Learning Outcomes-based Curriculum Framework
for
B.Sc. –with PHYSICS

(w. e. f. the Academic Session 2020-21 in phased manner)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SCHEME OF EXAMINATION FOR

B.Sc. - I (PHYSICS)

(1st& 2nd SEMESTER) EXAMINATIONS

Under Choice Based Credit System(CBCS)

W.E.F. SESSION 2020-21

SCHEME OF EXAMINATIONS

SEMESTER-I

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. Hours
					External	Internal	Total	
B-PHY-101	CC*-1	Mechanics-I	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-102	CC-2	Mechanics-II	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-103	CC-3	Physics Practical-I	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

*CC-Core Course

SEMESTER-II

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-201	CC-4	Electricity, Magnetism & E.M.Theory	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-202	CC-5	Electronics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-203	CC-6	Physics Practical-II	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SCHEME OF EXAMINATION FOR

B.Sc. -II (PHYSICS)

(3rd&4thSEMESTER) EXAMINATIONS

Under Choice Based Credit System (CBCS)

W.E.F. SESSION 2021-22

SCHEME OF EXAMINATIONS

SEMESTER-III

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-301	CC*-7	Thermal Physics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-302	CC-8	Statistical Mechanics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-303	CC-9	Physics Practical-III	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

*CC-Core Course

SEMESTER-IV

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-S1	Skill Enhancement Course in Physics (SECP-1)	(A) Applied Optics/ (B) Renewable Energy & Energy Harvesting	**02**	**02**	**40**	**10**	**50**	**3**
B-PHY-401	CC-10	Wave & Optics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-402	CC-11	Quantum Mechanics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-403	CC-12	Physics Practical-IV	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**250**	

KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SCHEME OF EXAMINATION FOR

B.Sc. -III(PHYSICS)

(5th&6thSEMESTER) EXAMINATIONS

Under Choice Based Credit System (CBCS)

W.E.F. SESSION 2022-23

SCHEME OF EXAMINATIONS

SEMESTER-V

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-501	DSE*-1	(I) Nuclear Physics (II) Mathematical Physics	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-502	DSE-2	(I) Solid State Physics (II) Medical Physics	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-503	DSE-3	(I) Physics Practical-V (II)	**02**	**04**	**40**	**10**	**50**	**3**
				Total Marks			**200**	

*DSE-Discipline Specific Elective

SEMESTER-VI

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-601	DSE-4	(I) Atomic & Molecular Spectroscopy (II) Elements of Modern Physics	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-602	DSE-5	(I) Digital Analogy & Instrumentation (II) Embedded System	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-603	DSE-6	(I) Physics Practical-VI (II)	**02**	**04**	**40**	**10**	**50**	**3**
				Total Marks			**200**	

Program Outcomes (PO) for Under Graduate Programme (1st to 6th semesters of B.Sc. with Physics), Institute of Integrated & Honors Studies, KUK:

PO1	Knowledge	Capable of demonstrating comprehensive disciplinary knowledge gained during course of study
PO2	Communication	Ability to communicate effectively on general and scientific topics with the scientific community and with society at large
PO3	Problem Solving	Capability of applying knowledge to solve scientific and other problems
PO4	Individual and Team Work	Capable to learn and work effectively as an individual , and as a member or leader in diverse teams, multidisciplinary settings
PO5	Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions
PO6	Modern Tool usage	Ability to use and learn techniques, skills and modern tools for scientific practices
PO7	Science and Society	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices
PO8	Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout life
PO9	Environment and Sustainability	Ability to design and develop modern systems which are environmentally sensitive and to understand the importance of sustainable development
PO10	Ethics	Apply ethical principles and professional responsibilities in scientific practices
PO11	Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects

Programme specific outcomes

After successful completion programme, the students will be able to:

PSO1: Acquire an in-depth understanding and knowledge of the basic concepts of physics and be able to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws through logical reasoning.

PSO2: Be capable of understanding the core physical laws to understand the basic concepts, latest progress and applications of certain sub fields such as nuclear physics, spectroscopy of atoms & molecules, solid state physics, computational physics & electronics.

PSO3: Gain hands-on skills for carrying out basic experiments as well as experiments related to different fields of Physics and attain abilities of critical thinking, problem mapping & solving using fundamental principles of Physics, systematic analysis & interpretation of results.

PSO4: Have a new perspective to look at everything from 'Scientific' point of view that enabling them to pursue higher studies at postgraduate & research level

PSO5: Have awareness of the impact of Physics in social, economical and environmental issues.

Mapping of CO with PO's and PSO's

Course code B-PHY-101																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-101.1	3	3	3	2	2	2	2	3	2	-	2	3	3	3	3	2
B-PHY-101.2	3	3	3	2	3	2	2	3	2	-	2	3	3	3	3	2
B-PHY-101.3	3	3	3	2	3	2	2	3	2	-	2	3	3	3	3	1
B-PHY-101.4	3	3	2	2	2	1	2	2	1	-	2	3	3	3	3	1
Average	3	3	2.75	2	2.5	1.75	2	2.75	1.75	-	2	3	3	3	3	1.5
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-102																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-102.1	3	3	3	2	2	2	2	3	2	-	2	3	3	2	2	2

B-PHY-102.2	3	3	3	3	3	2	2	2	2	-	2	3	3	2	3	2
B-PHY-102.3	3	3	2	2	2	2	2	2	2	-	2	3	3	2	3	2
B-PHY-102.4	3	3	2	2	2	2	2	3	2	-	1	3	3	2	2	2
Average	3	3	2.5	2.25	2.25	2	2	2.5	2	-	1.75	3	3	2	2.5	2

Course code:B-PHY-103																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-103.1	3	3	3	3	2	2	2	3	2	-	2	3	3	3	3	3
B-PHY-103.2	3	3	3	3	2	3	2	3	2	-	2	3	3	2	3	3
B-PHY-103.3	3	3	3	3	2	3	2	2	2	-	2	3	3	3	3	3
B-PHY-103.4	3	3	3	3	3	3	2	3	2	-	3	3	3	3	3	3
Average	3	3	3	3	2.75	2.75	2	2.75	2	-	2.75	3	3	2.75	3	3

Semester-II

Course code B-PHY-201															
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-201.1	3	3	3	2	2	2	3	2	2	-	3	3	3	2	3	2
B-PHY-201.2	3	3	3	2	2	2	2	3	2	-	2	3	3	2	3	2
B-PHY-201.3	3	3	3	2	2	2	2	2	2	-	2	3	2	2	2	2
B-PHY-201.4	3	3	3	2	2	2	3	2	2	-	3	3	2	2	2	2
Average	3	3	3	2	2	2	2.5	2.75	2	-	2.5	3	2.5	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-202

COs	PO1- Knowledge	PO2- Communication	PO3- Problem Solving	PO4- Individual and Team Work	PO5- Investigation of Problems	PO6- Modern Tool usage	PO7- Science and Society	PO8- Life-Long Learning	PO9- Environment and Sustainability	PO10- Ethics	PO11- Project Management	PSO1	PSO2	PSO3	PSO4	PSO5
B-PHY-202.1	3	3	3	3	3	2	2	3	2	-	2	3	3	2	3	2
B-PHY-202.2	3	3	3	3	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-202.3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-202.4	3	3	2	2	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2.25	2	2.5	2

Course code:B-PHY-203																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-203.1	3	3	2	3	3	2	2	3	2	-	2	3	2	2	3	2
B-PHY-203.2	3	3	3	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-203.3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-203.4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2

Mapping of CO with PO's and PSO's

Semester-III

Course code B-PHY-301																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-301.1	3	3	2	2	2	2	2	3	2	-	2	3	2	2	3	2
B-PHY-301.2	3	3	2	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-301.3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-301.4	3	3	2	2	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2	2	2	2	2	2.5	2	-	2	2.5	2	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-302																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-302.1	3	3	3	3	3	1	2	2	2	-	2	3	2	2	3	2
B-PHY-302.2	3	3	3	3	2	1	2	2	2	-	2	3	2	2	3	2
B-PHY-302.3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-302.4	3	3	2	2	2	1	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	1.25	2	2	2	-	2	2.5	2	2	2.5	2

Course code:B-PHY-303																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-303.1	3	3	2	3	3	2	2	3	2	-	2	3	2	2	3	2
B-PHY-303.2	3	3	3	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-303.3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-303.4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2

Mapping of CO with PO's and PSO's

Semester-IV

Course code B-PHY-401																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-401.1	3	3	2	3	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-401.2	3	3	2	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-401.3	3	3	2	2	2	2	2	2	2	-	2	2	2	2	2	2
B-PHY-401.4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	2	2
Average	3	3	2.25	2.5	2	2	2	2	2	-	2	2.5	2	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-402																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-402.1	3	3	2	2	2	2	2	2	2	-	2	3	2	2	2	2
B-PHY-402.2	3	3	2	2	2	2	2	2	2	-	2	3	3	2	3	2
B-PHY-402.3	3	3	3	2	2	2	2	2	2	-	2	3	3	2	2	2
B-PHY-402.4	3	3	3	3	2	2	2	2	2	-	2	3	3	2	2	2
Average	3	3	2.5	2.25	2	2	2	2	2	-	2	3	2.75	2	2.25	2

Course code:B-PHY-403																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-403.1	3	3	2	3	3	2	2	3	2	-	2	3	2	2	3	2
B-PHY-403.2	3	3	3	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-403.3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-403.4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2

Course code:B-PHY-S1(A)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-S1.1	2	2	2	3	2	2	2	2	2	-	2	2	2	2	2	2
B-PHY-S1.2	3	3	2	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-S1.3	3	3	3	2	2	2	2	2	2	-	2	3	2	2	2	2
B-PHY-S1.4	2	2	2	3	2	2	2	2	2	-	2	2	2	2	2	2
Average	2.5	2.5	2.25	2.5	2	2	2	2	2	-	2	2.5	2	2	2.25	2

Course code:B-PHY-S1(B)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-S1.1	2	2	2	3	2	2	2	2	3	-	2	2	2	2	2	2
B-PHY-S1.2	3	2	2	2	2	2	2	2	3	-	2	3	2	2	2	2
B-PHY-S1.3	2	2	2	2	2	2	2	2	2	-	2	2	2	2	2	2
B-PHY-S1.4	2	2	2	3	2	2	2	2	2	-	2	2	2	2	2	2
Average	2.25	2	2	2.5	2	2	2	2	2.5	-	2	2	2	2	2	2

Mapping of CO with PO's and PSO's
Semester-V

Course code B-PHY-501(I)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-501(I).1	3	3	3	2	2	2	2	3	2	-	2	3	2	2	2	2
B-PHY-501(I).2	3	3	2	2	2	2	2	2	2	-	2	3	2	2	2	2
B-PHY-501(I).3	3	3	2	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-501(I).4	3	3	3	2	2	2	2	3	2	-	2	3	3	2	3	2
Average	3	3	2.5	2	2	2	2	2.5	2	-	2	3	2.75	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-501(II)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-501(II).1	3	3	3	2	2	2	2	3	2	-	2	3	3	2	2	2
B-PHY-501(II).2	3	3	3	2	2	2	2	2	2	-	2	3	3	2	2	2
B-PHY-501(II).3	3	3	3	2	2	2	2	2	2	-	2	3	3	2	3	2
B-PHY-501(II).4	3	3	3	2	2	2	2	3	2	-	2	3	3	2	3	2
Average	3	3	3	2	2	2	2	2.5	2	-	2	3	3	2	2.5	2

Course code B-PHY-502(I)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-502(I).1	3	3	2	2	2	2	2	2	2	-	2	3	3	2	2	2
B-PHY-502(I).2	3	3	2	2	2	2	2	2	2	-	2	3	3	2	2	2
B-PHY-502(I).3	3	3	2	2	2	2	2	2	2	-	2	3	3	2	3	2
B-PHY-502(I).4	3	3	2	2	2	2	2	2	2	-	2	3	3	2	3	2
Average	3	3	2	2	2	2	2	2	2	-	2	3	3	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-502(II)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-502(II).1	3	3	2	2	2	2	2	3	2	-	2	3	2	2	2	2
B-PHY-502(II).2	3	3	2	2	2	2	2	2	2	-	2	3	2	2	2	2
B-PHY-502(II).3	3	3	2	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-502(II).4	3	3	2	2	2	2	2	3	2	-	2	3	2	2	3	2
Average	3	3	2	2	2	2	2	2.5	2	-	2	3	2	2	2.5	2

Course code B-PHY-503(I)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-503(I).1	3	3	2	3	3	2	2	3	2	-	2	3	2	2	3	2
B-PHY-503(I).2	3	3	3	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-503(I).3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-503(I).4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-503(II)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-503(II).1	3	3	2	3	3	2	2	3	2	-	2	3	2	2	3	2
B-PHY-503(II).2	3	3	3	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-503(II).3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-503(II).4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2

Mapping of CO with PO's and PSO's
Semester-VI

Course code B-PHY-601(I)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-601(I).1	3	3	2	2	2	2	2	2	2	-	2	3	2	2	2	2
B-PHY-601(I).2	3	3	3	3	2	2	2	3	2	-	2	3	3	2	3	2
B-PHY-601(I).3	3	3	3	3	2	2	2	3	2	-	2	3	3	3	3	2
B-PHY-601(I).4	3	3	2	2	2	2	2	2	2	-	2	3	2	2	2	2
Average	3	3	2.5	2.5	2	2	2	2.5	2	-	2	3	2.5	2.25	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-601(II)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-601(II).1	3	3	2	2	2	2	2	2	2	-	2	3	3	2	2	2
B-PHY-601(II).2	3	3	2	2	2	2	2	2	2	-	2	3	3	2	2	2
B-PHY-601(II).3	3	3	3	3	2	2	2	3	2	-	2	3	3	2	3	2
B-PHY-601(II).4	3	3	3	3	2	2	2	3	2	-	2	3	3	2	3	2
Average	3	3	2.5	2.5	2	2	2	2.5	2	-	2	3	3	2	2.5	2

