Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC201	Core course	Nuclear Physics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Develop a comprehensive understanding of nuclear structure, nuclear properties and binding energy.
2. Explain the principles of radioactivity, radioactive decay processes and the applications of radioisotopes.
3. .Understand the theoretical models of the nucleus and evaluate their significance in explaining nuclear phenomena.
4. Analyze nuclear reactions, fission, fusion and the working principles of particle accelerators and nuclear reactors.
5. Acquire knowledge of nuclear radiation detectors and elementary particles, and apply nuclear physics concepts to scientific, medical and industrial applications.

COURSE ALIGNMENT WITH UNSDG: The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)**.

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC201	Core course	Nuclear Physics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

1. Explain the structure and properties of atomic nuclei and evaluate nuclear stability using binding energy and mass relations.
2. Analyze radioactive decay processes and apply decay laws to solve problems related to nuclear transformations.
3. Compare different nuclear models and interpret experimental observations using appropriate theoretical approaches.
4. Apply conservation laws to nuclear reactions and explain the principles of nuclear energy generation and particle acceleration.
5. Demonstrate an understanding of radiation detection techniques and the basic concepts of elementary particle physics and their practical applications.

Teaching Pedagogy:

T1	Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2	ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

Chairperson
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Chairperson
Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Controller of Examination
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC201	Core course	Nuclear Physics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Assessment Tools

AT1-1	Quiz
AT1-2	Activity Based Learning
AT1-3	Midterm Exams
AT1-4	Flip Class
AT1-5	Seminar Presentation
AT1-6	Assignments
AT1-7	Poster
AT1-8	Oral Viva-voce examination
AT1-9	Industrial Visit Report

Prerequisites: HSC Standard knowledge of Classical and Modern Physics

Module	Descriptors/Topics	Hours	Assessment tools
I	Discovery of the nucleus. Nuclear size, shape and charge distribution. Constituents of the nucleus. Nuclear mass, mass defect, binding energy and packing fraction. Nuclear stability. Nuclear spin, magnetic dipole moment and electric quadrupole moment.	10	AT1 AT2 AT3 AT6 AT8

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC201	Core course	Nuclear Physics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

II	Nature of radioactivity. Radioactive decay law. Half-life and mean life. Alpha, beta and gamma decay. Radioactive series. Nuclear isomers. Applications of radioisotopes in science, medicine, agriculture and industry.	10	AT1 AT2 AT3 AT6 AT8
III	Liquid drop model and its applications. Semi-empirical mass formula. Shell model of the nucleus. Magic numbers. Collective model. Nuclear forces and their properties.	10	AT1 AT2 AT3 AT6 AT8
IV	Types of nuclear reactions. Conservation laws in nuclear reactions. Nuclear reaction cross-section. Nuclear fission and fusion. Chain reaction and nuclear reactors (basic concepts). Principles and working of particle accelerators: Cyclotron, Linear Accelerator (LINAC) and Betatron. Applications of nuclear reactions.	10	AT1 AT2 AT3 AT6 AT8

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC201	Core course	Nuclear Physics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

V	Interaction of charged particles and gamma rays with matter. Gas-filled detectors (Ionization chamber, Proportional counter and Geiger-Müller counter). Scintillation and semiconductor detectors. Elementary particles and their classification. Fundamental interactions. Conservation laws in particle physics. Quarks and leptons (introductory treatment).	10	AT1 AT2 AT3 AT6 AT8
	Total Hours	50	

Additional Resources

A. Value addition to course content/ Skill enhancement content:

Refer relevant online tutorial/ course available on "Swayam portal"

https://onlinecourses.nptel.ac.in/noc23_ph28/preview?

https://onlinecourses.swayam2.ac.in/cec25_ph01/preview?

B. Remedial classes for slow learners:

As per the AUMP SOP for slow and fast learners.

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
			Marks	THEORY			PRACTICAL		L	T	P	CREDITS
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC201	Core course	Nuclear Physics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Suggested Readings:

Reference Books:

1. **S. B. Patel**, *Nuclear Physics: An Introduction*, **2nd Edition**, New Age International (P) Ltd., New Delhi, 2014.
2. **S. N. Ghoshal**, *Atomic and Nuclear Physics*, **3rd Revised Edition**, S. Chand & Company Ltd., New Delhi, 2010.
3. **D. C. Tayal**, *Nuclear Physics*, **2nd Edition**, Himalaya Publishing House, Mumbai, 2011.
4. **Kenneth S. Krane**, *Introductory Nuclear Physics*, **1st Edition**, John Wiley & Sons, New York, 1988.
5. **Samuel S. M. Wong**, *Introductory Nuclear Physics*, **2nd Edition**, Wiley-VCH, 1998.
6. **W. E. Burcham and M. Jobes**, *Nuclear and Particle Physics*, **2nd Edition**, Pearson Education, 1995.

