ANANTRAO PAWAR COLLEGE, PIRANGUT

Department of Physics

Course Outcome and Program Outcome Attainment Worksheet for Courses

Academic Year	*2021-22*
Semester	*V*
Title of Course	*Atomic and Molecular Physics*
Course Code (Theory)	*PHY354*
Course Number(Theory)	*PHY354*
Course Code (lab)	*Nil*
Course Number(Lab)	*Nil*
Course Coordinator(Theory)	*Dr. Smita A. Lokare*
Course Coordinator(Lab)	*Not applicable*

ANANTRAO PAWAR COLLEGE, PIRANGUT

Department of PHYSICS

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Anantrao Pawar College, Pirangut

Programe Outcome Statements

PO No.	Statements
PO1	**Disciplinary knowledge Acquisition:** Acquire in depth knowledge, fundamental concepts and one or more disciplines that form a part of an undergraduate programme of study. .
PO2	**Skill Development:** Develop skill of applying fundamentals, concepts and techniques of physical sciences to real life situations.
PO3	**Critical thinking:** Capability to apply thought to a body of knowledge as well as analyse and evaluate evidence, arguments, claims, beliefson the basis of empirical evidence..
PO4	**Problem solving**: Capacity to extrapolate from what one has learned and apply competencies to solve different kinds of problems.
PO5	**Communication skills:** Communicate effectively with scientific professions and community as well as with society at large.
PO6	**Analytical Skills:** Identify scientific skills related problems to arise at substantiated conclusions using fundamentals learnt in the programme.
PO7	**Use of Tools and Technology:** Acquire knowledge of using new technological tools in the areas of science education and research.
PO8	**Moral and ethical awareness**: Ability to embrace moral/ethical values in everyday social, educational , National activities and programs.
PO9	evaluate ideas, evidence and experiences from an open-minded and reasoned perspective Scientific reasoning:
PO10	**Lifelong Learning and Collaborative Skills:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change learn to work collaboratively and productively in groups.

Anantrao Pawar College, Pirangut

Programe Specific Outcome Statements

PSO No.	Statements
PSO1	**Research-related skills** : A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating along with ability to define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation.
PSO2	**Self-directed learning** : Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
PSO3	**Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

Course Name:Atomic and Molecular Physics   Class: T. Y. B. Sc   Semester: V

Course Outcome Statements			
Course No.	Course Outcome No.	Statements	Blooms level
		At the end of the course, students will be able to:	
PHY354	PHY354.1	Memorize different Atomic Models and their postultes	Remember
	PHY354.2	Describe vector Atomic model and Quantum States	Understand
	PHY354.3	Implement vector atom meodel on one and two valence electron system	Evaluate
	PHY354.4	Examine zeeman effect and their applications	Analyse
	PHY354.5	Justify moleculae spectroscopy, rotational, vibrational and electronic spectra	Apply
	PHY354.6	Design Raman Spectroscopy and their applications	Create

CO-PO CORELATION LEVEL PREDECIDED												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
PHY354.1			√		√				√	√		
PHY354.2		√			√							
PHY354.3		√		√		√				√		
PHY354.4			√	√					√			
PHY354.5	√		√				√		√			
PHY354.6	√						√		√			

Low = 1,   Moderate = 2,   High = 3

CO-PO MATRIX												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
PHY354.1			1		3				2	1		
PHY354.2		2			1			1				
PHY354.3		3		2		1				3		
PHY354.4			1	2					3			
PHY354.5	3		2				1		1			
PHY354.6	1						2		3			
PHY354	2	2.5	.33333	2	2	1	1.5	1	2.25	2		

=AVERAGE(E23:E28)

CO-PO MATRIX												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
PHY354.1			L		H				M	L		
PHY354.2		M			L			L				
PHY354.3		H		M		L				H		
PHY354.4			L	M					H			
PHY354.5	H		M				L		L			
PHY354.6	L						M		H			

PHY354-1-PO3	It helps to aquire knowledge and basic concepts of Mathematical Physics
PHY354-1-PO5	To discuss different atomic meodels and their disadvantages
PHY354-1-PO9	To iddentify scientific concepts related to atomic model
PHY354-1-PO10	To analyse, interprete and evalute the structure of atom
PHY354-2-PO2	Ability to develop vector atom model
PHY354-2-PO5	To identify the orbital motion and electron spin
PHY354-2-PO8	To observe skill developed related quantum states
PHY354-3-PO2	To develop different skill of electronic configuration of elements
PHY354-3-PO4	To give the practise of quantunm state of different elements
PHY354-3-PO6	Todevelop the skill of spectra of one and two valence electron system
PHY354-3-PO10	To judge Capability to apply thought to knowledge by taking different elements in peroidic table
PHY354-4-PO3	To think about what happen after appling magnetic field
PHY354-4-PO4	To analyse normal and anamolous zeeman effect by experimental technique
PHY354-4-PO9	To interprete scientific application of normal zeeman effect
PHY354-5-PO1	Todefine basic knowledge of molecular spectroscopy
PHY354-5-PO3	To illustrate and analyse evidences related to rotational spectra of diatomic molecule
PHY354-5-PO7	To solving problems associated with diatomic molecule
PHY354-5-PO9	To define applications of UV spectroscopy
PHY354-6-PO1	To test the fundamental of Raman Spectra
PHY354-6-PO7	To survey difference betweem Zeeman effect and raman effect
PHY354-6-PO9	To justify physical significance of atomic and molecular spectroscopy

CO-PSO CORELATION LEVEL PREDECIDED													
	PSO.1	PSO.2	PSO.3										
PHY354.1													
PHY354.2		√											
PHY354.3	√		√										
PHY354.4			√										
PHY354.5	√	√	√										
PHY354.6		√											

CO-PSO MATRIX			
CO	PSO1	PSO2	PSO3
PHY354.1			
PHY354.2		1	
PHY354.3	2		2
PHY354.4			3
PHY354.5	3	1	2
PHY354.6		1	
PHY354	2.5	1	2.333333

=AVERAGE(E18:E24)

Justification	
Mapping	Justification
PSO.1-CO3	To write and verify hypothesis for enhacing Research Skill
PSO.1-CO5	To rank elements based on their atomic structure
PSO.2-CO2	To select appropriate resources of spectra required for atom/ molecule
PSO.2-CO5	To predict various physical parameters related to electronic, rotational and vibrational spectra
PSO.2-CO6	To experiment and Analyse various spectra using Raman Spectroscopy
PSO.3-CO3	To judge relevence of spectra by zeeman effect
PSO.3-CO4	To experiment to synthesise and analysis data from a variety elements
PSO.3-CO5	To summerize supporting and opposing view points related to material properties.

