Syllabus for B.Sc. III (Physics)

Implemented from June 2020

1. Structure of Syllabus: B.Sc.-III Semester-V

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Code	Lectures per week	Credits
Compulsory Papers				BPP508	10	4
Mathematical Physics	BPT501	3	2			
Quantum Mechanics	BPT502	3	2			
Classical Mechanics Relativity and Electrodynamics	BPT503	3	2	BPP509 + Project	10	4
Paper-X: Elective Papers (Any one)						
Electrical Winding, Analog Circuits and Instrumentation	BPT504	3	2			
Electrical Winding, Digital Electronics	BPT505					
Electrical Winding, Modern Physics	BPT506					
Numerical Skills in Physics	SECCPT507	2	1	SECCPP510	4	1

B.Sc.-III Semester-VI

Paper Title	Theory			Practical		
	Paper Code	Lectures Per week	Credits	Paper Title	Lectures per week	Credits
Compulsory Papers				**BPP608**	10	4
Nuclear and Particle Physics	BPT 601	3	2			
Solid State Physics	BPT 602	3	2			
Atomic, Molecular and Astrophysics	BPT 603	3	2	**BPP609 + Project**	10	4
Elective Papers (Any one)						
Solar Energy, Wind and Energy Studies	BPT 604	3	2			
Solar Energy and Energy Harvesting	BPT 605					
Solar Energy, Transducers and Sensors	BPT 606					
Entrepreneurship Development	SECCPT607	2	1	SECCPP610	4	1

Titles of Papers

Sr. No.	Semester-V	Semester-VI
1	BPT501: Mathematical Physics	BPT601: Nuclear and Partical Physics
2	BPT 502: Quantum Mechanics	BPT602 : Solid State Physics
3	BPT503:Classical Mechanics, Relativity and Electromagnetics	BPT603: Atomic, Molecular and Astrophysics
Elective Papers (Any one)		
4	BPT504:Electrical Winding, Analog Circuits and Instrumentation BPT505: Electrical Winding, Digital Electronics BPT506: Electrical Winding, Modern Physics	BPT604:Solar Energy, Wind and Energy Studies BPT605: Solar Energy and Energy Harvesting BPT606:Solar Energy, Transdusers and Sensors
5	SECCPT507 : Numerical Skills in Physics	SECCPT607 :Entrepreneurship Development
6	BPP 508: Practical Paper V	BPP 608: Practical Paper VII
7	BPP 509: Practical Paper VI	BPP 609: Practical Paper VIII
8	SECCPP510: Numerical Skills Practical	SECCPP610: Entrepreneurship Development (Industrial Visit and Project Proposal Writing)

B.Sc. III Semester V
BPT501: **Mathematical Physics**
Theory: 45 Lectures of 48 minutes (36 Hours)
Marks -50 (Credits: 02)

Course Objectives: Students should

1. understand wave method of solving partial differential equations.
2. study applications of partial differential equations.
3. study Cartesian, spherical polar and cylindrical co-ordinate systems.
4. understand Beta and Gamma functions.

UNIT-I

1. Partial Differential Equation (12)

Introduction to differential equations, Method of separation of variables for solving second order partial differential equations, Form of two dimensional Laplace differential equation in Cartesian coordinates and its solution, Three dimensional partial differential equation in Cartesian coordinates and its solution,

2. **Applications of Partial Differential Equations (10)**

The differential equation of progressive wave and its solution, Equation of Vibrating String, One Dimensional Heat Flow, Two Dimensional Heat Flow.

UNIT-II

3. Orthogonal Curvilinear Coordinates (14)

Introduction to Cartesian, spherical polar and cylindrical co-ordinate systems, concept of orthogonal curvilinear co-ordinates, unit tangent vectors, arc length, area and volume elements in orthogonal curvilinear co-ordinate system, gradient, divergence, curl, del and Laplacian in orthogonal curvilinear co-ordinate system, extension of gradient, divergence, curl, del and Laplacian in Cartesian, spherical polar and cylindrical coordinate systems.