Suggested e- resources (Websites/e-books):

NPTEL https://nptel.ac.in/courses & https://onlinecourses.nptel.ac.in.

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC201	Core course	Nuclear Physics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Articulation Matrix (Mapping of COs with POs)

Course Outcomes	Correlation with POs										Correlation with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	-	2	3	1	-	-	-	-	3	2	-
CO2	3	2	2	2	3	3	2	1	2	1	3	3	2
CO3	3	3	-	3	3	2	-	-	1	1	3	2	1
CO4	3	3	2	3	3	3	2	1	3	2	3	3	3
CO5	3	3	3	2	3	3	2	2	3	2	3	3	3

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
			Marks	THEORY			PRACTICAL		L	T	P	CREDITS
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC202	Core Course	Digital Electronics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Understand the fundamental concepts of digital electronics, including number systems, Boolean algebra, logic gates, and digital logic simplification techniques.
2. Develop the ability to design and analyze combinational and sequential logic circuits using standard digital building blocks such as adders, multiplexers, flip-flops, registers, and counters.
3. Acquire knowledge of semiconductor memory devices, programmable logic devices (PLDs, CPLDs, and FPGAs), and analog-to-digital and digital-to-analog conversion techniques.
4. Compare and evaluate different digital logic families (TTL and CMOS), their characteristics, interfacing methods, and suitability for practical digital system design.
5. Apply digital electronics concepts to modern scientific instrumentation, data acquisition systems, and experimental physics applications.

COURSE ALIGNMENT WITH UNSDG: The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC202	Core Course	Digital Electronics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Teaching Pedagogy:

T1	Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2	ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

Assessment Tools

AT1-1	Quiz
AT1-2	Activity Based Learning
AT1-3	Midterm Exams
AT1-4	Flip Class
AT1-5	Seminar Presentation
AT1-6	Assignments
AT1-7	Poster
AT1-8	Oral Viva-voce examination
AT1-9	Industrial Visit Report

Prerequisites: HSC Standard knowledge of Classical and Modern Physics

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC202	Core Course	Digital Electronics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Module	Descriptors/Topics	Hours	Assessment tools
I	Number systems: Binary, Octal, Decimal, Hexadecimal, Signed and unsigned binary numbers, 1's and 2's complement arithmetic, Binary codes: BCD, Gray, ASCII, Unicode Boolean algebra and logic gates, Universal gates (NAND and NOR), De Morgan's theorems, SOP and POS forms, Karnaugh Map (up to 5 variables), Logic circuit minimization	08	AT1 AT2 AT3 AT6 AT8
II	Adders and Subtractors: Half and Full Adders, Parallel and Carry Look-Ahead Adders, Comparators, Encoders and Decoders, Multiplexers and Demultiplexers, Parity generators and checkers, Code converters, Applications in digital instrumentation	08	AT1 AT2 AT3 AT6 AT8
III	Latches and Flip-Flops: SR, JK, D and T Flip-Flops, Master-Slave Flip-Flops, Race-around condition, Registers, Shift Registers, Universal Shift Registers, Counters, Asynchronous and Synchronous Counters, Ring and Johnson Counters, Mod-N Counters, State diagrams and state reduction	08	AT1 AT2 AT3 AT6 AT8

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC202	Core Course	Digital Electronics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

IV	**Programmable Logic Devices:** Introduction to Programmable Logic Devices (PLD), CPLD and FPGA: Basic Concepts and Applications Semiconductor Memories: RAM, SRAM, DRAM, ROM, PROM, EPROM, EEPROM, Flash Memory, Memory organization and addressing.	08	AT1 AT2 AT3 AT6 AT8
V	**Digital Systems:** TTL Logic Family: Characteristics, Fan-out, Propagation Delay, Power Dissipation, Noise Margin, CMOS Logic Family, Characteristics and Advantages, CMOS Inverter, Comparison of TTL and CMOS Logic Families, Interfacing between TTL and CMOS Circuits.	08	AT1 AT2 AT3 AT6 AT8
	Total Hours	40	

Additional Resources

A. Value addition to course content/ Skill enhancement content:

Refer relevant online tutorial/ course available on "Swayam portal".

https://onlinecourses.nptel.ac.in/noc21_ee10/preview?