Course Name : Atomic and Molecular Physics   **Class: T. Y. B. Sc**   **Semester: V**

Course No	Course Code	Course Name	Direct Assessment Tools					Indirect Assessment Tool
			External	Internal				
351	PHY354	Atomic and Molecular Spectroscopy	ESE	CA1- Class	CA2- Assg	CA3-Tutorials	Mid Semester Exam	Course Exit Survey
		Direct Attainment Ratio	70	30				
		Final Attainment Ratio	70					30

CA1- 10 Objectives, 5 Short questions   15 Marks
CA2 - 4 Assignments/ Case studies, 5 Marks each   25 Marks
CA3- Student Presentation/ Model   10 Marks

ESE - (Covering all Cos)   35 Marks
MSE- Covering 50 % Syllabus   20 Marks

Course Exit Survey - 5 - 10 feedback questions

Setting CO Attainment Targets				
Course No.	Course Outcome No.	Statements	Target (Class Average)	justification
PHY354	PHY354.1	Memorize different Atomic Models and their	60%	All the CO are considered equally important, hence assigned same target for each CO.As this is basic core subject ,hence the traget assigned is 60%
	PHY354.2	Describe vector Atomic model and Quantum	60%	
	PHY354.3	Implement vector atom meodel on one and two valence electron system	60%	
	PHY354.4	Examine zeeman effect and their applications	60%	
	PHY354.5	Justify moleculae spectroscopy, rotational, vibrational and electronic spectra	60%	
	PHY354.6	Design Raman Spectroscopy and their applications	60%	

Class Test-CA1 Question Paper

Course Name: Atomic and Molecular Physics   **Course Code:PHY354**

Class: T. Y. B. Sc Sem-V

Date: 27/07/2021   **Time:9.25 AM to 10.15 PM**   **Maximum Marks:15**

Instructions
1) Figures to the right indicate full marks
2) Assume suitable data wherever necessary with justification

Q1. Choose the correct alternative (1 X 5 = 5)		Course Outcome	Learning Level
1	Swimming is possible on account of ------- a) first law of motion c) second law of motion b) third law of motion d) Newton's law of gravitation	CO5	Apply
2	Which of the following quantities measured from different inertial frame are same a) force c) velocity b) displacement d) kinetic energy	CO5	Apply
3	Fundamental force include--------- a) gravitational force c) electrostatic force b) nuclear force d) all of above	CO1	Remember
4	What is the unit of energy in SI system? a) joule c) watt b)erg d) Newton	CO1	Remember
5	Same force act on two bodies of different mass 2kg and 5kg initially at rest. The ratio of time required to acquire same final velocity is ---- a)5:3 c) 25:4 b) 4:25 d) 2:5	CO3	Evaluate

Q2. Attempt any ane of the followings (1 X 5 = 5)		Course Outcome	Learning Level
a	State and Explain Spin orbit Interaction	CO2	Understand
b	Explain Singlet-Triplet separations for interaction energy of LS coupling	CO2	Understand

Q3. Answer the following question in detail. (1 X 5 = 5)		Course Outcome	Learning Level
	Write a short note on Rotational Spectra, Vibrational Spectra and electronic Spectra	CO4	Analyse

0.428571 14286 33333 0.75 14286 4 71429   0.71   4 714286 571429 .142857 9.142857

CO5	CO5	CO1	CO1	CO3	CO2	CO4

CO1	CO2	CO3	CO4	CO5

=AVERAGE(P12:P71)

CO1	CO2	CO3	CO4	CO5	CO-TOTAL	
2	5	1	5	2	15	CO Marks

=COUNTIF(L12:L71,">=1.32")

3	6	5	4	2	3 er of Students above a

Assignment No. 1 to 5

Questions (Attempt any Five)	CO	BL
Q.1) Explain the Molecular Spectra and its type	CO4	Analyze
Q.2) Describe rotational spectra of rigid diatomic molecule	CO4	Analyze
Q.3) Write the relation between Normal and Anamolous Zeeman effect	CO3	Evaluate
Q.4) Evaluate pd configuration using jj coupling	CO2	Understand
Q.5)State the vector atom model	CO1	Apply
Q. 6)Expain application of Raman Spectroscopy	CO6	Create
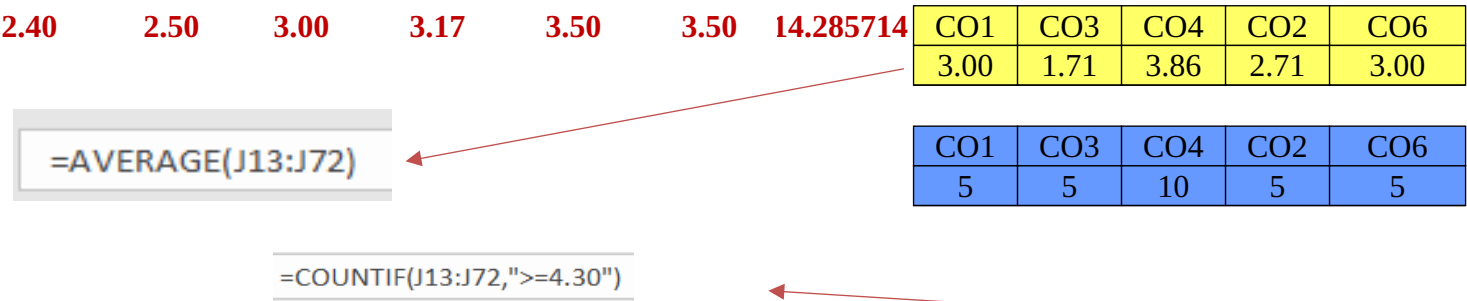
							CO1	CO3	CO4	CO2	CO6
2.40	2.50	3.00	3.17	3.50	3.50	14.285714	3.00	1.71	3.86	2.71	3.00