4. **Some Special Integrals (9)**

Gamma function, Properties of Gamma function, Beta function, Properties of Beta function, Relation between Beta and Gamma functions, Error function (Probability Integral).

Course outcomes:

Unit I: After completion, Students are able to:

1. solve partial differential equations.
2. understand applications of partial differential equations.

Unit II: After completion, Students are able to:

1. understand Cartesian, spherical polar and cylindrical co-ordinate systems.

2. understand Beta and Gamma functions.

Reference Books

1. Schaum's Outline of Advanced Calculus, Robert C. Wrede, Murray R. Spiegel, McGraw-Hill Education Publication,3rd edition,2010
2. A First Course in Differential Equations with Modeling Applications, Dennis G.Zill, Cengage Learning Publication, 10th edition ,2012
3. Partial Differential Equations, N. P. Bali, Laxmi Publications, 2011
4. Mathematical Physics, B. S. Rajput, Pragati Prakashan-Meerut ,2016
5. Mathematical Methods for Physicists, Arfken, Weber, Elsevier Publication, 7th edition,2012
6. Mathematical Methods for Scientists and Engineers, McQuarrie, Viva Books Publication ,2008
7. Mathematical Physics, H. K. Das, Rama Varma**,** S Chand Publishing ,2018
8. Essential Mathematical methods, K. F. Riley, M. P. Habson, Cambridge University Press,1st edition,2011
9. Mathematics for Physicists, Susan M. Lea, Brooks Cole Publisher ,2003

BPT 502: Quantum Mechanics

Theory: 45 Lectures of 48 minutes (36 Hours)
Marks -50 (Credits: 02)

Course Objectives: Students should

1. understand wave particle duality, uncertainity principle and its applications.
2. study Schrödinger wave equations, Eigen values and Eigen functions.
3. study the applications of Schrödinger wave equation.
4. understand operators, Eigen values and Eigen functions of L^2 and Lz operators Commutation relation between x and p and the Hilbert space and wave functions.

Unit-I:

1. Matter Waves (12)

Wave particle duality, De-Broglie hypothesis of matter waves, Derivation of wavelength of matter wave, Concept of wave packet, Relations between group velocity - phase velocity and group velocity-particle velocity, Davisson and Germer experiment, Uncertainity principle (statement only): position–momentum and energy- time, Application of uncertainity principle-non existence of free electrons in the nucleus.

2. Schrodinger's Wave Equation (10)

Wave function and its physical interpretation, Condition of physically acceptable wave function, Normalized and orthogonal wave functions, Schrödinger time dependent and time independent (steady state) wave equations in 1D and 3D, Probability current density (continuity equation), Eigen values and Eigen functions, Expectation values of dynamic variables.

Unit-III:

3. Applications of Schrodinger's Equation (11)

Particle in a rigid box (infinite potential well) in one dimension and three dimension, Step potential- reflection and transmission coefficients, Potential barrier-tunneling effect (qualitative treatment), Schrodinger equation for Hydrogen atom in spherical polar coordinates, Separation of radial and angular parts, Solution of radial part of Schrodinger's equation - Energy Eigen values.

4. Operators and Mathematical Tools in Quantum Mechanics (12)

Definition of an operator, Position operator (x), Linear momentum operator (p), Hamiltonian operator (H), Angular momentum operator (L)–components of angular momentum operator in Cartesian coordinate system, Ladder operators, Eigen values of L_z and L^2 (use equations for L^2 and Lz in spherical polar coordinates), Commutation relation between x and p, The Hilbert space and wave functions: The linear vector space, The Hilbert space, Dimension and basis of a vector space, Square integrable functions (Wave functions)

Course outcomes:

Unit I: After completion, Students are able to:

1. Define Concept of wave packet and Uncertainty principle.
1. understand Schrödinger time dependent and time independent wave equations

Unit II: After completion, Students are able to:

1. understand applications of Schrodinger equation.
2. understand operators, Commutation relations and Hilbert space.