Course code B-PHY-602(I)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-602(I).1	3	3	3	3	2	2	2	3	2	-	2	3	3	3	3	2
B-PHY-602(I).2	3	3	3	3	2	2	2	3	2	-	2	3	3	3	3	2
B-PHY-602(I).3	3	3	3	3	2	2	2	3	2	-	2	3	3	3	2	2
B-PHY-602(I).4	3	3	3	2	2	2	2	2	2	-	2	3	3	2	2	2
Average	3	3	3	2.75	2	2	2	2.75	2	-	2	3	3	2.75	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-602(II)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-602(II).1	3	3	2	2	2	2	2	2	2	-	2	3	2	2	2	2
B-PHY-602(II).2	3	3	2	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-602(II).3	3	3	2	2	2	2	2	2	2	-	2	3	2	3	3	2
B-PHY-602(II).4	3	3	2	2	2	2	2	2	2	-	2	3	2	3	3	2
Average	3	3	2	2	2	2	2	2	2	-	2	3	2	2.5	2.75	2

Course code B-PHY-603(I)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-603(I).1	3	3	2	3	3	2	2	3	2	-	2	3	2	2	3	2
B-PHY-603(I).2	3	3	3	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-603(I).3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-603(I).4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Course code: B-PHY-603(II)																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-603(II).1	3	3	2	3	3	2	2	3	2	-	2	3	2	2	3	2
B-PHY-603(II).2	3	3	3	2	2	2	2	2	2	-	2	3	2	2	3	2
B-PHY-603(II).3	3	3	2	2	2	2	2	3	2	-	2	2	2	2	2	2
B-PHY-603(II).4	3	3	3	3	2	2	2	2	2	-	2	2	2	2	3	2
Average	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2

Mapping of Courses with PO's and PSO's for core and elective courses																
COs	**PO1- Knowledge**	**PO2- Communication**	**PO3- Problem Solving**	**PO4- Individual and Team Work**	**PO5- Investigation of Problems**	**PO6- Modern Tool usage**	**PO7- Science and Society**	**PO8- Life-Long Learning**	**PO9- Environment and Sustainability**	**PO10- Ethics**	**PO11- Project Management**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
B-PHY-101	3	3	2.75	2	2.5	1.75	2	2.75	1.75	-	2	3	3	3	3	1.5
B-PHY-102	3	3	2.5	2.25	2.25	2	2	2.5	2	-	1.75	3	3	2	2.5	2
B-PHY-103	3	3	3	3	2.75	2.75	2	2.75	2	-	2.75	3	3	2.75	3	3
B-PHY-201	3	3	3	2	2	2	2.5	2.75	2	-	2.5	3	2.5	2	2.5	2
B-PHY-202	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2.25	2	2.5	2
B-PHY-203	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
B-PHY-301	3	3	2	2	2	2	2	2.5	2	-	2	2.5	2	2	2.5	2
B-PHY-302	3	3	2.5	2.5	2.75	1.25	2	2	2	-	2	2.5	2	2	2.5	2
B-PHY-303	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
B-PHY-401	3	3	2.25	2.5	2	2	2	2	2	-	2	2.5	2	2	2.5	2
B-PHY-402	3	3	2.5	2.25	2	2	2	2	2	-	2	3	2.75	2	2.25	2
B-PHY-403	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
B-PHY-S1(A)	2.5	2.5	2.25	2.5	2	2	2	2	2	-	2	2.5	2	2	2.25	2
B-PHY-S1(B)	2.25	2	2	2.5	2	2	2	2	2.5	-	2	2	2	2	2	2
B-PHY-501(I)	3	3	2.5	2	2	2	2	2.5	2	-	2	3	2.75	2	2.5	2
B-PHY-501(II)	3	3	3	2	2	2	2	2.5	2	-	2	3	3	2	2.5	2
B-PHY-502(I)	3	3	2	2	2	2	2	2	2	-	2	3	3	2	2.5	2
B-PHY-502(II)	3	3	2	2	2	2	2	2.5	2	-	2	3	2	2	2.5	2
B-PHY-503(I)	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
B-PHY-503(II)	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
B-PHY-601(I)	3	3	2.5	2.5	2	2	2	2.5	2	-	2	3	2.5	2.25	2.5	2
B-PHY-601(II)	3	3	2.5	2.5	2	2	2	2.5	2	-	2	3	3	2	2.5	2
B-PHY-602(I)	3	3	3	2.75	2	2	2	2.75	2	-	2	3	3	2.75	2.5	2
B-PHY-602(II)	3	3	2	2	2	2	2	2	2	-	2	3	2	2.5	2.75	2
B-PHY-603(I)	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
B-PHY-603(II)	3	3	2.5	2.5	2.75	2	2	2.5	2	-	2	2.5	2	2	2.5	2
Note: 3-Strong, 2-Medium, 1-Weak																

Learning Outcomes-based Curriculum Framework
for
B.Sc. –with PHYSICS

REVISED SYLLABI&SCHEME OF EXAMINATION

(w. e. f. the Academic Session 2020-21 in phased manner)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SYLLABI&SCHEME OF EXAMINATION FOR

B.Sc. - I (PHYSICS)

(1st& 2ndSEMESTER) EXAMINATIONS

Under Choice Based Credit System

W.E.F. SESSION 2020-21

SEMESTER-I

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. Hours
					External	Internal	Total	
B-PHY-101	CC*-1	Mechanics-I	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-102	CC-2	Mechanics-II	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-103	CC-3	Physics Practical-I	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

*CC-Core Course

SEMESTER-II

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-201	CC-4	Electricity, Magnetism & E.M.Theory	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-202	CC-5	Electronics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-203	CC-6	Physics Practical-II	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

B.Sc-1st year (Semester-I)
Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-101)
Nomenclature: Mechanics-I
No. of credits: 3

External Marks: 60
Internal Marks: 15

Time: 3 Hours

Note:-

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

UNIT-I

ROTATIONAL MOTION

Rotation of rigid body, Moment of inertia, Torque, Angular momentum, Kinetic Energy of rotation. Theorem of perpendicular and Parallel axis (with proof), Moment of inertia of Ring, Disc, Rectangular lamina, Solid bar of rectangular cross section, Solid sphere, Hollow sphere, Spherical shell, Solid Cylinder and Hollow cylinder. Fly wheel, Moment of inertia of an irregular body, Acceleration of a body rolling down on an inclined plane.

(15 Lectures)

UNIT-II

ELASTICITY

Elasticity, Stress and Strain, Hooks law, Elastic constant and their relations, Poisson's ratio, Torsion of cylinder and twisting couple, determination of coefficient of modulus of rigidity for the material of wire by Maxwell's Needle, bending of beam (Bending moment and its magnitude), Cantilever and Centrally loaded beam, Determination of Young's modulus for the material of the beam and Elastic constants for the material of the wire by Searle's method.

(15 Lectures)

UNIT-III

OSCILLATIONS

Review of SHM, Simple Harmonic Oscillations, Differential Equation of SHM and its solution. Kinetic Energy, Potential Energy and their space average, time average, total energy. Damped oscillations, forced oscillations, transient and steady state, sharpness of resonance, power dissipation and quality factor. **(15 Lectures)**

UNIT-IV

SURFACE TENSION

Surface Tension: Synclasticand anticlastic surface, excess pressure application to spherical drop and bubbles. Variation of Surface tension with temperature.

VISCOSITY

Kinematics of moving fluids: idea of compressible and incompressible fluids, equation of continuity, steamline and turbulent flow, Reynolds's number, Euler's equation, The special case of fluid statics $F = \Delta p$, Simple applications e.g. Pascal's law and Archimedes principle. Poiseuille's equation for flow of a viscous liquid through a capillary tube.

(15 Lectures)

CO No. **Course code (B-PHY-101): Mechanics-I**

After successfully completing the course, student will be able to:

CO-1 Understand the application of both translational and rotational dynamics motions simultaneously in analyzing rolling with slipping. Write the expression for the moment of inertia about the given axis of symmetry for different uniform mass distributions.

CO-2 Understand the principles and basic terms related to elasticity through the study of Young Modulus and modulus of rigidity.

CO-3 Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.

CO-4 Appreciate the concepts and Applications of surface tension and also be able to understand simple principles of fluid flow and different equations governing fluid dynamics.

REFERENCES

1. Mechanics "Berkeley Physics Course Vol. I", Charles Kittel, Tata McGraw-Hill
2. Elements of Properties of Matter, D.S. Mathur, S .Chand & Com. Pt. Ltd., New Delhi
3. Heat and Thermodynamics (5^{th} Edition), Mark W. Zermansky
4. Physics, Resnick, Halliday & Walker, Wiley
5. Properties of Matter, R. Murgeshan, S. Chand & Com. Pt. Ltd., New Delhi

B.Sc-1st year (Semester-I)
Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-102)
Nomenclature: Mechanics-II
No. of credits: 3

External Marks: 60
Internal Marks: 15

Time: 3 Hours

Note:-

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

UNIT-I

BASICCONCEPTSOFCLASSICALMECHANICS

Mechanics ofsingleandsystemof particles, Conversion law of linear momentum, Angular momentumandmechanical energy for aparticle anda system ofparticles, Centre ofMass andequation of motion.

(15 Lectures)

UNIT-II

GENERALIZED NOTATIONS

Degrees of freedom andGeneralized coordinates,Transformation equations, Generalized Displacement, Velocity,Acceleration, Momentum, ForceandPotential, Hamilton's variational principle,Lagrange'sequation of motion from Hamilton's principle,Linear Harmonic oscillator, Simple pendulum, Atwood'smachine.

(15 Lectures)

UNIT-III

THEORY OF RELATIVITY-I

Frame of reference, limitation of Newton's law of motion,Inertial frame of reference, Galilean transformation,Frame of reference with linear acceleration, Classical relativity, Galilean invariance, Transformationequation foraframe ofreference- inclined to aninertial

frameand Rotatingframe ofreference, Non-inertial frames; Theaccelerated frame of referenceand rotatingframe ofreference, Fundamental frame of reference, Michelson Morley'sexperiment.

(15 Lectures)

UNIT-IV

THEORY OF RELATIVITY-II

Special theoryofrelativity,Lorentzco-ordinate andphysical significance of Lorentz invariance,Length Contraction, Time Dilation, Twin Paradox, Velocityaddition theorem, Variation of masswith velocity, Massenergyequivalence, Transformationof relativistic momentumand energy, relation between relativistic momentum and energy, Mass, velocity, momentumand energyof zero restmass.

(15 Lectures)

CO No. **Course code (B-PHY-102): Mechanics-II**

After successfully completing the course, student will be able to:

CO-1 Learn the concept of conservation of energy, momentum, angular momentum and apply them to understand the basic problems in physics.

CO-2 Understand and explain the Hamilton's variational principle, derive Lagrange's equation of motion from Hamilton's principle and be able to apply these principles to derive the Lagrangian and Hamiltonian for various simple mechanical systems such as Linear Harmonic oscillator, Simple pendulum, Atwood's machine.

CO-3 Differentiate between inertial and Non-inertial frame of references and Describe how fictitious forces arise in a non-inertial frame. Understand the importance of Michelson Morley'sexperiment in referenceto special theory of relativity.

CO-4 Describe special relativistic effects and their effects on the mass and energy of a moving object and appreciate the nuances and important outcomes of Special Theory of Relativity.

REFERENCES

1. Classical Mechanics byH. Goldstein (2^{nd}Edition)
2. BerkeleyPhysics Course.Vol. 1.Mechanics, E.M. Purcell
3. Conceptsof Modern Physics,Arthur Beiser
4. Mechanics,D.S. Mathur, S.Chand& Com. Pt. Ltd., New Delhi
5. BerkeleyPhysics Course.Vol. 1.Mechanics, Charles kittel, Walter D Knight, Malvin A Ruderman, Carel A Helmholz and Burton J Moyer, McGraw-Hill, New York

B.Sc-1st year (Semester-I)
Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-103)
Nomenclature: Physics Practical-I
No. of credits: 2

External Marks: 40
Internal Marks: 10

Time: 3 HoursMax.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving **Internal marks** (under Lab. Record), each college will maintain practical assessment record by using the following procedure:-
   (i) Each student has to perform a minimum number of experiments prescribed in the syllabus.
   (ii) After the completion of a practical, the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the Lab. Record.
   (iii) To complete the final marks for Lab. Record a separate register for each class of B.Sc. will be maintained. The student will be assigned a separate page on this register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average, the total marks obtained will be divided by the total number of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
   (iv) The Lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.
5. The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

1. Measurement of Length (or diameter) using Vernier calliper, Screw Gauge & Travelling Microscope.
2. Moment of Inertia of a Fly Wheel
3. Moment of Inertia of irregular body using a Torsion Pendulum.
4. Surface Tension by Jaeger's Method.
5. Young Modulus by Bending of Beam.
6. Modulus of rigidity of material of wire by Maxwell's Needle.
7. Elastic constant by Searle's method.

8. Viscosity of water by its flow through a uniform capillary tube.
9. Acceleration due to Gravity 'g' by Bar pendulum.
10. To study the Motion of spring and calculate Spring constant & value of Acceleration due to Gravity.
11. To compare Moment of Inertia of a solid Sphere, Hollow Sphere and solid Disc of same mass with the help of Torsion Pendulum.

CO No.	Course code (B-PHY-103) : Physics Practical-I
	After successfully completing the course, student will be able to:
CO-1	Hands on experience with different instruments and appreciate the beauty of different concepts and related experiments in Physics.
CO-2	Verify some fundamental principles, effects and concepts of physics through Experiments.
CO-3	perform experiments related to mechanics (compound pendulum), rotational dynamics (Flywheel), elastic properties (Young Modulus and Modulus of Rigidity) and fluid dynamics (verification of Stokes law, Searle method) etc.
CO-4	Learn to present observations, results and analysis in suitable and presentable form.