Subject Incharge

=AVERAGE(J13:J72)

CO1	CO3	CO4	CO2	CO6
5	5	10	5	5

=COUNTIF(J13:J72,">=4.30")

Course Name: Atomic and Molecular Physics **Course Code: PHY354**

Class: T. Y. B. Sc

CA3 - Mode of Assessment: Students Models on Syllabus / Presentations

2	BANDGAR PARSHURAM RAMESH	7	1	2	4	7	
16	JORI SHUBHAM BHARAT	7	1	4	2	7	
20	KANGANE AKSHAY ANANT	8	1	4	3	8	
27	PATIL SWATI BASANT	6	2	2	2	6	
32	PUJARI SAKSHAM SHIVA	9	2	3	4	9	
40	GOANARKAR RUSHIKESH	5	1	2	2	5	
41	SALUNKHE RAKESH	5	2	1	2	5	
		6.71	**1.43**	**2.57**	**2.71**		

	CO4 (2)	CO5(4)	CO3 (4)		

Subject Incharge

=AVERAGE(D11:D70)

=COUNTIF(D11:D70, ">=1.72")

Count above avg	3	3	3			0
Attainment	N	N	N			N
% Attainmrnt	2.857143	2.857143	2.857143			0

Instructions to the Students:

1. Figures to the right indicate full marks
2. Assume suitable data wherever necessary, with proper justification

		(CO)	(Level)	Marks
Q. 1	**Choose the correct alternative**			**5 × 1 = 5**
1	Bharat Ratna' award is India's highest………award. a.　　Artist　　　　　　　　　b.　　Military c.　　Security　　　　　　　　d.　　Civilian	**CO4**	Remember	
2	Which of the following novels by Anita Desai was not shortlisted for the Booker Prize? a.　　In custody　　　　　　　b.　　Clear light of day c.　　Fasting, Feasting　　　　d.　　Sunny days	**CO4**	Analyse	
3	Meaning of the word 'Flake' is………………. a.　　Butterfly　　　　　　　　b.　　very thin piece c.　　Mammals　　　　　　　　d.　　Very large piece	**CO5**	Remember	
4	He said that the sun ------in the east. a.　　Awake　　　　　　　　　b.　　Will rise c.　　Rises　　　　　　　　　　d.　　Covers	**CO3**	Understand	
5	He said ……….. he must not play with fire. a.　　That　　　　　　　　　　b.　　While c.　　Which　　　　　　　　　d.　　None of the above	**CO3**	Understand	
Q.2	**Answer the following question.**			**5 × 1 = 05**
(A)	Write a note on massage of the peom 'stopping by woods on a snowy evening'.	**CO4**	Understand	
Q. 3	**Solve Any One of the following.**			**5 × 2 = 10**
(A)	What mistakes should you aviod while drafting a cover letter?	**CO1**	Understand	
(B)	How would you prepare for an interview for a post in company's edotorial department?	**CO1**	Apply	
(C)	What is significance of a cover letter?	**CO1**	Apply	

*** End ***

Class: T. Y. B.Sc

Roll. No	Name of Students	Q1 (MCQ - 5)					Q2 (5)	Q3 (10)	Total Marks	CO1	CO3	C04	CO5	
		CO4	CO4	CO5	CO3	CO3	CO4	CO1						=SUM(C9:I9)
		1	1	1	1	1	5	10	20	10	2	7	1	
	BANDGAR PARSHURAM RAMESH	1	0	1	0	0	3	6	11	6	0	4	1	

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Department of English

T. Y. B. Sc **A.Y. 2021-22**

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Subject: Atomic and Molecular Physics **Max. Marks: 50**

Roll No	Name of Student	CA1 (15)	CA2 (25)	CA3 (10)	Mid Sem (20)	CA+Mid Sem (70)	Uni. Internal (15)	ESE (35) CO1-6	Total Marks (50)	Total Marks (100)
1	BANDGAR PARSHURAM RAMESH	9	16	7	11	43	10	21	31	62
2	JORI SHUBHAM BHARAT	10	15	7	10	42	10	25	35	70
3	KANGANE AKSHAY ANANT	8	13	8	9	38	11	26	37	74
4	PATIL SWATI BASANT	10	19	6	12	47	9	28	37	74
5	PUJARI SAKSHAM SHIVA	10	16	9	8	43	12	26	38	76
6	GOANARKAR RUSHIKESH	9	9	5	8	31	9	33	42	84
7	SALUNKHE RAKESH	8	12	5	7	32	11	32	43	86

19.881356 9

27.29 54 0

54.57

=AVERAGE(I7:I66)

=I68*2

=COUNTIF(I7:I66,">=28.53")

NO. of Students Above Avg	3	
Attainment	N	
% Attainment	42.86	

Course Name: Atomic and Molecular Physics   **Class: T. Y. B. Sc**   **Semester:V**

Course End Survey

Sr. No	Question	CO	Level of Agreement			Attainment	% Attainment
			Strongly (3)	Fairly (2)	Neutral (1)		
1	Are you able to memorize different Atomic Models and their postultes	PHY354.1	6	1	0	2.9	95
2	Are you able to describe vector Atomic model and Quantum States	PHY354.2	4	3	0	2.6	86
3	Are you able to applied vector atom meodel on one and two valence electron system	PHY354.3	3	3	1	2.3	76
4	Are you able to analyse zeeman effect and their applications	PHY354.4	2	5	0	2.3	76
5	Are you able to summerize concept of moleculae spectroscopy, rotational, vibrational and electronic spectra	PHY354.5	2	3	2	2.0	67
6	Are you able to design Raman Spectroscopy and their applications	PHY354.6	3	3	1	2.3	76

=(F10/41)*3+(G10/41)*2+(H10/41)*1

=(I10/3)*100

Note: We should add Following survey to strengthen claim of attainment of Program outcomes			
1	Exit surevy	100 % students	
2	Alumni surevy	10-20 % Alumni	Feedback surevy should be based on POs
3	Employer survey	5-10 % Employer	

