REVISED SYLLABI AND SCHEME OF EXAMINATIONS FOR MULTIDISCIPLINARY COURSES FOR UNDER GRADUATE PROGRAMS B.Sc. PHYSICAL SCIENCES (MULTIDISCIPLINARY PROGRAMS)

B.Sc. (Physical Sciences) Electronics

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

WITH EFFECT FROM THE SESSION 2024-25

MAHARSHI DAYANAND UNIVERSITY ROHTAK (HARYANA)

Credit structure for multidisciplinary courses for

Under graduate single major/multidisciplinary programs/ single major program after 2nd semester of multidisciplinary program

Name of the Department	Nomenclature of Multidisciplinary Course (MDC) @ 3 credits	Course Code	Credits Distribution			Total Credits	Workload			Total Workload	Marks
			L	T	P		L	T	P	Contact Hours	Formative Assessment
	Electronics in Smart World	24ELEX01MD01	2	0	1	03	2	0	2	04	75
	Electronics in Daily Life	24ELEX02MD01	2	0	1	03	2	0	2	04	75
	Physics Fundamentals – III OR Installation and Maintenance of Solar Panels	25PHYX03MD01 OR 25PHYX03MD02	02	0	01	03	02	0	02	04	75

L: Lecture; T: Tutorial; P: Practical

Note:

A student has to opt for three Multidisciplinary Courses in first three semesters from the pool of the courses offered in the disciplines other than those of Major disciplines and Minor disciplines and the one not studied at 10+2 or equivalent level.

Semester I
Session: 2024-25

Name of Program	Not to be filled	**Program Code**	Not be filled
Name of the Course	Electronics in Smart World	**Course Code**	24ELEX01MD01
Hours per Week	04(2+2)	**Credits**	03
Components			**Marks Distribution**
Written Test (2×10 = 20)			20
Lab work (Practical File)/Field Work (Report)/Portfolio			20
Assignments/ Case Study/ Mini Project (2×10 = 20)			20
Seminar/Presentation			10
Attendance			05
Total			75

Course Learning Outcomes (CLO):

CLO 1: Understand applications of electronics in smart homes

CLO 2: Understand applications of electronics in education sector and agriculture sector

CLO 3: 21TUnderstand applications of electronics in smart healthcare

CLO 4: 21Tget the insight knowledge by experiential learning

Unit 1: Evolution of Smart homes, Concept of Smart Energy Consumption, Intelligent Water Management, Smart Thermostat, voice control, Remote Access, security features and various alarms alerts, CCTV cameras, visual tracking and activity identification

Unit 2: Role of Electronics in Education, e-learning platforms, smart boards, AI platforms in education and learning,21T ChatGPT21T , Role of electronics in Agriculture, Drones and their applications in agriculture, Smart-irrigation systems, weather monitoring and forecasting.

Unit 3: Introduction to Global Positioning System (GPS),use of electronic devices and gadgets in Auto-mobiles, Working and applications **of** Smart watch, RF-ID cards, and ATM

Unit 4: Electronics in Healthcare: Optoelectronic devices and their application in healthcare systems, Digital Thermometers, BP measurement, Digital X-Ray, MRI, USG, ECG (Basic principle only).

Practicals:

Perform at least two activities and make the report on it:

1. Prepare a project report on proposed features of smart Homes
2. Prepare a PowerPoint presentation on any one electronic instrument used in Health care.
3. Prepare a project report on proposed features of smart City
4. Prepare a report on ATM systems.
5. Prepare a report on use of technology in Agriculture sector.

References:

1. Automotive Electrical and Electronics, 37TUAK BabuU37T, Khanna Publications

2. Sensors Handbook- Sabrie Soloman, 2nd Ed. TMH,
3. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI
4. Make sensors: Terokarvinen, Kemo, Karvinen and Villey Valtokari, 1st edition, maker media
5. Ribbens, "Understanding Automotive Electronics", 7th Edition, Elsevier, Indian Reprint
6. https://kanchiuniv.ac.in/coursematerials/autotronics.pdf

Semester II
Session: 2024-25

Name of Program	Not to be filled	**Program Code**	Not be filled
Name of the Course	Electronics in Daily Life	**Course Code**	24ELEX02MD01
Hours per Week	04(2+2)	**Credits**	03
Components			**Marks Distribution**
Written Test (2×10 = 20)			20
Lab work (Practical File)/Field Work (Report)/Portfolio			20
Assignments/ Case Study/ Mini Project (2×10 = 20)			20
Seminar/Presentation			10
Attendance			05
Total			75

Course Learning Outcomes (CLO):

CLO 1: Understand the working principle of measuring instruments like multi-meter, CRO, DSO

CLO 2: Measure of resistance, capacitance, inductance and using different bridges

CLO 3: To understand the use of digital multimeter

CLO 4: Present the experimental results and conclusions by having Hands-on experience in the Laboratory

Unit 1: Resistor, Color code, Inductor, Capacitor, basic Potentiometer circuit, Multiple range Potentiometer Classification of Instruments, Analog and Digital Mode of operations, Basics of CRO, digital Multimeter

Unit 2: 21TAC/DC Voltage, Domestic Electric supply, Transformer, Power consumption, wire, electric tester, clamp meter, Fuse, circuit breaker, Inverter, Electric consumption meter reading, BEE rating, Soldering techniques, LED, Display HD, Full HD and UHD.