REFERENCES

1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M.Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, PragatiPrakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House

Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-201)
Nomenclature: Electricity, Magnetism & Electromagnetic Theory
No. of credits: 3

External Marks: 60
Internal Marks: 15

Time: 3 Hours

Note:-

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

UNIT-I

VECTORBACKGROUNDANDELECTRICFIELD

Gradient ofa scalar anditsphysical significance, Line, Surface and Volume integrals of a vectorand their physical significance,Fluxof avector field, Divergenceand curl ofa vector and their physicalsignificance,Gauss's divergence theorem, Stoke's theorem. Derivation of electricfield $\vec{E}$ from potential asgradient.Derivation ofLaplaceand Poisson equations, Electric flux, Gauss'sLaw, Mechanical force of chargedsurface, Energyperunitvolume.

(15 Lectures)

UNIT-II

MAGNETISM

Magnetic induction, Magneticflux, Solenoidal natureof vector field of induction, propertiesof $\vec{B}$ (i) $\nabla . \vec{B} = 0$ (ii) $\nabla \times \vec{B} = \mu_o J$, Electronictheoryofdiaandparamagnetism, Domaintheoryofferromagnetism(Langevin'stheory),CycleofMagnetization-Hysteresis loop(Energydissipation, Hysteresisloss and importance of Hysteresis Curve).

(15 Lectures)

UNIT-III

ELECTROMAGNETISM

Maxwellequations and their derivations, Displacement current, Vector and Scalar potentials,Boundaryconditionsatinterfacebetweentwodifferentmedia, Propagation of electromagneticwave(Basicidea,noderivation), PoyntingvectorandPoynting theorem.

(15 Lectures)

UNIT-IV

A.C. ANALYSIS

A.C. circuitanalysis using complexvariablewith(a)Capacitance and Resistance (CR) (b) ResistanceandInductance (LR)(c)Capacitanceand Inductance (LC) and (d) Capacitance,Inductanceand Resistance(LCR), Series and parallel resonancecircuit, Qualityfactor (sharpness of resonance).

(15 Lectures)

CO No. **Course code (B-PHY-201): Electricity, Magnetism & Electromagnetic Theory**

After successfully completing the course, student will be able to:

CO-1 Explain and differentiate the vector and scalar formalisms of electrostatics. Also be able to Apply Gauss's law of electrostatics to solve a variety of problems.

CO-2 Describe the important properties of magnetic field. Understand the properties and theories of dia-, para- & ferromagnetic materials.

CO-3 Derive Maxwell equations and understand the role of displacement current, scalar and vector potentials and boundary conditions at the interface between different media. The students will also be able to have basic idea about the propagation of electromagnetic waves.

CO-4 Analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.

REFERENCES

1. Electricity and Magnetism, Reitzand Milford (PrenticeHallofIndia)
2. Electricity and Magnetism,A.S. Mahajanand A.A. Rangwala(Tata McGrawHill)
3. Electricity and Magnetism, Edward M Purcell, 1986, McGraw-Hill Education
4. Electricity and Magnetism, J.H. Fewkes& J. Yarwood, Vol. I, 1991, Oxford University Press.
5. Introduction to Electrodynamics, D.J. Griffiths, 3rdEdn 1998 Benjamin Cummings.
6. Electricity and Magnetism, R. Murugeshan, S.Chand& Com. Pt. Ltd., New Delhi
7. Electromagnetic Fields and waves, K.D. Prasad, SatyaPrakashan, New Delhi

(Course Type: Core Course, Course Code: B-PHY-202)
Nomenclature: ELECTRONICS
No. of credits: 3

External Marks: 60
Internal Marks: 15

Time: 3 Hours

Note:-

1. Nine questions will be set in total.
2. Question no. 1 will be compulsory and based on the conceptual aspects of the entire syllabus. This question may have 4 parts and the answer should be in brief but not in Yes/No.
3. Four more questions are to be attempted, selecting one question out of two questions set from each unit. Each question may contain two or more parts. All questions will carry equal marks.
4. 20% numerical problems are to be set.
5. Use of scientific (non-programmable) calculator is allowed.

UNIT-I

BASIC ELECTRONICS

Ideal current source, Ideal voltage source, Current and voltage divider law, Millman's theorem, Thevenin's theorem, Norton's theorem and numericals based on these theorems. Maximum power transfer theorem (with both DC and AC sources), Delta-Star theorem, Nodal Analysis, Maxwell Loop method.

(15 Lectures)

UNIT-II

SEMICONDUCTORS

Energybandsinsolids,Intrinsicandextrinsicsemiconductors, carriermobilityand electricalresistivityofsemiconductors, Halleffect,p-njunctiondiodeandtheir characteristics,ZenerandAvalanchebreakdown, Zenerdiode,Zenerdiodeasavoltage regulator.Lightemittingdiodes(LED), Photoconductioninsemiconductors,Photodiode, SolarCell, *p-n*junctionasa rectifier,halfwaveandfullwaverectifiers(with derivation),filters(seriesinductor,shuntcapacitance,L-sectionorchoke,πandR.C. filter circuits).

(15 Lectures)

UNIT-III

TRANSISTORS

Junction transistors,WorkingofNPNand PNP transistors, Three configurations of transistor (C-B, C-E, C-C modes),Common base, common emitter and common collector characteristics of transistor,Constants of a transistor and theirrelation, Advantages anddisadvantages of C-E configuration. D.C. load line.Transistor biasing;various methods of transistor biasing and stabilization.

(15 Lectures)

UNIT-IV

TRANSISTOR AMPLIFIERS

Amplifiers, Classificationof amplifiers, commonbase and commonemitter amplifiers, couplingofamplifiers, various methodsof coupling, Resistance- Capacitance(RC) coupled amplifier (two stage, concept of band width, no derivation), Feedback in amplifiers, advantages ofnegative feedback, emitter follower, distortion inamplifiers.

(15 Lectures)

CO No.	**Course code (B-PHY-202) : Electronics**
	After successfully completing the course, student will be able to:
CO-1	Understand the complex electrical networks analysis using different network theorems.
CO-2	Understand the basic concepts and different applications of PN junction diode in different type of rectifiers, voltage regulators, solar cell, LED's etc.
CO-3	Describe the basic structure, working principle and characteristics of Bipolar Junction transistors.
CO-4	Understand and explain the classification of Amplifiers and the various coupling & feedback methods in BJT amplifiers.

REFERENCES

1. Basic Electronics andLinear Circuits,N.N.Bhargava, D.C. Kulshreshtha and S.C. Gupta (TITI CHD)
2. Solid State Electronics, J.P. Agarwal, AmitAgarwal, PragatiPrakashanMeerut
3. Electronics Fundamentalsand Applications, J.D. Ryder(Prentice Hall India)
4. Solid State Electronics, B.L.Theraja, S. Chand & Company, Delhi/Chandigarh
5. Electronic Devices and Circuits, Jacob Millman and Christos Halkias, McGraw Hill Publisher, New Delhi

B.Sc-1st year (Semester-II)
Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-203)
Nomenclature: Physics Practical-II

No. of credits: 2

External Marks: 40
Internal Marks: 10

Time: 3 Hours Max.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving **Internal marks** (under Lab. Record), each college will maintain practical assessment record by using the following procedure:-
   (i) Each student has to perform a minimum number of experiments prescribed in the syllabus.
   (ii) After the completion of a practical, the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the Lab. Record.
   (iii) To complete the final marks for Lab. Record a separate register for each class of B.Sc. will be maintained. The student will be assigned a separate page on this register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average, the total marks obtained will be divided by the total number of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
   (iv) The Lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

1. To use Multimeter for measuring Resistance, A.C. and D.C. Voltage and Current, checking of electrical fuses.
2. Low resistance by Carey Foster's bridge with calibration.
3. Determination of Impedance of an A.C. circuit and its verification.
4. Frequency of A.C. mains using an electromagnet.
5. Frequency of A.C. mains Electrical vibrator.
6. High resistance by substitution method.
7. To draw forward and reverse characteristics of semiconductor diode.
8. Zener diode voltage regulation characteristics.
9. Verification of inverse square law by photo- cell.
10. To study the characteristics of Solar cell.

11. To study the characteristics of a transistor in C.B configuration.
12. To study the characteristics of a transistor in C.E. configuration.

CO No.	Course code (B-PHY-203) : Physics Practical-II After successfully completing the course, student will be able to:
CO-1	Hands on experience with the uses of multimeter.
CO-2	Characterize various devices namely PN junction diodes, LEDs, Zener diode, solar cells, PNP and NPN transistors.
CO-3	Perform the experiments to determine the values of frequency of A.C. mains, values of low and high resistances using different methods and be able to appreciate the concepts of physics involved in these experiments.
CO-4	Learn to present observations, results and analysis in suitable and presentable form.

REFERENCES

1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M.Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, PragatiPrakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T.Worsnop, Asia Publishing House.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SYLLABI&SCHEME OF EXAMINATION FOR

B.Sc. - II(PHYSICS)

(3rd&4thSEMESTER) EXAMINATIONS

Under Choice Based Credit System

W.E.F. SESSION 2021-22

SEMESTER-III

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-301	CC*-7	Thermal Physics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-302	CC-8	Statistical Mechanics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-303	CC-9	Physics Practical-III	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

*CC-Core Course

SEMESTER-IV

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-S1	Skill Enhancement Course in Physics (SECP-1)	(A) Applied Optics/ (B) Renewable Energy & Energy Harvesting	**02**	**02**	**40**	**10**	**50**	**3**
B-PHY-401	CC-10	Wave & Optics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-402	CC-11	Quantum Mechanics	**03**	**03**	**60**	**15**	**75**	**3**
B-PHY-403	CC-12	Physics Practical-IV	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**250**	

B.Sc-2nd (Semester-III)
Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-301)
Nomenclature:Thermal Physics
No. of Credits: 03

External Marks: 60
Internal Marks: 15

Time: 3 Hours

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

KINETICTHEORYOFGASES-I

Assumptionof Kinetic theoryofgases, pressureof an idealgas(withderivation), Kinetic interpretation of Temperature, Ideal Gasequation, Degree of freedom,Law of equipartition of energyandits application for specific heat ofgases, Realgases, Vander Wall's equation, Brownian motion (Qualitative).

(15 Lectures)

UNIT-II

KINETICTHEORYOFGASES-II

Maxwell's distribution ofspeed and velocities (derivation required), Experimental verification of Maxwell's law of speed distribution: mostprobable speed, average and r.m.s. speed, Meanfree path, Transport ofenergy and momentum, Diffusionof gases.

(15 Lectures)

UNIT-III

THERMODYNAMICS-I

Thermodynamic systemandZeroth law of thermodynamics, First law of thermodynamics anditslimitations,Reversibleandirreversibleprocess,Secondlawofthermodynamics anditssignificance,Carnottheorem,Absolutescaleoftemperature,AbsoluteZeroand magnitudeofeachdivisiononworkscaleandperfectgasscale,Joule'sfreeexpansion, JouleThomsoneffect,Joule-Thomson(Porousplug)experiment,conclusionsand explanation,analyticaltreatmentofJouleThomsoneffect,Entropy,calculationsof entropyofreversibleandirreversibleprocess,T-Sdiagram,entropyofaperfectgas, Nernstheatlaw (thirdlawofthermodynamics),Liquefactionofgases,(oxygen,air, hydrogen and helium) solidification of helium below 4K, Cooling by adiabatic demagnetization.

(15 Lectures)

UNIT-IV

THERMODYNAMICS-II

DerivationofClausius-ClapeyronandClausiuslatentheatequationsandtheir significance, specificheatofsaturatedvapours, phasediagram and triplepointofa substance,developmentofMaxwellthermodynamicalrelations,Thermodynamical functions:Internalenergy(U),Helmholtzfunction(F),Enthalpy (H),Gibbsfunction(G) andtherelationsbetweenthem,derivationofMaxwellthermodynamicalrelationsfrom thermodynamicalfunctions, ApplicationofMaxwellrelations:relationsbetweentwo specificheatsofgas,DerivationofClausius-ClapeyronandClausiusequation, variation ofintrinsicenergywithvolumefor(i)perfectgas(ii) Vander wallgas(iii) solidsand liquids,derivationofStefan'slaw,adiabaticcompressionandexpansionofgas& deduction of theoryof Joule Thomson effect.

(15 Lectures)

CO No. **Course code (DSCP-B-PHY-301): Thermal Physics**

After successfully completing the course, student will be able to:

CO-1 Learn about Kinetic interpretation of Temperature, the real gas equations, Van der Waal equation of state and Brownian motion.

CO-2 Learn the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equitation of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion.

CO-3 Understand the basic concepts of thermodynamics, the first and the second law of thermodynamics, JouleThomsoneffect,Joule-Thomson(Porousplug)experiment,the concept of entropy and the associated theorems,calculationsof entropyofreversible& irreversibleprocess,T-Sdiagram and Nernstheatlaw (thirdlawofthermodynamics).

CO-4 DerivetheClausius-ClapeyronandClausiuslatentheatequationsand understand their significance. The students will also be able to learn about Maxwell's thermodynamic relations their physical interpretations.