Anantrao Pawar College, Pirangut

Department of Physics

A.Y 2019-20 (Sem I) F. Y. B. Sc

Course Name: Mechanics and Proper **Course Code: PHY354**

Class: F. Y. B. Sc

Computation of CO Attainment

Assessment Plan for Internal Assessment

Course No.	Course Outcome No.	CA1	CA2	CA3	MIDSEM
	Marks	15	25	10	20
PHY354	PHY354.1	60	60		60
	PHY354.2	60			0
	PHY354.3	60	60		60
	PHY354.4	60	60	60.00	60
	PHY354.5	60		60.00	60
	PHY354.6		60		

Class Average in Internal Assessment

Course No.	Course Outcome No.	CA1	CA2	CA3	MIDSEM	Internal Assessment class average %tage
		15	25	10	20	100
PHY354	PHY354.1	42.90	57.14		57.14	52.40
	PHY354.2	85.70	57.14			71.42
	PHY354.3	71.40	42.86	42.85	85.71	60.71
	PHY354.4	57.14	57.14	42.86	57.14	53.57
	PHY354.5	28.57		42.86	85.71	52.38
	PHY354.6		57.14			57.14

='13.CA2-Assignment Assessment'!M82

=AVERAGE(N17:Q17)

Attainment of CO using Direct Method

Course No.	Course Outcome No.	Internal Assessment(IA) class average %tage	External Assessment (ESE)	Direct CO Attainment (30% of IA + 70% ESE)
PHY354	PHY354.1	52	43	46
	PHY354.2	71	43	51
	PHY354.3	61	43	48
	PHY354.4	54	43	46
	PHY354.5	52	43	46
	PHY354.6	57	43	47
	Avg			47

=(0.3*W17)+(0.7*X17)

Computation of Total CO Attainment

Course No.	Course Outcome No.	Direct CO Attainment (30% of IA + 70% ESE)	Indirect CO Attainment(obtained from Exit Survey) % age	Total Co Attainment (70% of Direct Attainment + 30 % of exit survey)
PHY 111	PHY354.1	46	95	61
	PHY354.2	51	86	62
	PHY354.3	48	76	57
	PHY354.4	46	76	55
	PHY354.5	46	67	52
	PHY354.6	47	76	56
	Avg	47	79	57

=(0.7*AC17)+(0.3*AD17)

1.666667

Anantrao Pawar College, Pirangut
Department ofPhysics
A.Y 2021-22

Course Name: Atomic and Molecular Physics   **Class: T. Y. B. Sc**   **Semester: V**

CO Attainment Gap							
Course No.	Course Outcome No.		Total CO Attainment %age	CO Target % age	CO Attainment Gap(Attainment - Target		
PHY354	PHY354.1		61	60	1		
	PHY354.2		62	60	2		
	PHY354.3		57	60	-3		
	PHY354.4		55	60	-5		
	PHY354.5		52	60	-8		
	PHY354.6		56	60	-4		

Closure of Quality loop					
Course No.	Course Outcome No.	Target %age	Target achieved	Action proposed to bridge the gap	CO Attainment Gap(Attainment - Target
PHY354	PHY354.1	60	61		1
	PHY354.2	60	62		2
	PHY354.3	60	57	It is proposed to revise the vector atom Model	-3
	PHY354.4	60	55	It is proposed to explain the Zeeman Effect	-5
	PHY354.5	60	52	It is proposed to experimental proof on different spectra	-8
	PHY354.6	60	56	It is proposed to take raman spectra once again	-4

Course Name: Atomic and molecular Physics   Class: T. Y. B. Sc   Semester:V

CO-PO & PSO MATRIX												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
PHY354.1	3	2			1	2			1	1			
PHY354.2	2	1	2						1	1		1	
PHY354.3			3	2		1			1	1	2		2
PHY354.4			3	2		2	1		1		1		3
PHY354.5			3	3		3	2		1		3	1	2
PHY354.6													
PHY354	2.50	1.50			1.00	2.00	1.50		1.00	1.00	2.00	1.00	2.33

=AVERAGE(D8:D13)

Course No.	Course Outcome No.	Total CO Attainment %age	
PHY354	PHY354.1	61	
	PHY354.2	62	
	PHY354.3	57	
	PHY354.4	55	
	PHY354.5	52	
	PHY354.6	56	
		56.97	

Attainment of PO/PSO=(Average of Attainments of Relevant COs)*Scale Factor

Scale Factor=(Actual Mapping Strength/Maximum Possible Mapping Strength)=Actual Mapping strength/3

=(E18+E19+E20+E21+E22+E23)/6

PO & PSO Attainment												
C213	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
Mapping Strength	2.50	1.5			1	2	1.5		1	1	2.00	1	2.333333
Attainment %_avg	47	28	0	0	19	38	28	0	19	19	38	19	44

=(E24)*(F28/3)

Sr.No.	Year	Course No.	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3		
1	F. Y. B. Sc	PHY111			43	26	0	0	17	34	26	0	17	17	34	17	40		
2		PHY112																	
3		PHY113																	
4		PHY121																	
5		PHY122																	
6		PHY123																	
10	S. Y. B. Sc	PHY231																	
11		PHY232																	
12		PHY233																	
13		PHY241																	
14		PHY242																	
15		PHY243																	
1	T. Y. B. Sc	PHY																	
2																			
3																			
4																			
5																			
6																			

| | | Direct PO attainment | | | 43 | 26 | 0 | 0 | 17 | 34 | 26 | 0 | 17 | 17 | 34 | 17 | 40 |

=AVERAGE(F9:F26)

$(0.8*F28)+(0.2*F29)$

ANANTRAO PAWAR COLLEGE, PIRANGUT

Department of Physics

Course Outcome and Program Outcome Attainment Worksheet for Courses

Academic Year	*2021-22*
Semester	*VI*
Title of Course	*Quantum Mechanics*
Course Code (Theory)	*PHY362*
Course Number(Theory)	*PHY362*
Course Code (lab)	*Nil*
Course Number(Lab)	*Nil*
Course Coordinator(Theory)	*Dr. Smita A. Lokare*
Course Coordinator(Lab)	*Not applicable*