B. Remedial classes for slow learners:

As per the AUMP SOP for slow and fast learners.

Suggested Readings:

Chairperson
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Chairperson
Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Controller of Examination
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
			Marks	THEORY			PRACTICAL		L	T	P	CREDITS
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC202	Core Course	Digital Electronics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Textbooks:

Reference Books:

1. Digital Design, 6th Edition, Pearson Education.
2. Digital Fundamentals, 11th Edition, Pearson Education.
3. Digital Principles and Applications, 8th Edition, McGraw-Hill Education.
4. Modern Digital Electronics, 5th Edition, McGraw-Hill Education.
5. Digital Logic and Computer Design, Pearson Education.
6. Fundamentals of Digital Circuits, 4th Edition, PHI Learning.**gested**

e- resources (Websites/e-books):

NPTEL https://nptel.ac.in/courses & https://onlinecourses.nptel.ac.in.

The Physics of Quantum Mechanics:
https://www-thphys.physics.ox.ac.uk/people/JamesBinney/qb.pdf

Course Articulation Matrix (Mapping of COs with POs)

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC202	Core Course	Digital Electronics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Outcomes	Correlation with POs									Correlation with PSOs			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	2	-	-	-	-	3	2	1
CO2	3	3	3	3	3	2	-	1	2	1	3	3	2
CO3	3	3	3	2	3	3	-	1	2	2	3	3	2
CO4	3	2	2	2	3	3	-	1	2	1	3	2	2
CO5	3	3	3	3	3	3	1	2	3	2	3	3	3

Chairperson
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Chairperson
Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Controller of Examination
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
			Marks	THEORY			PRACTICAL		L	T	P	CREDITS
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC203	Core course	Statistical Mechanics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Develop a comprehensive understanding of the fundamental principles of statistical mechanics and their relationship with classical thermodynamics.
2. Apply ensemble theory and partition functions to derive thermodynamic properties of classical and quantum systems.
3. Analyze the statistical behavior of classical and quantum gases using Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics.
4. Understand the theory of phase transitions, critical phenomena, and symmetry breaking in condensed matter systems.
5. Apply the concepts of non-equilibrium statistical mechanics to transport phenomena, stochastic processes, diffusion, and irreversible thermodynamics.

COURSE ALIGNMENT WITH UNSDG: The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)**.

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC203	Core course	Statistical Mechanics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

1. Explain the microscopic basis of thermodynamics using statistical mechanics and derive equilibrium distribution laws.
2. Apply ensemble methods and partition functions to calculate thermodynamic quantities for classical and quantum systems.
3. Analyze the properties of ideal quantum gases and explain physical phenomena such as blackbody radiation, Bose-Einstein condensation, and electron behavior in metals.
4. Evaluate phase transitions and critical phenomena using Landau theory, the Ising model, and scaling concepts.
5. Solve problems involving stochastic processes, Brownian motion, transport phenomena, and non-equilibrium systems using modern statistical methods.

Teaching Pedagogy:

T1	Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2	ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC203	Core course	Statistical Mechanics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Assessment Tools

AT1-1	Quiz
AT1-2	Activity Based Learning
AT1-3	Midterm Exams
AT1-4	Flip Class
AT1-5	Seminar Presentation
AT1-6	Assignments
AT1-7	Poster
AT1-8	Oral Viva-voce examination
AT1-9	Industrial Visit Report

Prerequisites: HSC Standard knowledge of Classical and Modern Physics

Module	Descriptors/Topics	Hours	Assessment tools
I	Introduction to statistical mechanics and its relation to thermodynamics. Review of thermodynamic laws, thermodynamic variables, equations of state, and kinetic theory of gases. Microstates and macrostates.	09	AT1 AT2

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC203	Core course	Statistical Mechanics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