REFERENCES

1. Thermal Physics and Statistical Mechanics, S.K. Roy, New Age International Publishers, New Delhi
2. Thermodynamics and Statistical Physics,J.K.Sharma and K.K. Sarkar, Himalaya Publishing House, Bombay
3. Introduction to Thermodynamics and itsApplications,Stowe Keith,University Press (India) Pvt.Ltd,Hyderabad
4. IntroductoryThermodynamic s, PierreInfelta, BrownWalkerPress, Boca Ratan, Florida
5. Fundamentalsof Thermodynamics,J. K.Johnson, Universityof Pittsburgh2009
6. Thermodynamics andItsApplications,Jefferson Tester, Michael Modell, 3rd Edition
7. Thermodynamics, Statistical Thermodynamics & Kinetics, Thomas Engel, PhilipReid, 2nd Edition

Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-302)
Nomenclature: Statistical Mechanics
No. of Credits: 03

External Marks: 60
Internal Marks: 15

Time: 3 Hours

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

STATISTICAL PHYSICS-I

MicroscopicandMacroscopicsystems,events-mutuallyexclusive,dependentand independent.Probability,statisticalprobability,A-prioriProbabilityandrelation betweenthem,probabilitytheorems,someprobabilityconsiderations,combinations possessingmaximumprobability,combinationpossessingminimumprobability,Tossing of2,3andanynumberofCoins,Permutationsandcombinations,distributionsofN(for N=2,3,4)distinguishableandindistinguishableparticlesintwoboxesofequalsize, Micro and Macro states,Thermodynamical probability, Constraintsand Accessible states, Statisticalfluctuations,generaldistributionofdistinguishableparticlesincompartments ofdifferentsizes,Conditionofequilibriumbetweentwosystemsinthermalcontact--β parameter, Entropyand Probability(Boltzmann'srelation).

(15 Lectures)

UNIT-II

STATISTICAL PHYSICS-II

Postulatesofstatisticalphysics,Phasespace,DivisionofPhasespaceintocells,three kindsofstatistics,basicapproachinthreestatistics.M.B.statisticsappliedtoanideal gasinequilibrium-energydistributionlaw(includingevaluationofσandβ),speed distributionlaw&velocitydistributionlaw.Expressionforaveragespeed,r.m.s.speed, averagevelocity,r.m.s.velocity,mostprobableenergy&meanenergyforMaxwellian distribution.

(15 Lectures)

UNIT-III

QUANTUM STATISTICS

NeedforQuantumStatistics:Bose-Einsteinenergydistributionlaw,ApplicationofB.E. statisticstoPlanck'sradiationlawB.E.gas,DegeneracyandB.E.Condensation,Fermi-Diracenergydistributionlaw,F.D.gasandDegeneracy,FermienergyandFermi temperature, FermiDiracenergydistributionlaw,FermiDiracgas and degeneracy,Fermi

energyandFermitemperature,FermiDiracenergydistributionlawforelectrongasin metals,Zeropointenergy,Zeropointpressureandaveragespeed (at0K)ofelectrongas, Specificheatanomalyofmetalsanditssolution.M.B.distributionasalimitingcaseof B.E. andF.D. distributions, Comparison of three statistics.

(15 Lectures)

UNIT-IV

THEORY OF SPECIFIC HEAT OF SOLIDS

Dulong and Petitlaw.DerivationofDulong and Petitlawfromclassicalphysics, Specific heatatlowtemperature,Einsteintheoryofspecificheat,CriticismofEinsteintheory, Debyemodelofspecificheatofsolids,successand shortcomingsofDebyetheory, comparisonof Einstein and Debyetheories,

(15 Lectures)

CO No. **Course code (B-PHY-302): Statistical Mechanics**

After successfully completing the course, student will be able to:

CO-1 Understand the concepts of microstate, macrostate, thermodynamic probability and also understand the studies of particles with their distinguishably or indistinguishably nature and conditions which lead to the three different distribution laws e.g. Maxwell-Boltzmann distribution, Bose-Einstein distribution and Fermi-Dirac distribution laws of particles.

CO-2 Learn the basic Postulates of statistical physics, Phase space, Division of Phase space into cells and be able to derive the expression for average speed, r.m.s. speed, average velocity, r. m. s. velocity, most probable energy & mean energy for Maxwellian distribution.

CO-3 Understand the need and application of QuantumStatistics:Bose-Einstein&Fermi-Dirac statistics and be able to articulate the connection as well as dichotomy between classical statistical mechanics and quantum statistical mechanics.

CO-4 Learn and understand the different law's and theory of specific heat of solids and their significance.

REFERENCES

1. Statistical Mechanics, S. Prakash and J.P. Agarwal, KedarNathRamNath& Co, Meerut
2. Statistical Physics "BerkeleyPhysics Course.Vol. 5",Reif,McGrawHillBook Co. Ltd., New Delhi
3. Statistical Mechanics, D.A. McQuarrie, Viva Books PvtLtd., New Delhi
4. Classical and Statistical Thermodynamics, Hanna A. Rizk, Narosa Publishing House, New Delhi

B.Sc-2nd year (Semester-III)
Subject: Physics

(Course Type: Core Course, Course Code: B-PHY-303)
Nomenclature: Physics Practical-III
No. of credits: 2

External Marks: 40
Internal Marks: 10

Time: 3 Hours Max.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving**Internal marks**(underLab. Record),eachcollege will maintainpracticalassessment record byusingthefollowingprocedure:-
   (i) Each student has to perform a minimum number of experiments prescribed in the syllabus.
   (ii) After thecompletionofapractical,theteacherconcernedwillcheck thenote-bookandconductthe viva-voceofeachstudenttofindouthowmuch conceptsrelatedtothetheoreticalandexperimentalpartoftheexperiment he/shehasunderstood.Accordingtohis/herperformancemarkswillbe recordedontheirpracticalnote-book.ThesemarkswillconstitutetheLab. Record.
   (iii) TocompletethefinalmarksforLab.Recordaseparateregisterforeach classof B.Sc.willbemaintained.Thestudentwillbeassignedaseparatepageonthis register.Onthispagethemarksobtainedbythestudentindifferentpracticals willberecorded.Whiletakingthefinalaverage,thetotalmarksobtainedwill bedividedby thetotalnumberofrequiredpracticals,insteadofthenumberof practicalsperformedbythestudent.Thisrecordwillbesignedbythe concerned teacher.
   (iv) TheLab.recordregisterwillbepresentedtotheexternalpractical examinersfor lab. record marks. Theexternal examiners willverifytherecord randomly.
5. The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

1. Measurement of Planck constant using black body radiation.
2. To determine Stefan's Constant.
3. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
4. To determine the thermal conductivity of bad conductor by Lee and Charlton's disc method.
5. To determine the temperature co-efficient of resistance by platinum resistance thermometer.
6. To study the variation of thermo e.m.f. across two junctions of a thermocouple with temperature.

7. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.
8. To determine Mechanical Equivalent of Heat by Callender and Barne'scontant flow method.
9. To draw a calibration curve for a thermocouple.

CO No.	Course code (B-PHY-303) : Physics Practical-III
	After successfully completing the course, student will be able to:
CO-1	Hands on experience with different instruments and appreciate the beauty of different concepts and related experiments in Physics.
CO-2	Verify some fundamental principles, effects and concepts of physics through Experiments.
CO-3	Perform basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, temperature coefficient of resistant, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.
CO-4	Learn to present observations, results and analysis in suitable and presentable form.

REFERENCES

1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M.Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, PragatiPrakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House

(Course Type: Skill Enhancement, Course Code: B-PHY-S1(A))
Nomenclature: Applied Optics
No. of credits: 02

External Marks: 40
Internal Marks: 10
Time: 3 hrs.

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.

UNIT-I

INTRODUCTION TO LASER

Spontaneous and Stimulated Absorption and Emission of radiation, main features of a laser: Directionality, high intensity, high degree of coherence, spatial and temporal coherence, Einstein's coefficients and possibility of amplification, Kinetic of optical absorption, Population inversion: A necessary condition for light amplification, resonant cavity and laser pumping.

(8 Lectures)

UNIT-II

LASER SYSTEM

Laser rate equation; Three and Four level Lasers. Principle, Construction & working of He-Ne Laser, Ruby Laser,Semiconductor junction Laser, N_2-Laser, CO_2 laser.

(7 Lectures)

UNIT-III

LASER APPLICATIONS

Spatial Frequency Filtering, Holography, Laser induced Fusion, Lasers in Isotope Separation. Application of Laser Technologyin material processing (Drilling, Cutting, Welding), Medicine, Industry and Military.

(7Lectures)

UNIT-VI

THE OPTICAL FIBER

Optical fibres and their properties, Principal of light propagation through a optical fibre,The numerical aperture, Attenuation in optical fibre and attenuation limit, Singlemode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating.

(8 Lectures)

CO No.	**Course code (B-PHY-S1(A)) : Applied Optics**
	After successfully completing the course, student will be able to:
CO-1	Familiar with optical phenomena and different concepts related laser physics.
CO-2	Qualitative understanding of basic lasing mechanism, types of Lasers, characteristics of Laser Light, types of Lasers.
CO-3	Understand and appreciate the applications of Lasers in developing LED, Holography, in materials processing, in Medicine, Industry and Military.
CO-4	Have the idea of optical fibres, their properties and principle of propagation of electromagnetic waves through optical fibres.

REFERENCES

1. Optical Electronics, A.K. Ghatak and K. Thyagarajan, Cambridge University Press
2. Laser, Theory & Applications, K. Thyagarajan and A.K. Ghatak, Macmillan India limited
3. Lasers and Non-Linear Optics, B.B.Laud, New Age International (P) Ltd., Publishers, New Delhi
4. Lasers, Principles, Types and Applications, K.R. Nambiar, New Age International (P) Ltd., Publishers, New Delhi
5. Fundamental of optics, F. A. Jenkins &H. E. White, 1981, Tata McGraw Hill.
6. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
7. Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
8. Optical Physics, A. Lipson, S.G.Lipson, H.Lipson, 4thEdn., 1996, Cambridge Univ. Press

(Course Type: Skill Enhancement, Course Code: B-PHY-S1(B))
Nomenclature:Renewable Energy and Energy Harvesting

No. of Credits: 2

External Marks: 40
Internal Marks: 10
Time: 3 hrs.

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.

UNIT-I

FOSSIL FUELS, ALTERNATE SOURCES OF ENERGY AND SOLAR ENERGY

Fossil fuels and Nuclear Energy, theirlimitation, need of renewable energy, non-conventional energy sources. An overview ofdevelopments in Offshoredifferent types of energy. Solar Energy; its importance, storage of solar energy, solar pond, non -convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems.

(8 Lectures)

UNIT-II

OCEAN, GEOTHERMAL AND HYDRO ENERGY

Ocean Energy Potential against Wind and Solar, Wave Characteristicsand Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.Geothermal Energy: Geothermal Resources, Geothermal Technologies.Hydro Energy: Hydropower resources, hydropower technologies, environmental impactof hydro power sources.

(8 Lectures)

UNIT-IV

WIND AND PIEZOELECTRIC ENERGY HARVESTING

Wind Energy harvesting**;**Fundamentals of Wind energy, Wind Turbines and differentelectrical machines in wind turbines, Power electronic interfaces, and gridinterconnection topologies.Piezoelectric Energy harvesting: Introduction, Physics and characteristics ofpiezoelectric effect, materials and mathematical description of

piezoelectricity,piezoelectric parameters and modeling piezoelectric generators, piezoelectric energyharvesting applications.

(8 Lectures)

UNIT-IV

ELECTROMAGNETIC ENERGY HARVESTING

Linear Generators, Physics mathematical models, recent applications, Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability

(6 Lectures)

CO No.	**Course code (B-PHY-S1(B)) : Renewable Energy and Energy Harvesting**

After successfully completing the course, student will be able to:

CO-1 Learn not only the theories of the renewable sources of energy, but also to have hands-on experiences on them wherever possible.

CO-2 Learn about the potential of Ocean, Geothermal, hydrothermal energies and technologies and their impact on environment.

CO-3 Understand and appreciate the technology of wind and piezoelectric energy harvesting.

CO-4 Have the idea of electromagnetic energy harvesting through carbon- captured technologies like cells, batteries.

REFERENCES

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal, S. Chand and Co. Ltd., New Delhi
3. Solar energy - Suhas P Sukhative Tata McGraw Hill Publishing Company Ltd.
4. Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. http://en.wikipedia.org/wiki/Renewable_energy

Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-401)
Nomenclature Waves and Optics
No. of credits: 3

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

INTERFERENCE

Interference byDivisionof Wave front:Young's double slit experiment, Coherence, Conditions of interference, Fresnel's biprismand itsapplications to determine the wavelength of sodium lightand thickness of amicasheet,phasechangeon reflection. Interference byDivisionof Amplitude: Plane parallel thin film, productionof colors in thin films, classification of fringes infilms,Interference due totransmitted light and reflected light, wedgeshaped film, Newton's rings.

(15 Lectures)

UNIT-II

DIFFRACTION-I

Huygens-Fresnel's theory, Fresnel's assumptions, rectilinearpropagation of light,Fresnel's half period zones, zone plate, diffraction at a straight edge,rectangular slit and diffraction at a circular aperature. Diffraction due toa narrow slit, diffraction due to a narrow wire.

(15 Lectures)

UNIT-III

DIFFRACTION- II

Fraunhoffer diffraction:one slit diffraction, two slit diffraction, N-slit diffraction, plane transmission grating spectrum, dispersive powerofgrating, limit of resolution, Rayleigh's criterion, resolvingpower of telescopeand agrating.

(15 Lectures)

UNIT-IV

POLARIZATION

Polarization:Polarisationbyreflection,refractionandscattering, MalusLaw, Phenomenonofdoublerefraction,Huygens'swavetheoryofdoublerefraction(Normal andobliqueincidence),AnalysisofpolarizedLight.Nicolprism,Quarterwaveplateand halfwaveplate,productionanddetectionof(i)Planepolarizedlight(ii)Circularly polarizedlightand(iii)Ellipticallypolarizedlight.Opticalactivity,Fresnel'stheoryof optical rotation, Specificrotation, Polarimeters(half shade andBiquartz).

(15 Lectures)

CO No. **Course code (B-PHY-401) : Waves and Optics**

After successfully completing the course, student will be able to:

CO-1 Have understanding of Interference - by Division of Wave front, by Division of Amplitude and Interference due to transmitted light & reflected light.