ANANTRAO PAWAR COLLEGE, PIRANGUT

Department of PHYSICS

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Sr.No.	Description	NAAC SSR Metrics
1	*Program Outcome Statements*	**2.6.1**
2	*Program Specific Outcome Statements*	**2.6.1**
3	*Course Outcome Statements*	**2.6.1**
4	*CO-PO Matrix*	**2.6.2**
5	*CO-PSO Matrix*	**2.6.2**
6	*Assessment Process*	**2.6.2**
7	*Setting CO Attainment Target*	**2.6.2**
8	*CA-1 Question Paper*	**2.6.2**
9	*CA-1 Assessment*	**2.6.2**
10	*CA-2 Assessment*	**2.6.2**
11	*CA-3 Assessment*	**2.6.2**
12	*Mid sem Question Paper*	**2.6.2**
13	*Mid sem Assessment*	**2.6.2**
14	*Assignemnt Questions*	**2.6.2**
15	*Assignment Assessment*	**2.6.2**
16	*End Semester Examination*	**2.6.2**
17	*Course Exit Survey*	**2.6.2**
18	*Computation of Attainment of COs*	**2.6.2**
19	*CO Attainment Gap*	**2.6.2**
20	*Computation of Attainment of POs and PSOs*	**2.6.2**

Anantrao Pawar College, Pirangut

Programe Outcome Statements

PO No.	Statements
PO1	**Disciplinary knowledge Acquisition:** Acquire in depth knowledge, fundamental concepts and one or more disciplines that form a part of an undergraduate programme of study. .
PO2	**Skill Development:** Develop skill of applying fundamentals, concepts and techniques of physical sciences to real life situations.
PO3	**Critical thinking:** Capability to apply thought to a body of knowledge as well as analyse and evaluate evidence, arguments, claims, beliefson the basis of empirical evidence..
PO4	**Problem solving**: Capacity to extrapolate from what one has learned and apply competencies to solve different kinds of problems.
PO5	**Communication skills:** Communicate effectively with scientific professions and community as well as with society at large.
PO6	**Analytical Skills:** Identify scientific skills related problems to arise at substantiated conclusions using fundamentals learnt in the programme.
PO7	**Use of Tools and Technology:** Acquire knowledge of using new technological tools in the areas of science education and research.
PO8	**Moral and ethical awareness**: Ability to embrace moral/ethical values in everyday social, educational , National activities and programs.
PO9	evaluate ideas, evidence and experiences from an open-minded and reasoned perspective Scientific reasoning:
PO10	**Lifelong Learning and Collaborative Skills:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change learn to work collaboratively and productively in groups.

Anantrao Pawar College, Pirangut

Programe Specific Outcome Statements

PSO No.	Statements
PSO1	**Research-related skills** : A sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating along with ability to define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation.
PSO2	**Self-directed learning** : Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.
PSO3	**Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

Anantrao Pawar College, Pirangut
Department of Physics

A.Y 2021-22 (Sem VI) T. Y. B. Sc

Course Name:Quantum Mechanics   Class: T. Y. B. Sc   Semester: VI

Course Outcome Statements			
Course No.	Course Outcome No.	Statements	Blooms level
		At the end of the course, students will be able to:	
PHY362	PHY362.1	Enlist the origin of Quantum Mechanics and concept of wave particle duality	Remember
	PHY362.2	Classify different applications of Quantum Mechanics	Understand
	PHY362.3	Evalute the Schrodinger's equation , operators and expectation values	Evaluate
	PHY362.4	Analyse physical Applications ofSchrodingers Steady State Equation	Analyse
	PHY362.5	Apply Mathematicaloperators in quantum Mechanics	Apply
	PHY362.6	Create special feacturs of Quantum mechanics and its applications	Create

CO-PO CORELATION LEVEL PREDECIDED												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
PHY362.1			√		√				√	√		
PHY362.2		√			√							
PHY362.3		√		√		√				√		
PHY362.4			√	√					√			
PHY362.5	√		√				√		√			
PHY362.6	√						√		√			

Low = 1,　　　Moderate = 2,　　　High = 3

CO-PO MATRIX												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
PHY362.1			1		3				2	1		
PHY362.2		2			1			1				
PHY362.3		3		2		1				3		
PHY362.4			1	2					3			
PHY362.5	3		2				1		1			
PHY362.6	1						2		3			
PHY362	2	2.5	.33333	2	2	1	1.5	1	2.25	2		

=AVERAGE(E23:E28)

CO-PO MATRIX												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10		
PHY362.1			L		H				M	L		
PHY362.2		M			L			L				
PHY362.3		H		M		L				H		
PHY362.4			L	M					H			
PHY362.5	H		M				L		L			
PHY362.6	L						M		H			

PHY362-1-PO3	It helps to aquire knowledge and basic concepts of Mathematical Physics
PHY362-1-PO5	The topic helps the concepts and techniques of physical sciences to real life situations.
PHY362-1-PO9	To iddentify scientific concepts and its everyday applications
PHY362-1-PO10	To analyse, interprete and evalute the ideas behind it
PHY362-2-PO2	Ability to engage in independent learning
PHY362-2-PO5	To identify the depth of knowledge and fundamental concepts
PHY362-2-PO8	To observe skill developed related concepts
PHY362-3-PO2	To summarize thoughts to body of knowledge
PHY362-3-PO4	To represent scienticfic conclusion
PHY362-3-PO6	To translate in independent and lifelong learning in the broadest context
PHY362-3-PO10	To judge Capability to apply thought to knowledge and evalute evidence
PHY362-4-PO3	To practice problems of laws of physics
PHY362-4-PO4	To prepare scientific skill behind laws of Mechanics
PHY362-4-PO9	To interprete physical phenomenon associated with laws of Mechanice
PHY362-5-PO1	To transfer knowledge of laws of Mechanics for everyday phenomenon
PHY362-5-PO3	To illustrate and analyse evidences related to basuc properties of materials
PHY362-5-PO7	To infer material properties by solving problems associated with properties of materials
PHY362-5-PO9	To experiment and acquire analytical skill related to properties of materials
PHY362-6-PO1	To test the fundamental materials properties
PHY362-6-PO7	To survey different physical materials and thheir properties
PHY362-6-PO9	To justify physical pheniomenon related to basic material properties