Reference Books

1. Quantum Mechanics Concept and Applications-Nouredine Zettili,A John Wiley and Sons Ltd Publisher, 2nd edition, 2009
2. Quantum Mechanics, Satya Prakash and C. K. Singh ,KedarNath and RamNath Co. Publisher ,2012
3. Quantum Mechanics,V. Murugan , PEARSON INDIA Publisher , 1st edition ,2014
4. Quantum Mechanics- G.Aruldas , Prentice Hall India Learning Private Limited Publisher,

2nd edition ,2008

5. A Text book of Quantum Mechanics, P.M. Mathews and K. Venkatesan, Tata McGraw Hill Publisher,2nd Edn,2010
6. Quantum Mechanics Theory and Applications, A. K. Ghatak and S. Lokanathan, Laxmi Publications Pvt Ltd, 1st edition, 2019.

BPT 503: Classical Mechanics, Relativity and Electrodynamics
Theory: 45 Lectures of 48 minutes (36 Hours)
Marks -50 (Credits: 02)

Course Objectives: Students should

1. Learn langrangian formulation , D'Alembert's principle and applications.
2. Understand moving co-ordinate system and pseudo forces.
3. Study concepts in special theory of relativity.
4. Study concept of motion of charged particles in uniform electric and magnetic fields.

UNIT I

1. Langrangian Formulation: (11)

Constraints, degrees of freedom, generalized co-ordinates, principle of virtual work, D'Alembert's principle, Lagrange's equation from D'Alembert's principle, Applications of Langrange's equation: Motion of particle in free space, Atwood's machine and Bead sliding on rotating wire.

3.**Hamiltonian Formulation: (10)**

Hamilton's principle, deduction of Hamilton's principle from D'Alembert's principle, deduction of Langrange's equation from Hamilton's principle, Applications - Shortest distance between two points in a plane, Brachistochrone problem.

UNIT II

3. Special theory of Relativity (12)

Inertial and Non-Inertial frame of references, Galilean transformation equations, Michelson-Morley experiment, Ether hypothesis, Postulates of special theory of relativity, Lorentz transformation equations, Relativistic addition of velocities , Length contraction , Time dilation , variation of mass with velocity, mass energy relation.

4. Charged particle Dynamics (12)

Poisson's and Laplace's equation and their physical significance, Laplace equation in one dimension and it's solutions, non-relativistic motion of charged particles- in uniform electric field E, magnetic field B, crossed uniform electric field E and magnetic field B, Relativistic motion of charged particles- in constant electric field E, magnetic field B.

Course Outcomes:

UNIT I: **After completion of the unit, Students are able to:**

1. define constraints, Degree of freedom and generalized coordinates etc., and understand principle of virtual work and D'Alembert's principle.
2. derive Lagrange's equation from D'Alembert's principle and understand its of Langrange's equation

UNIT II: After completion of the unit, Students are able to:

1. define Inertial and Non–Inertial reference frames, Understand Michelson Morley Experiment, define Relativistic addition of velocities, Length contraction, Time dilation. Describe mass energy relation.
2. Define Poisons and Laplace equation and their physical significance and describe motion of charged particles in electric and magnetic fields.

Reference books

1. Classical mechanics, Goldstein Herbert, Narosa public/Person education,2018
2. Classical Mechanics ,N. C. Rana and P. S. Joag, Tata Mcgraw Hill Publishing Co Ltd , 2001
3. Classical Mechanics , S.L. Gupta, V. Kumar and H.V. Sharma, Pragati Prakashan, Meerut, 2001
4. Classical mechanics , P.V. Panat , Alpha Science International Ltd Publisher,2004
5. Introduction to Classical Mechanics, R.G.Takawale and P.S. Puranik , Tata Mc- Graw Hill Publisher , New Delhi,1980
6. Classical Electrodynamics, Puri S.P.,TATA MC GRAWHILL PUBLISHING COMPANY LIMITED ,1990
7. Classical Electrodynamics, Jackson J.D. , Wiley Publisher; Third edition ,2007