CO-2 Learn about Huygens-Fresnel's theory, diffraction at a straight edge and at a circular aperture, diffraction due to a narrow slit and due to a narrow wire.

CO-3 Understand and explain the Fraunhoffer diffraction, dispersive powerofgrating, Rayleigh's criterion and resolvingpower of telescope& agrating.

CO-4 Understand the theories and laws of polarization along with understanding of the production and detection of (i)Planepolarizedlight(ii)Circularly polarizedlightand(iii)Ellipticallypolarizedlight.

REFERENCES

1. Principles of Optics, M. Born and E. Wolf, PergamamanPress
2. Fundamentals of Optics,Jenkinsand White, McGraw HillBook Co.Ltd., New Delhi
3. Optics, K.D. Muller, UniversityScienceBooks, MillallyCalifornia
4. AnIntroduction toInterferometery,Tolansky, John Wiley&Sons, NewDelhi
5. PolarizedLight Production and Use, Shurcliff, Harward UniversityPress,Cambridge, M A (USA)
6. Refresher Course in Physics Vol.II, C.L. Arora, S Chand and Co, New Delhi

B.Sc-2nd year (Semester-IV)
Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-402)
Nomenclature: Quantum Mechanics
No. of credits: 3

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

THE ORIGIN QUANTUM PHYSICS

Overview,scaleofquantumphysics,boundarybetweenclassicalandquantum phenomena:Blackbody radiation, Planck's quantum theory; Quantum theory of light, Photon,Photoelectriceffect,Comptoneffect(theoryandresult),Frank-Hertzexperiment,de-Brogliehypothesis.DavissonandGermerexperiment, wave packet, phase velocity, group velocity and their relation.Heisenberg's uncertaintyprinciple.Timeenergyandangularmomentum,positionuncertainty.Uncertaintyprinciplefromde Brogliewave.(Wave-particleduality).GammaRay Microscope,Electrondiffractionfromaslit.

(15 Lectures)

UNIT-II

THE SCHRODINGERWAVEEQUATION

Time dependent Schrodinger equation and dynamical evolution of a quantum state ; properties of Wave Function, Interpretation of Wave Function, probability and probability current densities in three dimensions; Condition for physical acceptability of Wave Functions. Normalization, Linearity and Superposition Principles, Eigenvalues and Eigenfunctions, Position, Linear momentum & Energy operators; commutator of position and linear momentum operators; Expectation values of position and linear momentum; Wave Function of a free Particle; Time-independent Schrodingerwaveequation, Stationary states, Eigenfunctions,Eigenvalues andtheir significance.

(15 Lectures)

UNIT-III

APPLICATION OF SCHRODINGERWAVEEQUATION TO ID PROBLEMS

(i) Particleinone-dimensionalbox(solutionofSchrodingerwaveequation, Eigenfunctions,Eigenvalues,quantizationofenergy, nodes and anti nodes, zero point energy).
(ii) Onedimensionalsteppotential: E>Vo(reflectionandtransmission coefficients).
(iii) One dimensional steppotential: E <Vo (calculationof penetration depth).
(iv) Onedimensionalpotentialbarrier:E>Vo(reflectionandtransmission Coefficients).
(v) One-dimensional potential barrier, E<Vo (calculation of reflection and penetration or tunnellingcoefficients).
(vi) SolutionofSchrodingerequationforharmonicoscillator: energy eigen functions and eigen values, Zero-pointenergy.

(15 ectures)

UNIT-IV

APPLICATION OF SCHRODINGER WAVE EQUATION TO 3D PROBLEMS

Separation of Schrodinger wave equation in Cartesian coordinates; Free particle: energy eigenfunctions and eigenvalues; Particle in a cubic potential box:normalized energy eigenfunctions and eigenvalues, non-degenerate and degenerate eigenstates; Three-dimensional anisotropic and isotropic harmonic oscillator: normalized energy eigenfunctions and eigenvalues, degeneracy; Central potentials: Separation of Schrödinger equation in spherical polar coordinates, radial and angular equations.

(15 Lectures)

CO No. **Course code (B-PHY-402) : Quantum Mechanics**

After successfully completing the course, student will be able to:

CO-1 Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and understand the theory of quantum measurements, wave packets and uncertainty principle.

CO-2 Understand the central concepts of quantum mechanics: wave functions, Interpretation of Wave Function, momentum and energy operator, expectation values, the Schrodinger equation, time dependent and time independent cases, probability density, the normalization techniques, Eigen functions, Eigen values and their significance.

CO-3 Understanding the behavior of quantum particle encountering a i) barrier & ii) potential.

CO-4 Solve Schrodinger equation for ground state energy and wave functions of various simple quantum mechanical one dimensional and three dimensional potentials.

REFERENCES

1. QuantumMechanics, LeonardI.Schiff,3rdEdn 2010, Tata McGraw Hill.
2. A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, 2ndEdn, 2010, McGraw Hill.

3. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn, 2002, Wiley.
4. Quantum Mechanics, G. Aruldhas, 2nd Edn 2002, PHI Learning of India.
5. Quantum Mechanics, B.H. Bransden and C.J. Joachain, Pearson Education, New Delhi.
6. IntroductoryQuantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Education.
7. Quantum Physics of Atoms Molecules, Solids, Nuclei and Particles, R.M. Eisberg and R. Resnick, WileyEasternLtd, New Delhi

B.Sc-2nd year (Semester-IV)
Subject: Physics
(Course Type: Core Course, Course Code: B-PHY-403)
Nomenclature: Physics Practical-IV
No. of credits: 2

External Marks: 40
Internal Marks: 10

Time: 3 Hours Max.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving**Internal marks**(underLab. Record),eachcollege will maintainpracticalassessment record byusingthefollowingprocedure:-

(v) Each student has to perform a minimum number of experiments prescribed in the syllabus.

(vi) After thecompletionofapractical,theteacherconcernedwillcheck thenote-bookandconductheviva-voceofeachstudenttofindouthowmuch conceptsrelatedtothetheoreticalandexperimentalpartoftheexperiment he/shehasunderstood.Accordingtohis/herperformancemarkswillbe recordedontheirpracticalnote-book.ThesemarkswillconstitutetheLab. Record.

(vii) TocompletethefinalmarksforLab.Recordaseparateregisterforeach classof B.Sc.willbemaintained.Thestudentwillbeassignedaseparatepageonthis register.Onthispagethemarksobtainedbythestudentindifferentpracticals willberecorded.Whiletakingthefinalaverage,thetotalmarksobtainedwill bedividedby thetotalnumberofrequiredpracticals,insteadofthenumberof practicalsperformedbythestudent.Thisrecordwillbesignedbythe concerned teacher.

(viii) TheLab.recordregisterwillbepresentedtotheexternalpractical examinersfor lab. record marks. Theexternal examiners willverifytherecord randomly.

5. The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

1 To measurethe(a)area of awindow (b) height of an inaccessible object using a sextant.
2 To determine Refractive index of the material of a prism using sodium source.
3 To determine the dispersive power and Cauchy constants of the material of a prism using Mercurydischargesource.
4 To draw agraph between wavelength and minimum deviationfor various lines froma Mercurydischargesource.
5 Determinationof wave length ofsodium lightand thenumber of lines per centimetre usingadiffraction grating.
6 Determinationof wave length ofsodium light using Newton's Rings.
7 Resolving power of a telescope.
8 Comparison ofIlluminatingPowers byaPhotometer.

9 Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
10 Ordinaryandextra ordinary refractive indices for calcite or quartz.
11 Tofind the equivalentfocal length of a lens system bynodal slide assembly.

Additional particles ofQuantum Mechanics if needed may be introduced

1. To find the specific heat of a solid by a method of mixture.
2. To find the specific heat of a liquid (Turpentine oil) by law of cooling.
3. To find coefficient of apparent expansion of glycerine.

CO No. **Course code (B-PHY-403) : Physics Practical-IV**

After successfully completing the course, student will be able to:

CO-1 Hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. and resolving power of optical equipment.

CO-2 Understand various optical phenomena, principles, workings and applications optical instruments through Experiments.

CO-3 Learn to present observations, results and analysis in suitable and presentable form.

REFERENCES

1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M.Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics, S.L. Gupta and V. Kumar, PragatiPrakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, Asia Publishing House

KURUKSHETRA UNIVERSITY, KURUKSHETRA

REVISED SYLLABI&SCHEME OF EXAMINATION FOR

B.Sc. - III(PHYSICS)

(5th&6thSEMESTER) EXAMINATIONS

Under Choice Based Credit System

W.E.F. SESSION 2022-23

SEMESTER-V

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-501	DSE*-1	(I) Nuclear Physics (II) Mathematical Physics	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-502	DSE-2	(I) Solid State Physics (II) Medical Physics	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-503	DSE-3	(I) / (II) Physics Practical-V	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

*DSE-Discipline Specific Elective

SEMESTER-VI

Course Code	Course Type	Nomenclature	Credits	Work load Hours/Week	Marks			Duration of Exam. in Hours
					External	Internal	Total	
B-PHY-601	DSE-4	(I) Atomic & Molecular Spectroscopy (II) Elements of Modern Physics	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-602	DSE-5	(I) Digital Analogy & Instrumentation (II) Embedded System	**02**	**02**	**60**	**15**	**75**	**3**
B-PHY-603	DSE-6	(I) / (II) Physics Practical-VI	**02**	**04**	**40**	**10**	**50**	**3**
Total Marks							**200**	

B.Sc-3rd year (Semester-V)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-501(I))
Nomenclature: Nuclear Physics
No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

NUCLEAR STRUCTURE AND PROPERTIES OF NUCLEI

Nuclearcomposition(p-eandp-nhypotheses),Nuclearproperties;Nuclearsize,spin, parity,statistics,magneticdipolemoment,quadruplemoment(shapeconcept). DeterminationofmassbyBain-Bridge,Bain-BridgeandJordanmassspectrograph.DeterminationofchargebyMosleyLaw.DeterminationofsizeofnucleibyRutherford BackScattering.

(15 Lectures)

UNIT-II

NUCLEAR RADIATIONS DECAY PROCESS AND INTERACTION

Alpha-disintegrationanditstheory,Energeticofalpha-decay,Originofcontinuousbeta spectrum(neutrinohypothesis),typesofbeta-decayandenergeticofbeta-decay,Nature of gamma rays, Energetic ofgamma rays,Interactionofheavychargedparticles(Alphaparticles);Energylossofheavycharged particle(ideaofBetheformula;noderivation),Rangeandstragglingofalphaparticles. Geiger-Nuttallaw,Interactionoflightchargedparticle(Beta-particle),Energylossof beta-particles(ionization),Rangeofelectrons,absorptionofbeta-particles.Interactionof GammaRay;PassageofGammaradiationsthroughmatter(Photoelectric,Comptonand pairproductioneffect),electron-positronannihilation,AbsorptionofGammarays(Mass attenuation coefficient) and its application.

(15 Lectures)

UNIT-III

NUCLEAR ACCELERATORS AND NUCLEAR RADIATION DETECTORS

Linear accelerator,Tendem accelerator, Cyclotron and Betatronaccelerators, Gasfilledcounters;Ionizationchamber,proportionalcounter,G.M.Counter(detailed study), Scintillation counter and semiconductor detector.

(15 Lectures)

UNIT-IV

NUCLEAR REACTIONS AND NUCLEAR REACTORS

Nuclearreactions,Elasticscattering,Inelasticscattering,nucleardisintegration, Photonuclearreaction,Radiativecapture,Directreaction,Heavyionreactionsand spallation Reactions, Conservation laws, Q-valueand reaction threshold, Nuclear Reactors,GeneralaspectsofReactordesign,Nuclearfissionandfusionreactors, (Principle, construction,working and uses in brief).

(15 Lectures)

CO No. **Course code (B-PHY-501(I)): Nuclear Physics**

After successfully completing the course, student will be able to:

CO-1 Learn about nuclear composition & nuclear properties like nuclearsize,spin, parity,statistics,magneticdipolemoment,quadruplemoment and also be able to understand the basics of experimental techniques/methods to determine the mass and size of nuclei.

CO-2 Learn about the emission of alpha, beta and gamma rays, the mechanisms of the emissions of these rays, outlines of theory of alpha decay and Pauli's theory of beta decay with the neutrino hypothesis. Also Learn some basic aspects of interaction Interaction of heavy charged particles (Alpha particles) and interaction of gamma ray by photoelectric effect, Compton scattering and pair production, energy loss due to ionization.

CO-3 Understand the principles and basic constructions of particle accelerators and the detectors of nuclear radiations.

CO-4 Learn the basic aspects of nuclear reactions, the Q-value of such reaction & its derivation from conservation laws and understand the Principle, construction,working and uses of Nuclearfissionandfusionreactors.

REFERENCES

1. Nuclear Physics, 2nd Ed (1962), I. Kaplan, Oxford andIBH, NewDelhi
2. NuclearMeasurement Techniques, K. Sriram, AEWP, New Delhi
3. Introduction to Experimental Nuclear Physics, R.M. Singru, John Wiley & Sons
4. Nuclear Physics , D.C. Tayal, Himalayan Publishing House, Bombay
5. Atomic and NuclearPhysics VolII (1994), S.N. Ghoshal, S Chand &CoNew Delhi
6. BasicNuclearPhysics, B.N. Srivastava, (1993),PragatiPrakashanMeerut
7. IntroductoryNuclearPhysics, Halliday, Asia PublishingHouse, New Delhi
8. Fundamentals of Radiochemistry, D. D.Sood, A. V.R. Readyand Ramamoorthy,IANCAS(2007),BARC, Bombay.
9. Conceptsof Nuclear Physics (1998), B.L.Cohen, Tata McGrawHill, New Delhi
10. IntroductoryNuclear Physics (1988), K. S.Krane, JohnWiley&SonsNew Delhi
11. Nuclear Physics (1992), S.B. Patel, WileyEasternLtd, NewDelhi
12. NuclearPhysics (1993), R.R. Roy and B.P. Nigam, WileyEasternLtd. New Delhi.