CO-PSO CORELATION LEVEL PREDECIDED													
	PSO.1	PSO.2	PSO.3										
PHY351.1													
PHY351.2		√											
PHY351.3	√		√										
PHY351.4			√										
PHY351.5	√	√	√										
PHY351.6		√											

CO-PSO MATRIX			
CO	PSO1	PSO2	PSO3
PHY351.1			
PHY351.2		1	
PHY351.3	2		2
PHY351.4			3
PHY351.5	3	1	2
PHY351.6		1	
PHY351	2.5	1	2.333333

=AVERAGE(E18:E24)

Justification	
Mapping	Justification
PSO.1-CO3	To write and verify hypothesis for enhacing Research Skill
PSO.1-CO5	To rank materials based on their physical properties
PSO.2-CO2	To select appropriate resources required for projects
PSO.2-CO5	To predict various physical parameters of materials
PSO.2-CO6	To experiment and Analyse verious physical properties of materials
PSO.3-CO3	To judge relevence of evidence
PSO.3-CO4	To experiment to synthesise and analysis data from a variety of sources
PSO.3-CO5	To summerize supporting and opposing view points related to material properties.

Course No	Course Code	Course Name		Direct Assessment Tools					Indirect Assessment Tool
				External	Internal				
362	PHY362	Quantum Mechanics		ESE	CA1- Clas	CA2- Assg	CA3- Tutorials	Mid Semester Exam	Course Exit Survey
		Direct Attainment Ratio	70		30				
		Final Attainment Ratio		70					30

CA1- 10 Objectives, 5 Short questions　　　　15 Marks
CA2 - 4 Assignments/ Case studies, 5 Marks each　　　　25 Marks
CA3- Student Presentation/ Model　　　　10 Marks

ESE - (Covering all Cos)　　　　35 Marks
MSE- Covering 50 % Syllabus　　　　20 Marks

Course Exit Survey - 5 - 10 feedback questions

Setting CO Attainment Targets				
Course No.	Course Outcome No.	Statements	Target (Class Average)	justification
PHY362	PHY362.1	Enlist the origin of Quantum Mechanics and	60%	All the CO are considered equally important, hence assigned same target for each CO.As this is basic core subject ,hence the traget assigned is 60%
	PHY362.2	Classify different applications of Quantum	60%	
	PHY362.3	Evalute the Schrodinger's equation , operators and expectation values	60%	
	PHY362.4	Analyse physical Applications ofSchrodingers Steady State Equation	60%	
	PHY362.5	Apply Mathematicaloperators in quantum Mechanics	60%	
	PHY362.6	Create special feacturs of Quantum mechanics and its applications	60%	

Class Test-CA1 Question Paper

Course Name: Quantum Mechanics   **Course Code:PHY111**

Class: T. Y. B. Sc Sem-VI

Date: 27/07/2021   **Time:9.25 AM to 10.15 PM**   **Maximum Marks:15**

Instructions

1) Figures to the right indicate full marks
2) Assume suitable data wherever necessary with justification

Q1. Choose the correct alternative (1 X 5 = 5)		Course Outcome	Learning Level
1	The value of the commutator bracket [Lx,y] is -------- a) ihz c)-ihz b)ihx d)ihy	CO5	Apply
2	The ladder operator L+ is given as -------- a) Lx+iLy c) Lx-iLy b) Ly-iLx d) iLx-Ly	CO5	Apply
3	Nickel Crystal used in Davisson-Germer experiment belongs to the type --------- a) BCC c) Simple Crystal b) FCC d) HCP	CO1	Remember
4	The square of the magnitude of the wave function is called-------- a) current density c) probability density b) zero density d) volume density	CO1	Remember
5	Which of the following is not a characteristic of wave function? a) continuous c) differentiable b) discontinuous d) single valued	CO3	Evaluate

Q2. Attempt any ane of the followings (1 X 5 = 5)		Course Outcome	Learning Level
a	Obtain the expression for group velocity	CO2	Understand
b	Disscuss gamma ray microscope to illustrate uncertainty relation.	CO2	Understand

Q3. Answer the following question in detail. (1 X 5 = 5) (		Course Outcome	Learning Level
	Obtain equation of continuity. Give the Physical Significance	CO4	Analyse

0.714286	14286	28571	33333	57143	14286	28571
CO5	CO5	CO1	CO1	CO3	CO2	CO4

1.14	714286	857143	428571	.428571	10.571429
CO1	CO2	CO3	CO4	CO5	

=AVERAGE(P12:P71)

CO1	CO2	CO3	CO4	CO5	CO-TOTAL	
2	5	1	5	2	15	CO Marks
2	5	6	4	3	6	er of Students above av

=COUNTIF(L12:L71,">=1.32")

Assignment No. 1 to 5

Questions	CO	BL
Q.1) What is meant by eigen function and eigen values	CO4	Analyze
Q.2) Write a note on raising and lowering operator	CO4	Analyze
Q.3)Find the lowest energy of electron confined in a cubical box of each side 1Ao	CO3	Evaluate
Q.4) Obtain Schrodinger's time dependent equation	CO2	Understand
Q.5)Define an operator. State the quantum mechanical operators.	CO1	Apply
Q. 6)Write a note on uncertainity Principle	CO6	Create