	Thermodynamic probability and Boltzmann entropy. Phase space, density of states, Liouville theorem, ergodic hypothesis, equal a priori probability, Gibbs paradox, and Maxwell–Boltzmann distribution.		AT3 AT6 AT8
II	Microcanonical, canonical, and grand canonical ensembles. Distribution functions and their physical significance. Partition function and its thermodynamic applications. Thermodynamic functions from the partition function. Classical ideal gas, Sackur–Tetrode equation, equipartition theorem, and energy fluctuations.	09	AT1 AT2 AT3 AT6 AT8
III	Maxwell–Boltzmann, Bose–Einstein, and Fermi–Dirac statistics. Quantum gases and distribution functions. Photon gas and Planck's radiation law. Bose–Einstein condensation. Degenerate Fermi gas, Fermi energy, and Fermi temperature. Electron gas in metals, electronic specific heat, and introduction to density matrix.	09	AT1 AT2 AT3 AT6 AT8
IV	Phase equilibrium and Gibbs phase rule. Clausius–Clapeyron equation. First- and second-order phase transitions. Order parameter and spontaneous symmetry breaking. Landau theory of phase transitions. Ising model (introductory treatment). Critical phenomena, critical exponents, scaling laws, universality, and introduction to renormalization group.	09	AT1 AT2 AT3 AT6 AT8

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC203	Core course	Statistical Mechanics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

V	Random variables and stochastic processes. Random walk and diffusion. Brownian motion, Langevin equation, and Fokker–Planck equation. Correlation functions and fluctuation–dissipation theorem. Transport phenomena: diffusion, thermal conductivity, and viscosity. Master equation, Markov processes, relaxation phenomena, entropy production, and introduction to irreversible thermodynamics.	09	AT1 AT2 AT3 AT6 AT8
	Total Hours	45	

Additional Resources

A. Value addition to course content/ Skill enhancement content:

Refer relevant online tutorial/ course available on "Swayam portal".

https://onlinecourses.nptel.ac.in/noc24_ph10/preview?

https://onlinecourses.nptel.ac.in/noc20_cy28/preview?

B. Remedial classes for slow learners:

As per the AUMP SOP for slow and fast learners.

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC203	Core course	Statistical Mechanics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Suggested Readings:

1. L. D. Landau and E. M. Lifshitz, *Statistical Physics, Part 1 (Course of Theoretical Physics, Volume 5)*, 3rd Edition, Butterworth-Heinemann, 1980.
2. Mehran Kardar, *Statistical Physics of Particles*, 1st Edition, Cambridge University Press, 2007.
3. R. Kubo, H. Ichimura, T. Usui, and N. Hashitsume, *Statistical Mechanics: An Advanced Course with Problems and Solutions*, 2nd Edition, North-Holland (Elsevier), 1990.
4. R. K. Pathria and Paul D. Beale, *Statistical Mechanics*, 4th Edition, Academic Press (Elsevier), 2021.
5. Kerson Huang, *Statistical Mechanics*, 2nd Edition, John Wiley & Sons, 1987.
6. F. Reif, *Fundamentals of Statistical and Thermal Physics*, 1st Edition, McGraw-Hill Book Company, 1965.

Suggested e- resources (Websites/e-books):

NPTEL https://nptel.ac.in/courses & https://onlinecourses.nptel.ac.in.

https://ocw.mit.edu/courses/8-044-statistical-physics-i-spring-2013/

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC203	Core course	Statistical Mechanics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Articulation Matrix (Mapping of COs with POs)

Course Outcomes	Correlation with POs										Correlation with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2		3	3	2	-	-	-	-	3	2	-
CO2	3	3		3	3	2	-	-	1	1	3	3	1
CO3	3	3		3	3	3	-	-	2	2	3	3	2
CO4	3	3		3	3	3	1	1	2	2	3	3	2
CO5	3	3	2	3	3	3	2	1	3	2	3	3	3

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC204	Core course-4	Electrodynamics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Develop a comprehensive understanding of electrostatics, magnetostatics, and the mathematical formulation of electromagnetic fields.
2. Apply Maxwell's equations to analyze electromagnetic phenomena in free space and material media.
3. Understand the propagation, reflection, polarization, and radiation of electromagnetic waves.
4. Analyze electromagnetic wave propagation in waveguides and cavity resonators and their technological applications.
5. Apply the principles of relativistic electrodynamics to the motion of charged particles and modern applications in physics.

COURSE ALIGNMENT WITH UNSDG: The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4 (Quality Education)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

1. Solve electrostatic and magnetostatic problems using Gauss's law, Poisson's equation, Laplace's equation, and boundary value techniques.
2. Analyze electromagnetic fields in dielectric and magnetic materials and explain electromagnetic energy transfer using Poynting's theorem.
3. Derive Maxwell's equations and apply them to study electromagnetic wave propagation in different media.

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC204	Core course-4	Electrodynamics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

4. Explain electromagnetic radiation, waveguide theory, cavity resonators, and their applications in modern communication systems.
5. Apply Lorentz transformations and covariant formulations to analyze electromagnetic phenomena in relativistic systems.