BPT 504: Electrical Winding, Analog Circuits and Instrumentation
Theory: 45 Lectures (48 minutes) (36 Hours)
Marks -50 (Credits: 02)

Course Objectives: Students should understand

1. Understand electrical supply system and Introduction to re-winding.
2. Study rewinding procedure of motors.
3. Understand amplifier, power supply and oscillator.
4. Study basic theory and applications of Cathode Ray Oscilloscope.

A. Electrical Winding

UNIT-I

1. Electrical supply system and Introduction to re-winding: (11)

AC single phase and 3-phase supply, Difference between single and three phase supply in respect of voltage, current and power, Safe handling of stripping/winding tools, BIS rules for winding/rewinding, Types of winding wires, Types of insulating materials, Insulating materials as per class of insulation (A/E/B/C/F/H), Reasons for insulation failure in electrical machines, Method of stripping the old winding, Methods of preparing the winding former and the coils, Preparation of winding data as per old winding and rating plate of machine.

2. Rewinding procedure of motors: (11)

Procedure followed for re-winding of all kind of electric motors like single phase AC motors, pump motors, ceiling fan motors, table fan motors, submersible pump motor, etc., various methods of inserting coil into the slots. Preparation of winding table, connection diagram, winding diagram for given Motor, Testing for continuity and insulation.

B. Analog Circuits and Instrumentation

Unit-II

3. Transistor Amplifier and Oscillator (17)

Single stage transistor CE amplifier, load line analysis- D.C. load line, A.C. load line and Q point. Basic Concept of feedback in amplifier, Types of feedback, Barkhausen's criterion for sustained oscillations, Oscillatory circuit (tank circuit), essentials of transistor oscillator, sinusoidal oscillators-phase shift oscillator, Colpitts oscillator, Crystal oscillator using transistors.

4. Basic Theory and Applications of Cathode Ray Oscilloscope (7)

Introduction to CRO, Block diagram of CRO, Principle, Construction and working of CRT, Applications of CRO: measurement of A.C. and D. C. voltages, periodic time, frequency and phase difference, Lissajous figures.

Course Outcomes:

Unit I: After completion, Students are able to

1. explain single phase and 3-phase supply electrical supply system.
2. explain rewinding procedure of motors.

Unit II: After completion, Students are able to

1. explain Amplifier, power supply and oscillator.
2. explain basic theory and applications of Cathode Ray Oscilloscope.

Reference Books

1. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, Tata Mc-Graw Hill New Delhi Publisher,2012.

2. Electronic Principle, Albert Malvino, Tata Mc-Graw Hill Publisher, 2008.
3. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar,Oxford University Press,6th edition,2014.

BPT 505: Electrical Winding and Digital Electronics
Theory: 45 Lectures (48 minutes) (36 Hours)
Marks-50 (Credits: 02)

Course Objectives: Students should

1. Study single phase and 3-phase supply electrical supply system.
2. Understand rewinding procedure of motors.
3. Study working of operational Amplifier and Timer.
4. Study derived gates.

A. Electrical Winding

UNIT-I

1. Electrical supply system and Introduction to re-winding: (11)

AC single phase and 3-phase supply, Difference between single and three, phase supply in respect of voltage, current and power, Safe handling of stripping/winding tools, BIS rules for winding/rewinding, Types of winding wires, Types of insulating materials, Insulating materials as per class of insulation (A/E/B/C/F/H), Reasons for insulation failure in electrical machines, Method of stripping the old winding, Methods of preparing the winding former and the coils. Preparation of winding data as per old winding and rating plate of machine

2. Rewinding procedure of motors: (11)

Procedure followed for re-winding of all kind of electric motors like single phase AC motors, pump motors, ceiling fan motors, table fan motors, submersible pump motor, etc., various methods used of inserting coil into the slots. Preparation of winding table, connection diagram, winding diagram for given Motor, Testing for continuity and insulation.