B.Sc-3rd year (Semester-V)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-501(II))
Nomenclature: Mathematical Physics
No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

FOURIER SERIES

Periodic functions, Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only), Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients, Complex representation of Fourier series, Expansion of functions with arbitrary period, Expansion of non-periodic functions over an interval, Even and odd functions and their Fourier expansions, Application, Summing of Infinite Series.

SOME SPECIAL INTEGRALS

Beta and Gamma FunctionS, Relation between them.Expression of Integrals in terms of Gamma Functions, Error Function (Probability Integral).

(15 Lectures)

UNIT-II

CALCULUS OF FUNCTIONS OF MORE THAN ONE VARIABLE

Partial derivatives,exact and inexact differentials,Integrating factor, with simple illustration, Constrained Maximization using Lagrange Multipliers.

PARTIAL DIFFERENTIAL EQUATIONS

Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry.

(15 Lectures)

UNIT-III

FROBENIUS METHOD AND SPECIAL FUNCTIONS

Singular Points of Second Order Linear Differential Equations and their importance,Frobenius method and its applications to differential equations, Legendre, Bessel, Hermite and Laguerre

Differential Equations, Properties of Legendre Polynomials: Rodrigues Formula, Orthogonality, Simple recurrence relations.

(15 Lectures)

UNIT-IV

COMPLEX ANALYSIS

Brief Revision of Complex Numbers and their Graphical Representation, Euler's formula, De Moivre's theorem, Roots of Complex Numbers, Functions of Complex Variables, Analyticity and Cauchy-Riemann Conditions, Examples of analytic functions, Singular functions: poles and branch points, order of singularity, branch cuts, Integration of a function of a complex variable, Cauchy's Inequality, Cauchy's Integral formula.

(15 Lectures)

CO No. **Course code (B-PHY-501(II)): Mathematical Physics**

After successfully completing the course, student will be able to:

CO-1 Learn the Fourier analysis of periodic functions and their applications in physical problems. Learn the beta, gamma and the error functions and their applications in doing integrations.

CO-2 Acquire knowledge of methods to solve partial differential equations with the examples of important partial differential equations in Physics.

CO-3 Learn about the special functions, such as the Hermite polynomial, the Legendre polynomial, the Laguerre polynomial and Bessel functions and their differential equations and their applications in various physical problems.

CO-4 Learn about the complex numbers and their properties, functions of complex numbers and their properties such as analyticity, poles and residues.

REFERENCES

1. Mathematical Methods for Physicists: Arfken, Weber, 2005, Harris, Elsevier
2. Fourier Analysis by M.R. Spiegel, 2004, Tata McGraw-Hill.
3. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole.
4. An Introduction to Ordinary Differential Equations, Earl A Coddington, 1961, PHI Learning.
5. Differential Equations, George F. Simmons, 2006, Tata McGraw-Hill.
6. Essential Mathematical Methods, K.F. Riley and M.P. Hobson, 2011, Cambridge University Press
7. Partial Differential Equations for Scientists and Engineers, S.J. Farlow, 1993, Dover Publications.
8. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Books.

B.Sc-3rd year (Semester-V)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-502(I))
Nomenclature: Solid State Physics
No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

CRYSTAL STRUCTURE I

Crystallineandglassyforms,liquidcrystals,crystalstructure,periodicity,latticeand basis,crystaltranslationalvectorsandaxes.UnitcellandPrimitiveCell,WingerSeitz primitiveCell,symmetry operationsfora twodimensionalcrystal,Bravaislatticesintwo andthreedimensions.CrystalplanesandMillerindices,Interplanerspacing,Crystal structures ofZinc Sulphide, Sodium Chloride and Diamond.

(15 Lectures)

UNIT-II

CRYSTAL STRUCTURE II

X-raydiffraction,Bragg'sLawandexperimentalX-raydiffractionmethods.K-spaceandreciprocallatticeanditsphysicalsignificance,reciprocallatticevectors,reciprocallattice to a simple cubic lattice,b.c.c. and f.c.c. lattice.

(15 Lectures)

UNIT-III

ELECTRONIC PROPERTIES OF METALLIC SOLIDS

Free electron gas model, Energy levels and density of states in one and three dimensions, Fermi momentum, Fermi energy, Fermi temperature, Effect of temperature, heat capacity of electron gas (explicit calculation), Experimental heat capacity of metals, Concept of thermal effective mass, Electrical conductivity and Ohm's law, Experimental resistivity of metals, Matthiessen's rule, Motion in magnetic fields and Hall effect, Thermal conductivity of metals and Wiedmann-Franz law.

(15 Lectures)

UNIT-IV

SUPERCONDUCTIVITY

Historicalintroduction,Survey ofsuperconductivity,Superconductingsystems,HighTc Superconductors,IsotopicEffect,CriticalMagneticField,MeissnerEffect,London TheoryandPippards'equation,ClassificationofSuperconductors(typeIandTypeII), BCSTheoryofSuperconductivity,Fluxquantization,JosephsonEffect(ACandDC), PracticalApplicationsofsuperconductivityandtheirlimitations,powerapplicationof superconductors.

(15 Lectures)

CO No. **Course code (B-PHY-502(I)): Solid State Physics**

After successfully completing the course, student will be able to:

CO-1 Have brief idea about crystalline and amorphous substances, about lattice, unit cell, primitive cell, miller indices,Bravais lattices in two & three dimensions and crystal structures of Zinc Sulphide, Sodium Chloride and Diamond.

CO-2 Acquire knowledge about X-ray diffraction, Bragg's Law and experimental X-ray diffraction methods and about the reciprocal lattice to a simple cubic lattice, b.c.c. and f.c.c. lattice.

CO-3 Acquire knowledge about the electronic properties like electrical conductivity, resistivity, thermal conductivity, heat capacity etc. of metallic solids.

CO-4 Understand the basic idea about superconductors, their classifications and practical applications.

REFERENCES

1. IntroductiontoSolidStatePhysics, 7th Ed (1996) , C. Kittel, John Wiley&Sons, New Delhi
2. SolidStatePhysics,*AnIntroductiontoTheoryandExperiment*, H.Ibachand H.Lüth, Springer-Verlag,Berlin, 1991
3. SolidStatePhysics, S.O. Pillai, NewAgeInternational Publishers (2007) New Delhi
4. IntroductiontoSuperconductivity,M.Tinkham, McGraw-Hill, New York
5. SolidState Physics (2000), A.J. Dekkar, McMillanIndiaLtd New Delhi
6. Solid State Physics (2003), N.W. Ascroft N Wand N.D. Mermin, Harcourt Asia, Singapore
7. Solid State Physics: An introduction to theory and Experiment, H. Ibach and H.Luth
8. Solid State Physics (1993), H.V. Keer, WileyEasternLtd,New Delhi
9. Solid State Physics (1990), C.M.Kachhava, TataMcGrawHill CoLtd, New Delhi
10. Solid State Physics (1995),Gupta, Vikas PublishingHouse PvtLtd, New Delhi

B.Sc-3rd year (Semester-V)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-502(II))
Nomenclature: Medical Physics
No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

NOTE:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

PHYSICS OF THE BODY-I

Basic Anatomical Terminology: Standard Anatomical Position, Planes, Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal, Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement, Physics of Locomotors Systems: joints and movements, Stability and Equilibrium. Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Thermal Regulation. Pressure system of body: Physics of breathing, Physics of cardiovascular system.

PHYSICS OF THE BODY-II

Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound. Optical system of the body: Physics of the eye. Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer.

(15 Lectures)

UNIT-II

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I

X-Rays: Electromagnetic spectrum, production of X-rays, X-ray spectra, Brehmsstrahlung, Characteristic X-ray. X-ray tubes & types: Coolidge tube, X-ray tube design, tube cooling stationary mode, Rotating anode X-ray tube, Tube rating, quality and intensity of X-ray. X-ray generator circuits, half wave and full wave rectification, filament circuit, kilo voltage circuit, types of X-Ray Generator, high frequency generator, exposure timers and switches, HT cables, HT generation.

RADIATION PHYSICS

Radiation units exposure, absorbed dose, units: rad, gray, relative biological effectiveness, effective dose, inverse square law, Interaction of radiation with matter Compton & photoelectric effect, Rem & Sievert, linear attenuation coefficient.

RADIATION DETECTORS

Thimble chamber, condenser chambers, Geiger Muller counter, Scintillation counters and Solid State detectors, ionization chamber, Dosimeters, survey methods, area monitors, TLD, Semiconductor detectors.

(15 Lectures)

UNIT-III

MEDICAL IMAGING PHYSICS

Evolution of Medical Imaging, X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR), NMR imaging, MRI Radiological imaging, Ultrasound imaging, Physics of Doppler with applications and modes, Vascular Doppler. Radiography: Filters, grids, cassette, X-ray film, film processing, fluoroscopy. Computed tomography scanner- principle & function, display, generations, mammography.Thyroid uptake system and Gamma camera (Only Principle, function and display).

PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II

Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography. Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment. Medical Instrumentation: Basic Ideas of Endoscope and Cautery, Sleep Apnea and Cpap Machines, Ventilator and its modes.

(15 Lectures)

UNIT-IV

RADIATION ONCOLOGY PHYSICS

External Beam Therapy (Basic Idea): Telecobalt, Conformal Radiation Therapy (CRT), 3DCRT, IMRT, Image Guided Radiotherapy, EPID, Rapid Arc, Proton Therapy, Gamma Knife, Cyber Knife, Contact Beam Therapy (Basic Idea): Brachytherapy-LDR and HDR, Intra Operative Brachytherapy, Radiotherapy, kilo voltage machines, deep therapy machines, Telecobalt machines, Medical linear accelerator, Basics of Teletherapy units, deep x-ray, Telecobalt units, medical linear accelerator, Radiation protection, external beam characteristics, dose maximum and build up – bolus, percentage depth dose, tissue maximum ratio and tissue phantom ratio, Planned target Volume and Gross Tumour Volume.

RADIATION AND RADIATION PROTECTION

Principles of radiation protection,protective materials-radiation effects, somatic, genetic stochastic and deterministic effect. Personal monitoring devices: TLD film badge, pocket dosimeter, OSL dosimeter, Radiation dosimeter, Natural radioactivity, Biological effects of radiation, Radiation monitors, Steps to reduce radiation to Patient, Staff and Public, Dose Limits for Occupational workers and Public. AERB: Existence and Purpose.

(15 Lectures)

CO No.	Course code (B-PHY-502(II)): Medical Physics
	After successfully completing the course, student will be able to:
CO-1	Learn about the human body, its anatomy, physiology and biophysics, the Physics of the senses, exploring its performance as a physical machine.
CO-2	Gain knowledge with reference to working of various diagnostic tools, medical imaging techniques, how ionizing radiation interacts with matter, how it affects living organisms and how it is used as a therapeutic technique and radiation safety practices.
CO-3	Have functional knowledge regarding need for radiological protection and the sources of an approximate level of radiation exposure for treatment purposes.
CO-4	Gain a broad and fundamental understanding of Physics while developing particular expertise in medical applications.

REFERENCES

1. Medical Physics, J.R. Cameron and J.G. Skofronick, Wiley (1978)
2. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
3. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
4. Physics of Radiation Therapy: F M Khan - Williams and Wilkins, Third edition (2003)
5. Physics of the human body, Irving P. Herman, Springer (2007).
6. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
7. Handbook of Physics in Diagnostic Imaging: R.S. Livingstone: B.I. Publication Pvt Ltd.

B.Sc-3rd year (Semester-V)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-503(I))
Nomenclature: Physics Practical-V
No. of credits: 2

External Marks: 40
Internal Marks: 10

Time: 3 Hours Max.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving **Internal marks** (under Lab. Record), each college will maintain practical assessment record by using the following procedure:-

(i) Each student has to perform a minimum number of experiments prescribed in the syllabus.

(ii) After the completion of a practical, the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the Lab. Record.

(iii) To complete the final marks for Lab. Record a separate register for each class of B.Sc. will be maintained. The student will be assigned a separate page on this register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average, the total marks obtained will be divided by the total number of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.

(iv) The Lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

5. The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

1. Study of Hysteresis curve by CRO.
2. To measure the resistivity of a semiconductor (Ge) crystal with temperature by Four Probe Method(from room temperature to 150 ^{o}C) and to determine its band gap.
3. To measure the Dielectric constant of a dielectric materials with frequency.
4. To determine the elastic constant of quartz crystal.
5. Velocity of Ultrasonic waves by grating formation in CCl_4.
6. To determine the Hall coefficient of a semiconductor sample.
7. To find the magnetic susceptibility of a solids.

8. To study the PE Hysteresis curve of a ferroelectric crystal.
9. To draw the Platue of G.M. Counter.
10. To draw the Mass Attenuation coefficient by G.M. Counter.

CO No.	Course code (B-PHY-503(I)) : Physics Practical-V
	After successfully completing the course, student will be able to:
CO-1	Perform experiments to determine resistance & band gap of semiconductor materials and be able to study the ferroelectric properties of ferroelectric materials.
CO-2	Familiar with the use and proper handling of different instruments such as CRO, dielectric setup, G.M.Counter, Gauss meter etc.
CO-3	Draw the platue of G.M. Counter & determine the Mass Attenuation coefficient by G.M. Counter.
CO-4	Learn to present observations, results and analysis in suitable and presentable form.

REFERENCES

1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
2. Advanced Level Practical Physics, M.Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi
4. Practical Physics , S.L. Gupta and V. Kumar, PragatiPrakashan Meerut
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop,1971, Asia Publishing House

(Course Type: Discipline Specific Elective, Course Code: B-PHY-503(II))
Nomenclature: Physics Practical-V
No. of credits: 2

External Marks: 40
Internal Marks: 10
Time: 3 Hours Max.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving**Internal marks**(underLab. Record),eachcollege will maintainpracticalassessment record byusingthefollowingprocedure:-

(i) Each student has to perform a minimum number of experiments prescribed in the syllabus.