Unit 3: 21TRectifiers, transformer, energy meter, basic maintenance of home appliances, Electric Iron, basic idea of internal circuit and working of Inverters and UPS, Switch Mode Power Supply

Unit 4: 21TMeasurement of Earth Resistance: Necessity of Earth Electrode, Necessity of measurement of Earth Electrode, Factors effecting Earth Electrodes, Methods of measuring

Earth Resistance

List of Experiments

1. 21TMeasurement of alternating voltage using multimeter.
2. 21TMeasurement of voltage and Time period and using CRO
3. 21TMeasurement of resistance value using colour codes and multimeter.
4. 21TDesign and verify the potential divider arrangement using resistances
5. 21TTesting of wire, measuring voltage, current and frequency using multimeter
6. 21TDemonstrate soldering of basic electronics components using soldering iron.
7. 21TUnderstanding the role of transformer.
8. Use of multimeter for checking of electrical fuses.

Note: A student has to perform atleast 5 experiments from the above list.

References:

1. Electronics Instrumentation & Measurement Techniques: Cooper; PHI.
2. A course in Electrical & Electronics Measurements & Instrumentation: A.K. Sawhney; Dhanpat Rai & Sons.
3. Electronics Instrumentation by JB Gupta, Satya Prakashan, New Delhi
4. Electronics Measurement and Instrumentation by Oliver, Tata McGraw Hill Education Pvt
5. Electronics Instrumentation and measurement by Sanjeev Kumar and Yash Pal; North Publications
6. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub.

Semester-III

Session: 2025-26

Name of Program	Not to be filled	**Program Code**	Not be filled
Name of the Course	Physics Fundamentals – III	**Course Code**	25PHYX03MD01
Hours per Week	04(2+2)	**Credits**	03
Components			**Marks Distribution**
Written Test (2×10 = 20)			20
Lab work (Practical File)/Field Work (Report)/Portfolio			20
Assignments/ Case Study/ Mini Project (2×10 = 20)			20
Seminar/Presentation			10
Attendance			05
Total			75

Course Learning Outcomes (CLO):

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

CLO1: develop a deep understanding of key principles, including Coulomb's law, electric and magnetic fields, Gauss's law, Ampere's law,

CLO2: solve problems related to electric and magnetic field calculations, potential, capacitance, and diode characteristics

CLO3: explore current-voltage (I-V) characteristics of a p-n junction diode in forward and

reverse bias and rectifier circuit

CLO4: Analyse the behavior of charges in static electric and magnetic fields through

Unit 1:

Electric charge: Properties of charge, comparison of charge and mass, conservation of charge, Quantization of charge, Coulomb's law, Coulomb's law in vector form, Force on a point charge due to multiple charges, Electric field intensity, Electric field due to an isolated point charge, uniformly charged long thin wire and charged ring, Electric dipole and dipole moment. Electric intensity on axial line and equatorial line of an electric dipole, Electric field lines, Electric flux, Gauss's law, Derivation of Coulomb's law from Gauss's law. Capacitance, Capacitance of an isolated spherical conductor, Capacitor and its principle, Capacitance of a parallel plate capacitor, Combination of the capacitor, energy stored in a charged capacitor

Unit 2:

Electric current, Charge carriers in different materials, Ohm's law, resistivity and conductivity. Resistors, types of resistors, Classification of materials based on resistivity, temperature dependence of resistivity, Superconductivity, Combination of resistors, Cell and Battery, the electromotive force of a cell, the internal resistance of a cell, Grouping of cells. Measurement of electric current, Kirchoff's rules, electric energy, electric power, Joules's law of heating, electrical power transmission, electric fuse

Unit 3:

Magnetic field due to current, motion of a charged particle in a magnetic field, Lorentz force, cyclotron, force on a current carrying conductor in a magnetic field, Torque on a rectangular current loop in a uniform magnetic field, Biot-Savart law and its applications, Ampere's circuital law and its applications, Coulomb's law of force between two magnetic poles, Magnetic field lines and magnetic flux, Gauss's law in magnetism, Magnetic dipole and dipole moment, Magnetic field at a point an axial line and equatorial line of a bar magnet, Torque on a bar magnetic in uniform magnetic field. Time period of vibration of a freely suspended magnet in a uniform magnetic field, The earth magnetism, Classification of magnetic materials, Hysteresis, Permanent magnets and electromagnets.