Subject Incharge
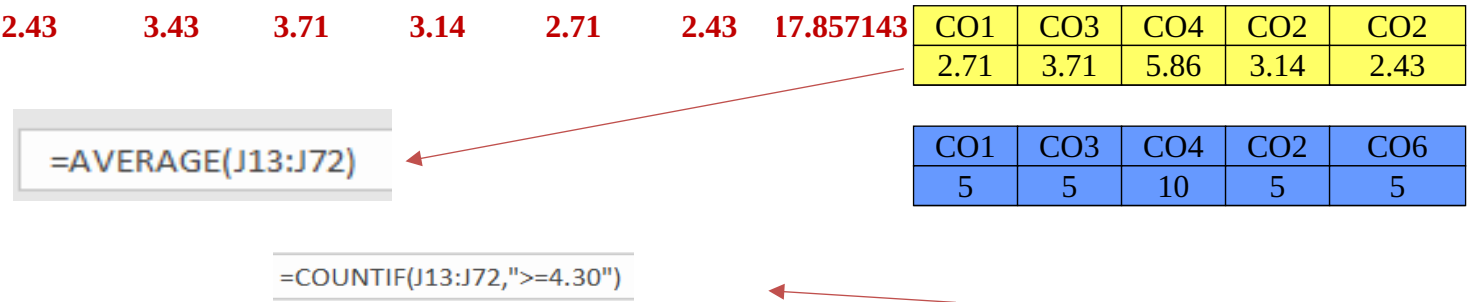
2.43   3.43   3.71   3.14   2.71   2.43   17.857143

CO1	CO3	CO4	CO2	CO2
2.71	3.71	5.86	3.14	2.43

=AVERAGE(J13:J72)

CO1	CO3	CO4	CO2	CO6
5	5	10	5	5

=COUNTIF(J13:J72,">=4.30")

Course Name: Quantum Mechanics   **Course Code:PHY356**

Class: T. Y. B. Sc

CA3 - Mode of Assessment: Students Models on Syllabus / Presentations

2	BANDGAR PARSHURAM RAMESH	7	1	2	4	7		
16	JORI SHUBHAM BHARAT	7	1	4	2	7		
20	KANGANE AKSHAY ANANT	8	1	4	3	8		
27	PATIL SWATI BASANT	8	2	2	4	8		
32	PUJARI SAKSHAM SHIVA	9	2	3	4	9		
40	GOANARKAR RUSHIKESH	5	1	2	2	5		
41	SALUNKHE RAKESH	5	2	1	2	5		
		7.00	**1.43**	**2.57**	**3.00**			
			CO4 (2)	**CO5(4)**	**CO3 (4)**			
	Subject Incharge							

=AVERAGE(D11:D70)

=COUNTIF(D11:D70, ">=1.72")

Count above avg	3	3	4				0
Attainment	N	N	N			N	
% Attainmrnt	2.857143	2.857143	7.142857				0

Instructions to the Students:

1. Figures to the right indicate full marks
2. Assume suitable data wherever necessary, with proper justification

		(CO)	(Level)	Marks
Q. 1	**Choose the correct alternative**			**5 × 1 = 5**
1	Bharat Ratna' award is India's highest………award. a. Artist b. Military c. Security d. Civilian	**CO4**	Remember	
2	Which of the following novels by Anita Desai was not shortlisted for the Booker Prize? a. In custody b. Clear light of day c. Fasting, Feasting d. Sunny days	**CO4**	Analyse	
3	Meaning of the word 'Flake' is………………. a. Butterfly b. very thin piece c. Mammals d. Very large piece	**CO5**	Remember	
4	He said that the sun ------in the east. a. Awake b. Will rise c. Rises d. Covers	**CO3**	Understand	
5	He said ……….. he must not play with fire. a. That b. While c. Which d. None of the above	**CO3**	Understand	
Q.2	**Answer the following question.**			**5 × 1 = 05**
(A)	Write a note on massage of the peom 'stopping by woods on a snowy evening'.	**CO4**	Understand	
Q. 3	**Solve Any One of the following.**			**5 × 2 = 10**
(A)	What mistakes should you aviod while drafting a cover letter?	**CO1**	Understand	
(B)	How would you prepare for an interview for a post in company's edotorial department?	**CO1**	Apply	
(C)	What is significance of a cover letter?	**CO1**	Apply	

*** End ***

Class: F. Y. B.Sc

Roll. No	Name of Students	Q1 (MCQ - 5)					Q2 (5)	Q3 (10)	Total Marks		CO1	CO3	C04	CO5	
		CO4	CO4	CO5	CO3	CO3	CO4	CO1							
		1	1	1	1	1	5	10	20		10	2	7	1	
	BANDGAR PARSHURAM RAMESH	1	1	1	1	0	3	8	15		8	1	5	1	

=SUM(C9:I9)

Department of Physics

T. Y. B. Sc   A.Y. 2021-22

Subject: Quantum Mechanics   **Max. Marks: 50**

Roll No	Name of Student	CA1 (15)	CA2 (25)	CA3 (10)	Mid Sem (20)	CA+Mid Sem (70)	Uni. Internal (15)	ESE (35) CO1-6	Total Marks (50)	Total Marks (100)
1	BANDGAR PARSHURAM RAMESH	11	14	7	15	47	11	21	32	64
2	JORI SHUBHAM BHARAT	11	20	7	10	48	11	25	36	72
3	KANGANE AKSHAY ANANT	11	21	8	8	48	11	26	37	74
4	PATIL SWATI BASANT	11	27	8	11	57	10	28	38	76
5	PUJARI SAKSHAM SHIVA	13	16	9	11	49	12	26	38	76
6	GOANARKAR RUSHIKESH	6	18	5	10	39	10	30	40	80
7	SALUNKHE RAKESH	11	20	5	7	43	12	32	44	88
			19.881356			9				
								26.86	54	0
								53.71		

=AVERAGE(I7:I66)

=I68*2

=COUNTIF(I7:I66,">=28.53")

NO. of Students Above Avg	3	
Attainment	N	
% Attainment	42.86	

Course Name:Quantum Mechanics   **Class: T. Y. B. Sc**   **Semester:VI**

Course End Survey

Sr. No	Question	CO	Strongly (3)	Fairly (2)	Neutral (1)	Attainment	% Attainment
			Level of Agreement				
1	Are you able to enlist the origin of Quantum Mechanics and concept of wave particle duality	PHY362.1	4	2	1	2.4	81
2	Are you able to Classify different concept of work and energy	PHY362.2	3	4	0	2.4	81
3	Are you able to Evalute the Schrodinger's equation , operators and expectation values	PHY362.3	3	3	1	2.3	76
4	Are you able to testing various physical laws apllied in Mechanics	PHY362.4	4	3	0	2.6	86
5	Are you able to analyse physical properties of matter such as elasity and surface tension	PHY362.5	6	1	0	2.9	95
6	Are you able to apply different concepts of mechanics to solve various real life physical problems	PHY362.6	5	2	0	2.7	90

