SYLLABI AND SCHEME OF EXAMINATIONS FOR SKILL ENHANCEMENT COURSES FOR UNDER GRADUATE PROGRAMS B.Sc. PHYSICAL SCIENCES (MULTIDISCIPLINARY PROGRAMS) OFFERED BY Physics

(Based on Curriculum and Credit Framework for UG Programs under NEP)

WITH EFFECT FROM THE SESSION 2024-25

MAHARSHI DAYANAND UNIVERSITY ROHTAK (HARYANA)

SYLLABI AND SCHEME OF EXAMINATIONS FOR SKILL ENHANCEMENT COURSES FOR

UNDER GRADUATE SINGLE MAJOR/MULTIDISCIPLINARY PROGRAMS/ SINGLE MAJOR PROGRAM AFTER 2nd SEMESTER OF MULTIDISCIPLINARY PROGRAM

Skill Enhancement Course (SEC)	Nomenclature of Course	Course Code	Credits Distribution			Total Credits	Workload			Total Workload	Marks				
			L	T	P		L	T	P		Theory		Practical		Total Marks
											Internal	External	Internal	External	
SEMESTER 1 (2024-25)															
SEC 1 @ 3 credits	Electrical Circuit & Instrumentation Skills	24PHY401SE01	02	0	01	03	02	0	02	04	15	35	05	20	75
SEMESTER II (2024-25)															
SEC 2 @ 3 credits	Computational Techniques in Physics	24PHY402SE01	02	0	01	03	02	0	02	04	15	35	05	20	75
SEMESTER 1II (2024-25)															
SEC 3 @ 3 credits	Physics Workshop Skills	24PHY403SE01	02	0	01	03	02	0	02	04	15	35	05	20	75
SEMESTER VI (2024-25)															
SEC 4 @ 2 credits (offered only in case of Single Major Programme)															
SEMESTER VI1 (2024-25)															
SEC 5 @ 4 credits (if offered as an option)															
SEMESTER VII1 (2024-25)															
SEC 6 @ 4 credits (if offered as an option)															

L: Lecture; T: Tutorial; P: Practical

Syllabi for Electrical Circuit & Instrumentation Skills

Semester -I

Session: 2024-25

Name of Program	B.Sc. Physical Sciences	**Program Code**	UMPS4
Name of the Course	Electrical Circuit & Instrumentation Skills	**Course Code**	24PHY401SE01
Hours per Week	04(2+2)	**Credits**	03
Maximum Marks	Theory : 15+35 Practical: 05+20 Total : 75	**Time of Examinations**	Theory: 03 Hours Practicals: 03 Hours

Note:

Examiner will set nine questions of seven marks each and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks

Course Learning Outcomes (CLO):

After completing this course, the learner will be able to:

CLO1: understand basic physics and applications of CRO

CLO2:understand working and usage of digital multimeter, LCR meter, CRO and ac voltammeter

CLO3: Appreciate and learn importance of specifications of various measuring instruments

CLO4: understand working and operational aspects of Signal Generators

Unit 1:

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter, Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Electronic Voltmeter: Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC milli-voltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac milli-voltmeter, specifications and their significance.

Unit 2:

Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. (6 Lectures) Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

Unit 3:

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. (3 Lectures) Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution. Voltmeter. (3 Lectures) Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution.

Unit 4:

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers. Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.

Practicals:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. To study characteristics of Zener diode.
8. To find high resistance by substitution method
9. Measurement of R, L and C using a LCR bridge/ universal bridge.
10. To study Diode characteristics (I – V).
11. Designing of regulated power supply of 15Volts.
12. To test a diode and transistor using multi-meter and CRO.
13. Designing of B-H loop tracer

Note: A student has to perform at least eight (08) experiments from the above list.

References:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, 3rd Ed., 2012,
7. Tata Mc-Graw Hill
8. Electronic circuits: Handbook of design and applications, U. Tietze, Ch.Schenk, 2008, Springer

9. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

Name of Program	B.Sc. Physical Sciences	**Program Code**	UMPS4
Name of the Course	Computational Techniques in Physics	**Course Code**	24PHY402SE01
Hours per Week	04(2+2)	**Credits**	03
Maximum Marks	Theory : 15+35 Practical: 05+20 Total : 75	**Time of Examinations**	Theory: 03 Hours Practicals: 03 Hours

Note: Examiner will set nine questions of seven marks each and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks

Course Learning Outcomes (CLO):

After completing this course, the learner will be able to:

CLO1: Understand the programming language and their use in various applications

CLO2: Solve difficult integrals using numerical methods

CLO3: Fit experimental data to different types of curves and interpolate the data

CLO4: Students would be able to design Fortran/Python programs to solve numerical computationally

Unit 1:

Introduction to Programming using Python: Structure of a Python Program, Functions, Interpreter shell, Indentation. Identifiers and keywords, Literals, Strings, Basic operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment Operator, Bit wise operator). Standard libraries in Python, notion of class, object and method.

Unit 2:

Creating Python Programs: Identifiers and keywords; Literals, numbers, and strings; Operators; Expressions; Input/output statements; Defining Functions; Control structures (conditional statements, loop control statements, break, continue and pass, exit function), default arguments. Mutable and immutable objects. Testing and debugging a program

Unit 3:

Data types: Integer and Floating-point arithmetic; Fortran variables; Real and Integer variables; Input and Output statements; Formats; Expressions; Built in functions; Executable and non-executable statements; Control statements; Go To statement; Arithmetic IF and logical IF statements; Flow charts; Truncation errors, Round off errors; Propagation of errors. Block IF statement; Do statement; Character DATA management; Arrays and subscripted variables

Unit 4:

Numerical differentiation (Forward and Backward difference formula) and Integration (Trapezoidal and Simpson rules), Curve Fitting: Principle of least square; Linear regression; Polynomial regression; Exponential and Geometric regression, Interpolation: Finite differences; Interpolation with equally spaced points; Gregory - Newton's Interpolation formula for forward and backward interpolation; Solution of ODE First order differential equation using Euler, modified Euler and Runge- Kutta second order methods Second order differential equation e.g. First order differential equation, Radioactive decay, Current in RC and LC circuits with DC source

Practicals:

1. To find the area of a triangle, sphere and cylinder.
2. A program that takes a number as an input from the user and computes its factorial.
3. Calculate the sum and product of two compatible matrices.
4. Numerical Integration using trapezoidal and Simpson1/3 rules
5. Motion of Projectile thrown at an angle
6. Charging and discharging of Capacitor
7. Solution of LR and LCR circuits
8. Least square fitting for linear regression
9. Numerical solution of ordinary differential equation
10. Solution of Quadratic equation

A student has to perform at least eight (08) programs from the above list.

References:

1. E. Balagurusamy, Introduction to Computing and Problem-Solving using Python, 2nd edition, McGraw Hill Education, 2018
2. R C Desai, Fortran Programming and Numerical methods, Tata McGraw Hill, New Delhi.
3. Suresh Chandra, Computer Applications in Physics, Narosa Publishing House
4. M L De Jong, Introduction to Computation Physics, Addison-Wesley publishing company.
5. R C Verma, P K Ahluwalia and K C Sharma, Computational Physics an Introduction, New Age International Publisher.
6. S S Sastry Introductory methods of numerical Analysis, Prentice Hall of India Pvt. Ltd.
7. V Rajaraman, Computer Oriented Numerical Method, Prentice Hall of India Pvt. Ltd.
8. Computer Programming in FORTRAN 77". V. Rajaraman (Publisher: PHI).
9. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co