Unit 4:

Dual nature of radiation, Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light, Experimental study of photoelectric effect, Matter waves-wave nature of particles, de-Broglie relation, Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model of hydrogen atom, Expression for radius of nth possible orbit, velocity and energy of electron in nth orbit, Energy bands in conductors, semiconductors and insulators (qualitative ideas only) Intrinsic and extrinsic semiconductors- p and n type, p-n junction, Semiconductor diode - I-V characteristics in forward and reverse bias, application of junction diode -diode as a rectifier

Practicals:

1. To study the variation in potential drop with the length of a wire for a steady current.
2. To determine the resistivity of two/three wires by plotting a graph for potential difference versus current.
3. To study the earth's magnetic field using a compass needle-bar magnet by plotting magnetic field lines and tangent galvanometer

4. To measure resistance, voltage (AC/DC), and current (AC) and check the continuity of a given circuit using a multi-meter.
5. To study various factors on which the internal resistance/EMF of a cell depends.
6. To determine the internal resistance of a given primary cell using potentiometer.
7. To draw the I-V characteristic curve of a p-n junction in forward bias and reverse bias.
8. To draw the characteristic curve of a Zener diode and to determine its reverse breakdown voltage.
9. To identify a diode, an LED, a transistor, an IC, a resistor and a capacitor from a mixed collection of such items

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

References:

1. Concept of Physics by H.C Verma (Part – I & II)
2. Essential University Physics, Vol-I & II by Richard Wolfson
3. Physics by Resnick, Halliday &Walker

OR

Semester-III

Session: 2025-26

Name of Program	Not to be filled	**Program Code**	Not to be filled
Name of the Course	Installation and Maintenance of Solar Panels	**Course Code**	25PHYX03MD02
Hours per Week	04(2+2)	**Credits**	03
Components			**Marks Distribution**
Written Test (2×10 = 20)			20
Lab work (Practical File)/Field Work (Report)/Portfolio			20
Assignments/ Case Study/ Mini Project (2×10 = 20)			20
Seminar/Presentation			10
Attendance			05
Total			75

Course Learning Outcomes (CLO):

After completing this course, learners will be able to:

CLO1: Explain the principles of solar energy and the need for solar energy to electrical energy conversion.

CLO2: Identify the components of SPV systems.

CLO3: Understand the procedure for installing SPV systems.

CLO4: Perform testing and inspection of SPV systems.

CLO5: Develop and implement maintenance schedules.

Unit 1: Introduction to solar energy and solar panels: Solar Energy and its potential, harnessing solar energy, need for Solar energy to electrical energy conversion, Solar photo voltaic (SPV) system, SPV panels and their types, ratings and specifications. Advantages and

disadvantages of SPV panels, basics of load calculation and SPV requirement.

Unit 2: SPV Panels systems and their Installation: Solar panel to SPV systems: OFF grid and ON grid solar systems, Areas of applications of SPV systems, components of solar systems; solar panel, inverter (Stand alone and grid tied) , Battery Energy system (BES), Charge controller, Tools and equipments : Digital Multimeter, Clamp Meter, Hydrometer, Sun pathfinder, Thermography Camera , drills and fasteners, sealents, pliers and strippers, Pyranometer, Personal Protective Equipments (PPE), Battery maintenance kit Battery water filler etc. Installation: Site selection criteria, steps and procedure for solar panel array installation, different mounting structures, installation of AC and DC distribution boxes, earthing and grounding pits, optimal cable sizing and cable laying.

Unit 3: Testing and Inspection: Testing methods and techniques, testing of SPV open circuit and load voltage, Battery SOC testing, testing of protective systems and earth resistance, Inspection of connected systems and running a test.

Unit 4: Maintenance and Troubleshooting: Scheduled and unscheduled maintenance, checking dust accumulation, Module Shading Module Mismatch, Physical Integrity, standard trouble shooting procedure.

Practicals:

1. Measure the open-circuit voltage (V_{oc}) and short-circuit current (I_{sc}) of a solar panel under sunlight using multimeter.
2. Analyze how the tilt angle of a solar panel affects voltage and current output using multimeter.
3. Study the effect of partial shading on solar panel output on V_{oc} and I_{sc}.
4. To draw forward and reverse bias characteristics of a semiconductor diode.
5. Plot the current-voltage (I-V) curve of a PV cell under sunlight using variable resistors.
6. Compare the voltage and current output of PV cells connected in series and parallel.
7. To determine energy conversion efficiency of a PV cell using lux meter.
8. Investigate how reflectors / mirrors can increase the output of a PV cell.
9. Examine how different light colours affect the output of a PV cell using colour filters.
10. Examine the impact of dust on panel performance and the improvement after cleaning.

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

Recommended Books / resources:

1. Solar Photovoltaic technology PHI 2013, Chetan Singh Solanki.
2. Solar Electrical Handbook 2021, Michael Boxwell.
3. Handbook for rooftop solar panel installation in Asia, 2014 Asian Development Bank (ADB).