(ii) After thecompletionofapractical,theteacherconcernedwillcheck thenote-bookandconducttheviva-voceofeachstudenttofindouthowmuch conceptsrelatedtothetheoreticalandexperimentalpartoftheexperiment he/shehasunderstood.Accordingtohis/herperformancemarkswillbe recordedontheirpracticalnote-book.ThesemarkswillconstitutetheLab. Record.

(iii) TocompletethefinalmarksforLab.Recordaseparateregisterforeach classof B.Sc.willbemaintained.Thestudentwillbeassignedaseparatepageonthis register.Onthispagethemarksobtainedbythestudentindifferentpracticals willberecorded.Whiletakingthefinalaverage,thetotalmarksobtainedwill bedividedby thetotalnumberofrequiredpracticals,insteadofthenumberof practicalsperformedbythestudent.Thisrecordwillbesignedbythe concerned teacher.

(iv) TheLab.recordregisterwillbepresentedtotheexternalpractical examinersfor lab. record marks. Theexternal examiners willverifytherecord randomly.

5. The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

MATHEMATICAL PHYSICS

The aim of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems.
- Use of computer language as a tool in solving physics problems (applications).
- The course will consist of lectures (both theory and practical) in the Computer Lab.
- Evaluation done not on the programming but on the basis of formulating the problem.
- Aim at teaching students to construct the computational problem to be solved.
- Students can use anyone operating system Linux or Microsoft Windows

Topics	Description with Applications

Introduction and Overview	Computer architecture and organization, memory and Input/output devices.
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, algorithms, Sequence, Selection and Repetition, single and double precision arithmetic, underflow & overflowemphasize the importance of making equations in terms of dimensionless variables, Iterative methods.
Errors and error Analysis	Truncation and round off errors, Absolute and relative errors, Floating point computations.
Review of C & C++ Programming fundamentals	Introduction to Programming, constants, variables and data types, operators and Expressions, I/O statements, scanf and printf, c in and c out, Manipulators for data formatting, Control statements (decision making and looping statements) (If-statement. If-else Statement. Nested if Structure. Else-if Statement. Ternary Operator. Goto Statement. Switch Statement. Unconditional and Conditional Looping. While-Loop. Do-While Loop. FOR Loop. Break and Continue Statements. Nested Loops), Arrays (1D&2D) and strings, user defined functions, Structures and Unions, Idea of classes and objects.
Programs: using C/C++ language	Sum & average of a list of numbers, largest of a given list of numbers and its location in the list, sorting of numbers in ascending-descending order, Binary search.
Random number generation	Area of circle, area of square, volume of sphere, value of pi (π)
Solution of Algebraic and Transcendental equations by Bisection, Newton Raphson and Secant methods	Solution of linear and quadratic equation, solving $\alpha = \tan\alpha$; $I = I_o((Sin\ \alpha\ \|\alpha\ )^2$in optics
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation	Evaluation of trigonometric functions e.g. Sin θ, Cos θ, tan θ, etc.
Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Monte Carlo method	Given Position with equidistant time data to calculate velocity and acceleration and vice-versa. Find the area of B-H Hysteresis loop
Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation • Radioactive decay • Current in RC, LC circuits with DC source • Newton's law of cooling • Classical equations of motion Attempt following problems using RK 4 order method: • Solve the coupled differential equations $\frac{dx}{dy}$ = y + x$-\frac{x3}{3}$; $\frac{dy}{dx}$ = x for four initial conditions x(0) = 0, y(0) = -1, -2, -3, -4.

		Plot x vs y for each of the four initial conditions on the same screen for $0 \leq t \leq 15$ The differential equation describing the motion of a pendulum is $\frac{d2\theta}{dt2} = -Sin\theta$. The pendulum is released from rest at an angular displacement α, i.e. υ (0)= αand υ'(0) = 0. Solve the equation for α = 0.1, 0.5 and 1.0 and plot υ as a function of time in the range $0 \leq t \leq 8\pi$. Also plot the analytic solution valid for small υ(sin(υ) = υ

MEDICAL PHYSICS

1. Understanding the working of a manual Hg Blood Pressure monitor and measure the Blood Pressure.
2. Understanding the working of a manual optical eye-testing machine and to learn eye-testing.
3. Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/breadboard.
4. Correction of Hypermetropia/Hyperopia (long sightedness) using a combination of lenses on an optical bench/breadboard.
5. To learn working of Thermoluminescent dosimeter (TLD) badges and measure the background radiation.
6. Familiarization with Geiger-Muller (GM) Counter and to measure background radiation.
7. Familiarization with Radiation meter and to measure background radiation.
8. Familiarization with the Use of a Vascular Doppler.

CO No. **Course code (B-PHY-503(II)) : Physics Practical-V**

After successfully completing the course, student will be able to:

CO-1 Acquire proficiency in computing integrations and in solving differential equations by various methods. Also be able to learn about the basic theory of errors, their analysis, and estimation with examples of simple experiments in Physics.

CO-2 Learn the fundamentals of the C and C++ programming languages and their applications in solving simple physical problems involving interpolations, differentiations, integrations, differential equations as well as finding the roots of equations.

CO-3 Have hands-on and gain knowledge with reference to working of various diagnostic tools and medical equipment.

CO-4 Acquire a broad and fundamental understanding of Physics while developing particular expertise in medical applications and appreciate the applications of Physics to clinical medicine.

REFRENCES

1. Introduction to Numerical Analysis, S.S. Sastry, 5thEdn., 2012, PHI Learning Pvt. Ltd.
2. Schaum's Outline of Programming with C++. J.Hubbard, 2000, McGraw-Hill Publications.
3. Numerical Recipes in C++: The Art of Scientific Computing, W.H. Pressetal., 3rdEdn., 2007, Cambridge University Press.
4. A first course in Numerical Methods, Uri M. Ascher and Chen Greif, 2012, PHI Learning.
5. Elementary Numerical Analysis, K.E. Atkinson, 3rdEdn., 2007, Wiley India Edition.
6. Numerical Methods for Scientists and Engineers, R.W. Hamming, 1973, Courier Dover Pub.
7. An Introduction to Computational Physics, T. Pang, 2ndEdn., 2006, Cambridge Univ. Press.
8. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003).
9. Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
10. Physics of Radiation Therapy: F M Khan - Williams and Wilkins, Third edition (2003).
11. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002).
12. The Physics of Radiology-H E Johns and Cunningham.
13. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
14. Handbook of Physics in Diagnostic Imaging: Roshan S. Livingstone: B. I. Publications Pvt Ltd.
15. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

B.Sc-3rd year (Semester-VI)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-601(I))
Nomenclature: Atomic and Molecular Spectroscopy

No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

Note:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

HISTORICALBACKGROUNDOFATOMICSPECTROSCOPY

Introductionofearlyobservations,emissionandabsorptionspectra,atomicspectra,wave number,spectrumofHydrogenatominBalmerseries,Bohratomicmodel(Bohr'spostulates), spectraofHydrogenatom,explanationofspectralseriesinHydrogenatom,un-quantizedstates andcontinuousspectra,spectralseriesinabsorptionspectra,effectofnuclearmotiononline spectra(correctionoffinitenuclearmass),variationinRydbergconstantduetofinitemass,short comingsofBohr'stheory,Wilsonsommerfeldquantizationrule,de-Broglieinterpretationof Bohrquantization law,Bohr's correspondingprinciple, Sommerfeld's extensionof Bohr'smodel, Sommerfeldrelativisticcorrection,ShortcomingsofBohr-Sommerfeldtheory,Vectoratom model**;**spacequantization,electronspin,couplingoforbitalandspinangularmomentum, spectroscopictermsandtheirnotation,quantumnumbersassociatedwithvectoratommodel, transition probabilityandselection rules.

(15 Lectures)

UNIT-II

VECTORATOMMODEL(SINGLEVALANCEELECTRON)

Orbitalmagneticdipolemoment(Bohrmegnaton),behaviorofmagneticdipolein external magnetic filed;Larmors' precession andtheoremPenetratingandNon-penetratingorbits,Penetratingorbitsontheclassicalmodel**;** Quantumdefect,spinorbitinteractionenergyofthesinglevalanceelectron,spinorbit interactionforpenetratingandnon-penetratingorbits.quantummechanicalrelativity correction,Hydrogenfinespectra,MainfeaturesofAlkaliSpectraandtheirtheoretical interpretation,termseriesandlimits,Rydeburg-Ritzecombinationprinciple,Absorption spectraofAlkaliatoms.observeddoubletfinestructureinthespectraofalkalimetals anditsInterpretation,Intensityrulesfordoublets,comparisonofAlkalispectraand Hydrogen spectrum.

(15 Lectures)

UNIT-III

VECTORATOMMODEL(TWOVALANCEELECTRON)

EssentialfeaturesofspectraofAlkaline-earthelements,Vectormodelfortwovalance electron atom:application of spectra. CouplingSchemes;LSorRussell–SaundersCouplingSchemeandJJcouplingscheme, InteractionenergyinL-Scoupling(sp,pdconfiguration),Landeintervalrule,Pauli principalandperiodicclassificationoftheelements.InteractionenergyinJJCoupling (sp,pdconfiguration),equivalentandnon-equivalentelectrons,Twovalanceelectron system-spectraltermsofnon-equivalentandequivalentelectrons,comparisonofspectral termsinL-SAndJ-Jcoupling.Hyperfine structureofspectrallinesandits origin;isotope effect,nuclear spin.

(15 Lectures)

UNIT-IV

ATOMINEXTERNALFIELD

ZeemanEffect(normalandAnomalous),Experimentalset-upforstudyingZeemaneffect, ExplanationofnormalZeemaneffect(classicalandquantummechanical),Explanationof anomalousZeemaneffect(Landeg-factor), ZeemanpatternofD1andD2linesofNa-atom,Paschen-Backeffectofasinglevalenceelectronsystem.WeakfieldStarkeffectof Hydrogen atom.

MOLECULAR PHYSICS

General Considerations,Electronic StatesofDiatomic Molecules, Rotational Spectra (Far IRandMicrowaveRegion),VibrationalSpectra(IRRegion),RotatorModelofDiatomic Molecule, Raman Effect,Electronic Spectra.

(15 LECTURES)

CO No. **Course code (B-PHY-601(I)) : Atomic and Molecular spectroscopy**

After successfully completing the course, student will be able to:

CO-1 Acquire knowledge about the historical background and developments of atomic spectroscopy through the study of spectral series in Hydrogen atom, effect of nuclear motion on line spectra (correction of finite nuclear mass), short comings of Bohr's theory, Wilson sommerfeld quantization rule, Sommerfeld's extension of Bohr's model, Sommerfeld relativistic correction, Short comings of Bohr-Sommerfeld theory and finally Vector atom model.

CO-2 Understand and explain the vector atom model, various coupling schemes and atomic spectra of one and two electron atoms.

CO-3 Explain the influence on the spectra of atoms in the presence of external applied electric and magnetic field i.e. Zeeman effect, Paschen-Back effect, Stark effect.

CO-4 Have basic idea about the rotational, vibrational and rotational-vibrational spectra of diatomic molecules and basic idea of Raman Effect.

REFERENCES

1. Concept of Modern Physics(1987), A. Beiser, McGrawHill CoLtd. New Delhi
2. Atomic Physics (2007), J.B. Rajab, S Chand & Co, New Delhi
3. Atomic Physics VolII (1991), J.H.Fewkes and J. Yarwood, Oxford UniversityPress
4. Physics of Atomsand Molecules 2nd Ed(2009), B.H.Bransden and C.J. Joachain, Pearson Education, New Delhi
5. Fundamental of Molecular Spectroscopy,Colin N.Banwell and Elaine M. McCash, McGrawHill CoLtd. New Delhi
6. Atomic and NuclearPhysics VolI (1996) S.N. Ghoshal, S. Chand & Com., New Delhi
7. Atomic and Nuclear Physics (1982), K. Gopalkrishnan, McMillanIndia, New Delhi
8. Elements ofSpectroscopyS.L.Gupta, V. Kumar and R.C.Sharma, PragatiPrakashan, Meerut.

B.Sc-3rd year (Semester-VI)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-601(II))

Nomenclature: Elements of Modern Physics
No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

Note:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.

UNIT-I

INTRODUCTION TO MODERN PHYSICS

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering, De Broglie wavelength and matter waves; DavissonGermer experiment, Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra.

(15 Lectures)

UNIT-II

HEISENBERG UNCERTAINTY PRINCIPLE AND SCHRODINGER WAVE EQUATION

Position measurement-gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wave function, probabilities and normalization; Probability and probability current densities in one dimension.

(15 Lectures)

UNIT-III

APPLICATION OF SCHRODINGER WAVE EQUATION

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension -across a step potential and across a rectangular potential barrier, Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.

(15 Lectures)

UNIT-IV

BASIC CONCEPT IN NUCLEAR PHYSICS

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & half-life; α-decay; β-decay-energy released, spectrum and Pauli's prediction of neutrino; γ-ray emission. Fission and fusion, mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with U^{235} Fusion and thermonuclear reactions.

(15 LECTURES)

CO No. **Course code (B-PHY-601(II)) : Elements of Modern Physics**

After successfully completing the course, student will be able to:

CO-1 Know main aspects of the inadequacies of classical mechanics and understand historical development of quantum mechanics and ability to discuss and interpret experiments that reveal the dual nature of matter.

CO-2 Understand the theory of quantum measurements, wave packets and uncertainty principle.

CO-3 Understand the central concepts of quantum mechanics: wave functions, momentum and energy operator, the Schrodinger equation, time dependent and time independent cases, probability density and the normalization techniques, skill development on problem solving e.g. one dimensional rigid box, tunneling through potential barrier, step potential, rectangular barrier.