B. Digital Electronics

Unit-II:

3. Operational Amplifier: (9)

Differential amplifier and its type, Op-Amp, Block diagram of an Op- Amp. Op-Amp parameters, Characteristics of an ideal and practical Op-Amp (IC 741), Applications of Op-Amps: Inverting amplifier and Non-inverting amplifier, Adder, Substractor, Differentiator, Integrator.

4. Digital Electronics and Timer IC (14)

Review of number system, Binary number system, Binary Arithmatic, 1’s and 2's Compliment Method, Octal number System, Hexadecimal number System.

Review of basic logic gates, Derived logic gates (NOR, NAND, XOR and XNOR gates), NAND and NOR gates as universal gates, De Morgan's theorems.

Block diagram of IC 555, IC 555 Pin configuration, Applications of IC 555 as astable and monostable multivibrator.

Course Outcomes:

Unit I : After completion of the unit, students are able to explain

1. single phase and 3-phase supply electrical supply system.
2. rewinding procedure of motors.

Unit II: After completion of the unit, students are able to explain

1. working of operational Amplifier and Timer.
2. derived gates.

Reference Books

1. Digital Principles and Applications, A.P. Malvino, D.P. Leach and Saha, Tata McGraw Hill Publisher ,7th Edition, 2011,
2. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, Oxford University Press. 6th Edition , 2014.
3. Fundamentals of Digital Circuits, A. Anand Kumar, PHI Course Ltd Publisher, 2nd Edition, 2009
4. OP-AMP and Linear Digital Circuits, R.A. Gayakwad, PHI Course Pvt Publisher, 2000
5. Electronic Principle, Albert Malvino, Tata Mc-Graw Hill Publisher,2008
6. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, Tata Mc- Graw Hill Publisher, 2012

BPT 506: Electrical Winding and Modern Physics

Theory: 45 Lectures (48 minutes) (36 Hours)

Marks -50 (Credits: 02)

Course Objectives: Students should

1. Understand single phase and 3-phase supply electrical supply system.
2. Study rewinding procedure of motors.
3. Study concept of optical fiber.
4. Understand number system.

A. Electrical Winding

UNIT-I

1. Electrical supply system and **Introduction to re-winding: (11)**

AC single phase and 3-phase supply, Difference between single and three, phase supply in respect of voltage, current and power, Safe handling of stripping/winding tools, BIS rules for

winding/rewinding, Types of winding wires, Types of insulating materials, Insulating materials as per class of insulation (A/E/B/C/F/H), Reasons for insulation failure in electrical machines, Method of stripping the old winding, Methods of preparing the winding former and the coils. Preparation of winding data as per old winding and rating plate of machine

2. Rewinding procedure of motors: (11)

Procedure followed for re-winding of all kind of electric motors like single phase AC motors, pump motors, ceiling fan motors, table fan motors, submersible pump motor, etc., various methods used of inserting coil into the slots. Preparation of winding table, connection diagram, winding diagram for given Motor, Testing for continuity and insulation.

B. Modern Physics

UNIT-I

1. Optical Fibers (11)

Principle and structure, types of optical fibers, numerical aperture (definition only) and pulse dispersion in step index fiber, fiber optic communication system (qualitative treatment only), advantages of optical fibers.

2. Number System: (12)

Review of number system, Binary to decimal conversion, Decimal to binary conversion, One's Complement Representation, Two's Complement Representation ,Binary Arithmetic, Octal to decimal conversion, Decimal to octal conversion, Octal to Binary conversion, Binary to Octal conversion, Hexadecimal to Decimal conversion, Decimal to hexadecimal conversion, Hexadecimal to Binary conversion, Binary to Hexadecimal conversion.

Course Outcomes:

Unit I : After completion of the unit, students are able to explain

1. electrical supply system and Introduction to re-winding.
2. rewinding procedure of motors.