Teaching Pedagogy:

T1	Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching
T2	ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

Assessment Tools

AT1-1	Quiz
AT1-2	Activity Based Learning
AT1-3	Midterm Exams
AT1-4	Flip Class
AT1-5	Seminar Presentation
AT1-6	Assignments
AT1-7	Poster
AT1-8	Oral Viva-voce examination
AT1-9	Industrial Visit Report

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC204	Core course-4	Electrodynamics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Prerequisites: HSC Standard knowledge of Classical and Modern Physics

Module	Descriptors/Topics	Hours	Assessment tools
I	Coulomb's law. Electric field and electric flux density. Gauss's law and its applications. Electrostatic potential. Poisson's and Laplace's equations. Boundary value problems. Uniqueness theorem. Green's theorem and Green's functions. Method of images. Multipole expansion. Polarization and dielectric materials.	10	AT1 AT2 AT3 AT6 AT8
II	Steady currents. Biot–Savart law. Ampere's circuital law. Magnetic vector potential. Magnetic dipole moment and magnetic energy. Magnetic properties of matter: diamagnetism, paramagnetism, and ferromagnetism. Boundary conditions at material interfaces. Electromagnetic fields in dielectric and magnetic media. Poynting theorem and electromagnetic energy density.	10	AT1 AT2 AT3 AT6 AT8
III	Maxwell's equations in integral and differential forms. Displacement current. Electromagnetic wave equation. Propagation of electromagnetic waves in free space, dielectric media, conducting media, and plasmas. Reflection and transmission of electromagnetic waves. Polarization of electromagnetic waves. Poynting vector and energy transport.	10	AT1 AT2 AT3 AT6 AT8

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
				THEORY			PRACTICAL					
			Marks	END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC204	Core course-4	Electrodynamics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

IV	Retarded potentials and Liénard–Wiechert potentials. Radiation from oscillating electric dipoles. Radiation fields and angular distribution of power. Introduction to scattering and radiation reaction. Electromagnetic waves in waveguides and cavity resonators. TE and TM modes. Cutoff frequency and applications in microwave engineering and optical communication.	10	AT1 AT2 AT3 AT6 AT8
V	Lorentz transformations. Four-vectors. Electromagnetic field tensor. Covariant form of Maxwell's equations. Transformation of electric and magnetic fields. Motion of charged particles in electromagnetic fields. Relativistic dynamics. Electromagnetic invariants. Applications to particle accelerators and high-energy physics.	10	AT1 AT2 AT3 AT6 AT8
	Total Hours	50	

Additional Resources

A. Value addition to course content/ Skill enhancement content:

Refer relevant online tutorial/ course available on "Swayam portal".

Electromagnetic Theory – Prof. D. C. Dube (IIT Delhi): https://nptel.ac.in/courses/115102095

B. Remedial classes for slow learners:

Chairperson
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Chairperson
Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Controller of Examination
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC204	Core course-4	Electrodynamics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

As per the AUMP SOP for slow and fast learners.

Suggested Readings:

Reference Books:

1. **David J. Griffiths**, *Introduction to Electrodynamics*, **4th Edition**, Cambridge University Press, 2017.
2. **John David Jackson**, *Classical Electrodynamics*, **3rd Edition**, John Wiley & Sons, 1999.
3. **S. P. Puri**, *Classical Electrodynamics*, **3rd Edition**, Tata McGraw-Hill Education, New Delhi, 2011.
4. Wolfgang K. H. Panofsky and Melba Phillips, Classical Electricity and Magnetism, 2nd Edition, Dover Publications, 2005 (Reprint).
5. A. Zangwill, Modern Electrodynamics, 1st Edition, Cambridge University Press, 2013.
6. Edward M. Purcell and David J. Morin, Electricity and Magnetism, 3rd Edition, Cambridge University Press, 2013.

Suggested e- resources (Websites/e-books):

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc Physics

SEMESTER-II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME									
			Marks	THEORY			PRACTICAL		L	T	P	CREDITS
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHC204	Core course-4	Electrodynamics	Max	60	20	20	30	20	3	0	0	3
			Min	24	16		14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

NPTEL https://nptel.ac.in/courses & https://onlinecourses.nptel.ac.in.