CO-4 Understanding the properties of and structure of atomic nuclei, liquid drop model and nuclear shell model and mass formula. Acquire the ability to calculate the decay rates and lifetime of radioactive decays like alpha, beta, gamma decay.

REFERENCES

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009, PHI Learning
3. Six Ideas that Shaped Physics: Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill
4. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
5. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning.
6. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill

B.Sc-3rd year (Semester-VI)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-602(I))

Nomenclature: Digital and Analog Circuits & Instrumentation
No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

Note:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

DIGITAL CIRCUITS

Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, Logic Gates: AND, OR and NOT (Their realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gates. De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra. Fundamental Products: Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (i) Sum of Products Method and (ii) Karnaugh Map.

(15 Lectures)

UNIT-II

COMBINATIONAL LOGIC CIRCUITS

Binary Addition, Binary Subtraction (using 2's Complement Method). Half Adders and Full Adders, and Subtractors, 4-bit binary Adder-Subtractor. Decoder: Binary-coded-decimal (BCD) system, BCD-to-decimal decoder, Demultiplexer: 4-to-16 line decoder, decoder/lamp driver, Multiplexer (Data selector): Applications- Parallel to serial conversion, sequential data selection; Encoders. Seven segment Display, BCD-to-seven segment decoder.

(15 Lectures)

UNIT-III

OPERATIONAL AMPLIFIERS (BLACK BOX APPROACH)

Characteristics of an Ideal and Practical Op-Amp (IC 741), Open-loop & Closed-loop Gain.CMRR, concept of Virtual ground. Applications of Op-Amps: (i) Inverting and Non-inverting Amplifiers, (ii) Adder, (iii) Subtractor, (iv) Differentiator, (v) Integrator, (vi) Zero Crossing Detector (vii) Electronic analog computation (viii) Square wave generator (ix) Triangular wave generator.

(15 Lectures)

UNIT-IV

INSTRUMENTATIONS

Digital to analog converters: Weighted resistor type D/A converter, Ladder type D/A converter; Analog to Digital converter. Timer IC: IC 555 Pin diagram and its application as Astable&MonostableMultivibrator. Introduction to CRO: Block diagram of CRO, Applications of CRO (i) Study of Waveform (ii) Measurement of Voltage, Current, Frequency and Phase Difference.

(15 Lectures)

CO No.	Course code (B-PHY-602(I)) : Digital and Analog Circuits & Instrumentation
	After successfully completing the course, student will be able to:
CO-1	Difference between analog and digital circuits and acquire knowledge about number systems, their interconversions, Basic logic gates, synthesis of circuits using Boolean algebra and Conversion of a Truth Table into an Equivalent Logic Circuit by (i) Sum of Products Method and (ii) Karnaugh Map.
CO-2	Understand and explain about the various Combinational digital systems like Half adders, full adders, BCD-to-decimal decoder, Demultiplexer, Multiplexer etc. and also be able to appreciate the applications of these devices.
CO-3	Realize the basics characteristics and implementation of operational amplifier for various applications like addition, subtraction, differentiation, integration, Waveform generator-square wave generator.
CO-4	Acquire knowledge about digital to analog and analog to digital signal conversion. Also understand the working and application of CRO.

REFERENCES

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
3. Microelectronic Circuits, M.H. Rashid, 2nd Edn.,2011, Cengage Learning.
4. Modern Electronic Instrumentation & Measurement Tech., Helfrick& Cooper, 1990, PHI Learning.
5. Digital Principles & Applications, A.P. Malvino, D.P. Leach &Saha, 7th Ed., 2011,Tata Mc-Graw Hill
6. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
7. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
8. OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

B.Sc-3rd year (Semester-VI)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-602(II))
Nomenclature:

Embedded System: Introduction to Microcontroller

No. of Credits: 2

External Marks: 60
Internal Marks: 15
Time: 3 hrs.

Note:-

1. Nine Questions willbe set in total and attempt five questions in all.
2. Questionnumber1willbecompulsoryandwillbebasedonthe conceptual aspectsofentiresyllabus. Thisquestionmayhave at least fivepartsandtheanswer shouldbe in briefbutnotinYes/ No.
3. Formorequestionsaretobeattempted,selectingonequestionout oftwo questions set fromeach unit. Each question maycontaintwo or more parts.
4. 20% numerical problems are to be set.
5. Use of scientific(non-programmable)calculator is allowed

UNIT-I

EMBEDDED SYSTEM ITRODUCTION, DESIGN & DEVELOPMENT

Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges and design issues in embedded systems, operational and non-operational quality attributes of embedded systems,Embedded system design and development: Embedded system development environment, file types generated after cross compilation, disassembler/ decompiler, simulator, emulator and debugging, embedded product development life-cycle, trends in embedded industry.

(15 Lectures)

UNIT-II

REVIEW OF MICROPROCESSORS

Organization of Microprocessor based system, 8085μp pin diagram and architecture, concept of data bus and address bus, 8085 programming model, instruction classification, subroutines, stacks and its implementation, delay subroutines, hardware and software interrupts.8051 microcontroller: Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions.

(15 Lectures)

UNIT-III

8051 I/O PORT PROGRAMMING

Introduction of I/O port programming, pin out diagram of8051 microcontroller, I/O port pins description and their functions, I/O port programming in 8051, (Using Assembly Language), I/O programming: Bit manipulation.Programming of 8051: 8051addressing modes and accessing memory using various addressing modes, assembly language instructions using each addressing mode, arithmetic & logic instructions, 8051 programming in C:- for time delay and I/O operations and manipulation, for arithmetic & logic operations, for ASCII and BCD conversions.

(15 Lectures)

UNIT-IV

TIMER AND COUNTER PROGRAMMING

Programming 8051 timers, counter programming.SERIAL PORT PROGRAMMING WITH AND WITHOUT INTERRUPT: Introduction to 8051 interrupts, programming timer interrupts, programming external hardware interrupts and serial communication interrupt, interrupt priority in the 8051. INTERFACING 8051 MICROCONTROLLER TO PERIPHERALS: Parallel and serial ADC, DAC interfacing, LCD interfacing. PROGRAMMING EMBEDDED SYSTEMS:Structure of embedded program, infinite loop, compiling, linking and locating, downloading and debugging.

(15 LECTURES)

CO No. **Course code (B-PHY-602(II)) : Embedded System: Introduction to Microcontroller**

After successfully completing the course, student will be able to:

CO-1 Acquire knowledge about the embedded systems including its generic architecture, design and classifications, Embedded processors and microcontrollers.

CO-2 Learn about the organization of intel microprocessor 8085, its architecture, pin diagram, timing diagram, instruction set and programming in assembly language.

CO-3 Understand the organization of Intel 8051 microcontroller, its architecture, instruction set, programming and its memory organization, timing diagram and Input/output operations and manipulation for arithmetic and logical operations.

CO-4 Acquire knowledge about programming with and without interrupt service request. Interfacing parallel and serial ADC and DAC.

REFERENCES

1. Embedded Systems: Architecture, Programming & Design, R. Kamal, 2008, Tata McGraw Hill
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
3. Embedded Microcomputer System: Real Time Interfacing, J.W. Valvano, 2000, Brooks/Cole
4. Embedded Systems and Robots, SubrataGhoshal, 2009, Cengage Learning
5. Introduction to embedded system, K.V. Shibu, 1st Edition, 2009, McGraw Hill
6. Microcontrollers in practice, I.Susnea and M.Mitescu, 2005, Springer.
7. Embedded Systems: Design & applications, 1/e S.F. Barrett, 2008, Pearson Education India
8. Embedded Microcomputer systems: Real time interfacing, J.W.Valvano 2011,Cengage Learning

B.Sc-3rd year (Semester-VI)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-603(I))
Nomenclature: Physics Practical-VI

No. of credits: 2

External Marks: 40
Internal Marks: 10
Time: 3 Hours Max.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving**Internal marks**(underLab. Record),eachcollege will maintainpracticalassessment record byusingthefollowingprocedure::-
   - **(i)** Each student has to perform a minimum number of experiments prescribed in the syllabus.
   - **(ii)** After thecompletionofapractical,theteacherconcernedwillcheck thenote-bookandconducttheviva-voceofeachstudenttofindouthowmuch conceptsrelatedtothetheoreticalandexperimentalpartoftheexperiment he/shehasunderstood.Accordingtohis/herperformancemarkswillbe recordedontheirpracticalnote-book.ThesemarkswillconstitutetheLab. Record.
   - **(iii)** TocompletethefinalmarksforLab.Recordaseparateregisterforeach classof B.Sc.willbemaintained.Thestudentwillbeassignedaseparatepageonthis register.Onthispagethemarksobtainedbythestudentindifferentpracticals willberecorded.Whiletakingthefinalaverage,thetotalmarksobtainedwill bedividedby thetotalnumberofrequiredpractical's,insteadofthenumberof practical'sperformedbythestudent.Thisrecordwillbesignedbythe concerned teacher.
   - **(iv)** TheLab.recordregisterwillbepresentedtotheexternalpractical examinersfor Lab. record marks. Theexternal examiners willverifytherecord randomly.

The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

1. Determination of specific charge (e/m) by Thomson method.
2. To find Plank's constant.
3. Rydberg Constant by Hydrogen gas spectrum.
4. To determine the ionization potential of mercury.
5. To study the absorption spectra of iodine and to determine its dissociation energy.
6. To design a CB &CE amplifier of a given gain (mid-gain) using voltage divider bias.
7. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
8. To verify and design AND, OR, NOT and XOR gates using NAND gates.
9. To minimize a given logic circuit. 4. Half adder, Full adder and 4-bit Binary Adder.
10. Adder-Subtractor using Full Adder I.C.
11. To study IV characteristics of PN diode, Zener and Light emitting diode
12. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
13. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.

14. To study a precision Differential Amplifier of given I/O specification using Opamp.
15. To investigate the use of an op-amp as a Differentiator
16. To design a Wien Bridge Oscillator using an op-amp.

CO No. **Course code (B-PHY-603(I)) : PHYSICS PRACTICAL-VI**

After successfully completing the course, student will be able to:

CO-1 Perform experiments to determine specific charge (e/m) by Thomson method, Plank's constant, Rydberg Constant etc.

CO-2 Perform experiments to realize the applications of different analog and digital devices like Operational amplifier, basic logic gates, Half & Full adders/Subtractors, Zener and Light emitting diode etc.

CO-3 Design and study CB & CE amplifier and also be able to carry out the Measurement of voltage and frequency of a periodic waveform using CRO.

CO-4 Have in-depth knowledge about the electronic circuit fundamentals, making of electrical connections and handling of instruments.

REFERENCES

1. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi.
2. Advanced Level Practical Physics, M. Nelkon and Ogborn, Henemann Education Books Ltd., New Delhi.
3. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi.
4. Practical Physics , S.L. Gupta and V. Kumar, PragatiPrakashan Meerut.
5. Modern Approach to Practical Physics, R.K. Singla, Modern Publishers, Jalandhar.
6. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop,1971, Asia Publishing House.
7. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
8. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
9. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, PrenticeHall.
10. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

B.Sc-3rd year (Semester-VI)
Subject: Physics
(Course Type: Discipline Specific Elective, Course Code: B-PHY-603(II))
Nomenclature: Physics Practical-VI
No. of credits: 2
External Marks: 40

Internal Marks: 10
Time: 3 Hours Max.

Distribution of External Marks:

Experiment	25 marks
Viva- voce	15 marks
Internal Marks (based on Lab Record)	10 marks
Total	50 marks

NOTE:-

1. Do any eight experiments from the list given.
2. The students are required to perform and calculate the error involved in a particular experiment in the final examination.
3. The Practical examination will be held in a single session of 3 hours.
4. Forgiving **Internal marks** (under Lab. Record), each college will maintain practical assessment record by using the following procedure:-

   Each student has to perform a minimum number of experiments prescribed in the syllabus.

   (i) After the completion of a practical, the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoretical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded on their practical note-book. These marks will constitute the Lab. Record.

   (ii) To complete the final marks for Lab. Record a separate register for each class of B.Sc. will be maintained. The student will be assigned a separate page on this register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average, the total marks obtained will be divided by the total number of required practical's, instead of the number of practical's performed by the student. This record will be signed by the concerned teacher.

   (iii) The Lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

   (iv) The size of each group for the practical paper may be 15 to 20 students.

LIST OF EXPERIMENTS

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionization potential of mercury.
5. To determine the absorption lines in the rotational spectrum of Iodine vapour.
6. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.
7. To determine the value of e/m by magnetic focusing.
8. To setup the Millikan oil drop apparatus and determine the charge of an electron.
9. To find that the given numbers is prime or not using 8051.
10. To find the factorial of a number using 8051.
11. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number using 8051.
12. Using 8051, Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.

13. Using 8051; Program to glow first four LED then next four using TIMER application.
14. Program to rotate the contents of the accumulator first right and then leftusing 8051.
15. Application of embedded systems: Temperature measurement, some information on LCD display, interfacing a keyboard Using 8051.

CO No. **Course code (B-PHY-603(II)) : Physics Practical-VI**

After successfully completing the course, student will be able to:

CO-1 Perform experiments to determine value of Boltzmann constant, work function of material of filament of directly heated vacuum diode, ionization potential of mercury etc.

CO-2 Study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.

CO-3 Design, fabricate, test and run the programs using 8051 microprocessor.

CO-4 Learn the applications of embedded systems such as temperature measurement, acquiring some information on LCD display and interfacing a keyboard Using 8051.

REFERENCES

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.
4. Embedded Systems: Architecture, Programming & Design, R. Kamal, 2008, Tata McGraw Hill
5. The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
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7. Embedded System, B.K. Rao, 2011, PHI Learning Pvt. Ltd.
8. Embedded Microcomputer systems: Real time interfacing, J.W.Valvano 2011,Cengage Learning.