				
A.	☐University	☐ College	☒ Department	☐Track
B.	☐Required		☒ Elective	
3. Level/year at which this course is offered: (Level 2 or 3/Year 1 or 2)				
4. Course general Description: This course is designed to cover the advanced topics in plasma physics with a focus on waves in plasma and plasma technology. It discusses connected fundamental physics and up to date knowledge of plasma theory and applications. The course will prepare the students to do research in plasma and nanotechnology areas.				
5. Pre-requirements for this course (if any)**:Non**				
6. Co-requirements for this course (if any)**:Non**				
7. Course Main Objective(s):				

The main objectives of this course are focused on the following:

1. **Discuss the fundament of plasma.**
2. **Investigate the Fluid model and waves in plasma.**
3. **Discuss the fundamentals and principles operation of plasma sources and selected diagnostics.**
4. **Examine the concept of collision processes, plasma chemistry and plasma dynamics.**
5. **Investigate fundamental interactions of particles in the plasma with the surface.**
6. **Outline the Plasma applications.**

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		
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 CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	**Describe** the model of plasma, waves in plasma, waves in plasma for constant electric and/or magnetic field, waves in plasma for space and/or time variable electric	**PLO 1.1**	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration –	**Direct**: In class interactive questioning, quizzes, written exams **Indirect:**

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	and/or magnetic field, Plasma Chemistry and Surface Interactions: Plasma collisions, Plasma dynamics, Plasma chemistry, Plasma surface interactions.		Problem based learning.	student survey.
1.2	**Describe** State Plasma Sources, such as Electric breakdown, DC plasma sheaths, DC and RF discharges, Capacitive coupled plasma discharges, inductively coupled plasma discharges, High-Pressure Plasma Sources, Plasma applications: Plasma etching, Plasma enhanced chemical vapor deposition (PECVD), Plasma implantation, Plasma polymerization, Plasma catalysis.	**PLO 1.1**	Lectures, blackboard and diagram illustration, group discussion, Interactive illustrations- Student contribution	**Direct**: In class interactive questioning, quizzes, written exams **Indirect**: student survey
1.3	**Discuss** plasma applications: plasma etching, plasma enhanced chemical vapor deposition (PECVD), Plasma implantation, Plasma polymerization, Plasma catalysis.	**PLO 1.2**	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct**: In class interactive questioning, quizzes, written exams **Indirect:** student survey
2.0	Skills			
2.1	**Solve** problems related to plasma	**PLO2.1**	Lectures, blackboard and	**Direct**: In class

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	criteria, plasma density, the average kinetic energy of particles in thermal equilibrium, cyclotron frequency, Larmor radius, confinement time, Lawson criterion for fusion reaction, temperature and, density using an electric probe as a diagnostic tool.		visualization, brainstorming, group and interactive discussion, Interactive illustration – Problem based learning	interactive questioning, quizzes, written exams **Indirect:** student survey
2.2	**Derive** expressions for the frequency of basic plasma waves: Langmuir wave, ion sound wave, Debye length, average kinetic energy in thermal equilibrium, Cyclotron frequency, Larmor radius, drift velocity, plasma frequency, and breakdown condition.	**PLO 2.1**	Lectures, blackboard and visualization, brainstorming, group and interactive discussion, Interactive illustration – Problem based learning	**Direct**: In class interactive questioning, quizzes, written exams **Indirect:** student survey
3.0	Values, autonomy, and responsibility			
3.1	**Adopt** some practices of self and long life learning in the field of plasma and its important applications through some essays and case studies.	**PLO 3.2**	Discussion - Brain storming - guided group analysis	**Direct**: - essays assignment- case study **Indirect:** student survey- viva
3.2	**Develop** skills of working in groups in group assignments and discussion and bear individual	**PLO 3.3**	Interactive and Group discussion, expository and discovery teaching	**Direct** : In class interactive questioning

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	responsibility in the assigned tasks.			**Indirect:** student survey
...				

C. Course Content:

No	List of Topics	Contact Hours
1.	Review of plasma fundamentals: Plasma parameters, Plasma criteria, Debye shielding, Collective behavior, Quasi-neutrality, Degree of ionization, and Electron temperature, Basic plasma Equations and equilibrium, Plasma Collisions.	**7.5**
2.	Fluid model of plasma, Waves in plasma, Waves in plasma for constant electric and/or magnetic field, Waves in plasma for space and/or time variable electric and/or magnetic field.	**6**
3.	Plasma Sources: Electric breakdown, DC plasma sheaths, DC and RF discharges, Capacitive coupled plasma discharges, Inductive coupled plasma discharges, High Pressure Plasma Sources.	**7.5**
4.	Plasma Chemistry and Surface Interactions: Plasma collisions, Plasma dynamics, Plasma chemistry, Plasma surface interactions.	**15**
5.	Plasma applications: Plasma etching, Plasma enhanced chemical vapor deposition (PECVD), Plasma implantation, Plasma polymerization, Plasma catalysis.	**9**
Total		45

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Assignment 1**	**2**	**5**
2.	**Assignment 2**	**7**	**5**
3.	**Quiz I**	**4**	**5**
4.	**First Mid-term exam**	**6**	**10**
5.	**Report**	**8**	**10**

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
7.	**Quiz II**	**10**	**5**
4.	**Second Mid-term exam**	**12**	**10**
8.	**Final Exam**	**16**	**50**

*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	M.A.Lieberman and A.J.Lichtenberg, Principles of Plasma Discharges and Materials Processing, 2nd edition, (Wiley Interscience 2005).
Supportive References	F. F. Chen Introduction to Plasma Physics and controlled Fusion, 3rd Edition Springer (2015). T. Makabe, and Z. Lj. Petrovic; Plasma Electronics: Applications in Microelectronic Device Fabrication, (Taylor & Francis 2006). P. Chabert and N. Braithwaite, Physics of Radio-Frequency Plasmas, (Cambridge University Press 2011). Fridman and L.A. Kennedy, Plasma Physics and Engineering, 2nd edition (Taylor &Francis 2011).
Electronic Materials	https://edisciplinas.usp.br/pluginfile.php/5914191/course/section/6090251/Lieberman.pdf https://edisciplinas.usp.br/pluginfile.php/5913606/course/section/6090129/Chen.pdf
Other Learning Materials	

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities	Class room

Items	Resources
(Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	
Technology equipment (projector, smart board, software)	smart boar -Data show
Other equipment (depending on the nature of the specialty)	Non

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, peer, and program leader	Indirect peer evaluation
Effectiveness of students assessment	Students, and program assessment committee	Direct/Indirect
Quality of learning resources	Students, and faculty members	Indirect
The extent to which CLOs have been achieved	Instructor	Direct/Indirect
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**Department Council**
REFERENCE NO.	**Psci2415**
DATE	**1/10/2024**