=(F10/41)*3+(G10/41)*2+(H10/41)*1

=(I10/3)*100

Note: We should add Following survey to strengthen claim of attainment of Program outcomes

1	Exit surevy	**100 % students**	
2	Alumni surevy	**10-20 % Alumni**	**Feedback surevy should be based on POs**
3	Employer survey	**5-10 % Employer**	

CO1	Enlist components of types of motions and Newtons laws
CO2	
CO3	
CO4	
CO5	

Anantrao Pawar College, Pirangut

Department of Physics

A.Y 2021-22 (Sem VI) T. Y. B. Sc

Course Name: Quntum Mechanics   Course Code: PHY362

Class: F. Y. B. Sc

Computation of CO Attainment																					

Assessment Plan for Internal Assessment							Class Average in Internal Assessment							Attainment of CO using Direct Method					Computation of Total CO Attainment			
Course No.	Course Outcome No.	CA1	CA2	CA3	MIDSEM		Course No.	Course Outcome No.	CA1	CA2	CA3	MIDSEM	Internal Assessment class average %tage	Course No.	Course Outcome No.	Internal Assessment(IA) class average %tage	External Assessment (ESE)	Direct CO Attainment (30% of IA + 70% ESE)	Course No.	Course Outcome No.	Direct CO Attainment (30% of IA + 70% ESE)	Indirect CO Attainment(obtained from Exit Survey) % age	Total Co Attainment (70% of Direct Attainment + 30 % of exit survey)
	Marks	15	25	10	20				15	25	10	20	100									
	PHY362.1	60	60		60			PHY362.1	28.57	57.14		42.86	42.86		PHY362.1	43	43	43		PHY362.1	43	81	54
	PHY362.2	60			0			PHY362.2	71.40	57.14			64.27		PHY362.2	64	43	49		PHY362.2	49	81	59
PHY362	PHY362.3	60	60		60		PHY 111	PHY362.3	85.71	85.71	57.14	85.71	78.57	PHY 111	PHY362.3	79	43	54	PHY 111	PHY362.3	54	76	60
	PHY362.4	60	60	60.00	60			PHY362.4	57.14	42.86	42.85	42.86	46.43		PHY362.4	46	43	44		PHY362.4	44	86	56
	PHY362.5	60		60.00	60			PHY362.5	42.86		42.85	71.43	52.38		PHY362.5	52	43	46		PHY362.5	46	95	61
	PHY362.6		60					PHY362.6		57.14			57.14		PHY362.6	57	43	47		PHY362.5	47	90	60
																		Avg	47	Avg	47	85	58

1.666667

='13.CA2-Assignment Assessment'!M82

=AVERAGE(N17:Q17)

=(0.3*W17)+(0.7*X17)

=(0.7*AC17)+(0.3*AD17)

Course Name: Mathematical Methods in Physics II   **Class:F. Y. B. Sc   Semester:I**

			CO Attainment Gap				
Course No.	Course Outcome No.		Total CO Attainment %age	CO Target % age	CO Attainment Gap(Attainment - Target		
PHY362	PHY362.1		54	60	-6		
	PHY362.2		59	60	-1		
	PHY362.3		60	60	0		
	PHY362.4		56	60	-4		
	PHY362.5		61	60	1		
	PHY362.6		60	60	0		

			Closure of Quality loop		
Course No.	Course Outcome No.	Target %age	Target achieved	Action proposed to bridge the gap	CO Attainment Gap(Attainment - Target
PHY362	PHY362.1	60	54	It is proposed to detail basics about Quantum Mechanics	-6
	PHY362.2	60	59	It is proposed to repeat the cocepts of work and energy	-1
	PHY362.3	60	60		0
	PHY362.4	60	56	It is proposed to practce on the Physical laws in mechanics	-4
	PHY362.5	60	61		1
	PHY362.6	60	60		0

Course Name: Quantum Mechanics   **Class: T. Y. B. Sc**   **Semester:VI**

CO-PO & PSO MATRIX												
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
PHY362.1			1		3				2	1			
PHY362.2		2			1			1				1	
PHY362.3		3		2	1					3	2		2
PHY362.4			1	2					3				3
PHY362.5	3		2				1		1		3	1	2
PHY362.6	1						2		3			1	
PHY362	2.00	2.50			2.00	1.00	1.50		2.25	2.00	2.50	1.00	2.33

=AVERAGE(D8:D13)

Course No.	Course Outcome No.	Total CO Attainment %age	
PHY362	PHY362.1	54	
	PHY362.2	59	
	PHY362.3	60	
	PHY362.4	56	
	PHY362.5	61	
	PHY362.6	60	
		58.43	

Attainment of PO/PSO=(Average of Attainments of Relevant COs)*Scale Factor

Scale Factor=(Actual Mapping Strength/Maximum Possible Mapping Strength)=Actual Mapping strength/3

=(E18+E19+E20+E21+E22+E23)/6

PO & PSO Attainment												
C213	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
Mapping Strength	2.00	2.5			2	1	1.5		2.25	2	2.50	1	2.333333
Attainment %_avg	39	49	0	0	39	19	29	0	44	39	49	19	45

=(E24)*(F28/3)

Sr.No.	Year	Course No.	Course Code	Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3		
1	F. Y. B. Sc	PHY111			43	26	0	0	17	34	26	0	17	17	34	17	40		
2		PHY112																	
3		PHY113																	
4		PHY121																	
5		PHY122																	
6		PHY123																	
10	S. Y. B. Sc	PHY231																	
11		PHY232																	
12		PHY233																	
13		PHY241																	
14		PHY242																	
15		PHY243																	
1	T. Y. B. Sc	PHY																	
2																			
3																			
4																			
5																			
6																			

	Direct PO attainment				43	26	0	0	17	34	26	0	17	17	34	17	40

=AVERAGE(F9:F26)

$(0.8*F28)+(0.2*F29)$