Course Articulation Matrix (Mapping of COs with POs)

Course Outcomes	Correlation with POs										Correlation with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	-	3	3	2	-	-	-	-	3	2	-
CO2	3	3	-	3	3	2	-	-	1	1	3	3	1
CO3	3	3	-	3	3	3	-	1	2	2	3	3	2
CO4	3	3	2	3	3	3	1	1	3	2	3	3	3
CO5	3	3	-	3	3	3	1	1	2	2	3	3	2

Chairperson	Chairperson	Controller of Examination	Registrar
Board of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Faculty of Studies, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore	Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Major Physics

SEMESTER-II(2026-29)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME						L	T	P	CREDITS
			Marks	THEORY			PRACTICAL					
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHL205	Lab	Physics Lab-II	Max				30	20		0	8	4
			Min				14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

provide hands-on experience in electronics, semiconductor characterization, magnetism, thermal radiation, and quantum physics experiments. The course aims to develop experimental skills, analytical thinking, data interpretation, and scientific reporting while reinforcing the theoretical concepts learned in physics courses.

COURSE ALIGNMENT WITH UNSDG:

The Course aims to fulfill the United Nations Sustainable Development Goals, **SDG 4(Quality Education)**.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

Demonstrate proficiency in performing physics laboratory experiments, analyzing experimental data, verifying fundamental physical principles, and interpreting results using appropriate scientific methods while maintaining laboratory safety and ethical practices.

TEACHING PEDAGOGY:

T1 Classroom teaching (white board), Power Point Presentations, Interactive lectures, Inquiry-based teaching

T2 ABL activities, Assignments, Flip Class/ Seminars, Quizzes, Oral Viva-voce examination

ASSESSMENT TOOLS:

ATL1 Quiz

ATL2 Activity Based Learning

ATL3 Midterm Exams

ATL4 Flip Class

ATL5 Seminar Presentation

Chairperson | Chairperson | Controller of Examination | Registrar

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Major Physics

SEMESTER-II(2026-29)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME										
			Marks	THEORY			PRACTICAL		L	T	P	CREDITS
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHL205	Lab	Physics Lab-II	Max				30	20		0	8	4
			Min				14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ATL6 Assignments
ATL7 Poster
ATL8 Oral Viva-voce examination
ATL9 Industrial Visit Report

PREREQUISITES:

Basic knowledge of electricity, magnetism, semiconductor physics, and modern physics

SYLLABUS:

List of Experiments	1. Assembly of logic gates using discrete components and to verify truth table. 2. Solving Boolean Expressions. 3.Estimation of band energy gap of a semiconductor. 4. Hall effect and determination of type and number of carriers. 5. Determination of the value of e/m (specific charge ratio) by Bush method. 6 Determination of the B-H Curve. 7. Temperature variation of resistivity of semiconductor by four probe method and calculate the band gap. 8. Determination of Stefan constant. 9. Determination of Planck's constant by using photocell. 10. To plot the probability distribution curve.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Science

Choice Based Credit System (CBCS) in the light of NEP-2020

M.Sc. Major Physics

SEMESTER-II(2026-29)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME										
			Marks	THEORY			PRACTICAL		L	T	P	CREDITS
				END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MSPHL205	Lab	Physics Lab-II	Max				30	20		0	8	4
			Min				14	9				

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

ADDITIONAL RESOURCES

A. **Value addition to course content/ Skill enhancement content:**
https://www.youtube.com/playlist?list=PLUl4u3cNGP60_JNv2MmK3wkOt9syvfQWY(MIT OCW)

B. **Remedial classes for slow learners:** As per the AUMP SOP for slow and fast learners.

Recommended Books

1. Squires, G. L., *Practical Physics*, Cambridge University Press.
2. Worsnop, B. L., and Flint, H. T., *Advanced Practical Physics*, Asia Publishing House.
3. Gupta, S. L., and Kumar, V., *Practical Physics*, Pragati Prakashan.
4. Chattopadhyay, D., Rakshit, P. C., and Saha, B., *An Advanced Course in Practical Physics*, New Central Book Agency.
5. Singh, S. P., *Advanced Practical Physics*, Pragati Prakashan.
6. Malvino, A. P., and Leach, D. P., *Digital Principles and Applications*, McGraw-Hill.

Suggestede- resources (Websites/e-books)

1. https://ndl.iitkgp.ac.in
2. Access to physics laboratory manuals, textbooks, and reference books.

COURSE ARTICULATION MATRIX (MAPPING OF COs WITH POs)

Course Outcomes	Correlation with POs										Correlation with PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	2	2	3	2	2	3	3	3