Unit II: After completion of the unit, students are able to explain

1. concept of optical fibre.
2. number system.

References:

1. Modern Physics , BVN Rao,Wiley Eastern Limited Publisher, 1993.
2. Concepts of Modern Physics , Arthur Beiser, Shobhit Mahajan, S Rai Chaudhury, McGraw Hill Education Pvt. Ltd. Publisher, 7th Edition, 2015.
3. Modern Physics , B. L. Theraja, S. Chand and Company, 16th Edition, 2008
4. Modern Digital Electronics , R. P Jain, Tata McGraw Hill Pvt. Ltd, 4th Edition, 2012.

SECCPT507: Numerical Skills in Physics
Theory: 23 Lectures (48 minutes) (18 Hours)

Course Objective: Students should

1. understand basics of algorithms and flowchart.
2. understand C- Programming.
3. understand python language and operators.

Unit -I:

1. **Algorithms and Flowchart** **(06)**

Algorithms: Definition, properties and development. Flowchart: Concept of Flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar coordinate, Roots of Quadratic Equation, sum of two matrices, sum and product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile at an angle the horizontal.

2. **Overview of Programming and Introduction to Python** **(17)**

Structure of a Python Program, Elements of Python, Hello world application, Interpreters, modules, and a more interesting program, Variables, Names and Assignment, Types Input and Output Statements.

Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator), Conditional and looping statement.

Course Outcomes: After completion, students are able to

Unit I: 1. Define basics of Algorithms and flowchart.

2. Write programs in python.

Reference Books:

1. Introducing Python, Bill Lubanovic, Shroff/O'Reilly Publisher, 1st edition, 2014
2. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press, 2nd edition 2018

BPP 508: Practical Paper V

Course Objectives: Students should understand

1. Understand experimental determination of surface tension by various methods.
2. Understand experimental determination of Yong's modulus (Y) by various methods.
3. Study use of C programming to solve physics experimental calculations.
4. Study use of Scilab software to solve physics experimental problems.

Experiments

1. Resonance pendulum
2. S.T. of soap solution
3. Surface tension of mercury by Fergusson modified method.
4. Surface tension of mercury by ripple method.
5. Y and η using Flat Spiral Spring
6. Y by Koenig's method
7. Y by Cornu's spiral
8. Searle's Viscometer
9. C program to arrange the given set of numbers in ascending/descending order
10. C program to find largest/smallest number from a given set of numbers
11. Scilab Expt. 1 (problem from Quantum Mechanics)
12. Scilab Expt. 2 (problem from Quantum Mechanics)

Course Outcomes: After completion, students are able to

1. determine surface tension of mercury by various practical methods.
2. determine Yong's modulus (Y) by various practical methods.
3. use C program to solve physics experimental calculations.
4. use Scilab software to solve physics experimental problems.

BPP 509: Practical Paper VI

Course Objectives: Student should

1. learn building and testing of various oscillators using BJT.
2. study use of C.R.O. to determine A.C. and D. C. voltages.
3. study relaxation oscillator using UJT.
4. Study methods fault finding and repairing in various electrical motors.

Experiments

1. To design a single stage CE amplifier of given gain using voltage divider bias.
2. To built and test Colpitts oscillator using BJT.
3. To built and test Phase shift oscillator using BJT.
4. To built and test Hartley oscillator using BJT.
5. To determine A.C. and D.C. sensitivity of the C.R.O. and to measure unknown frequency.
6. Measurement of phase shift of RC network using CRO.
7. Band gap energy of semiconductor using p-n junction diode.
8. Verification of D'Morgans Theorems.

9. UJT as Relaxation oscillator.
10. Fault finding and repairing of Pump motors.
11. Fault finding and repairing of ceiling fan motors, table fan motors.
12. Fault finding and repairing of submersible pump motor.

Course Outcomes:

After completion, students are able to

1. built and test various oscillators using BJT.
2. use C.R.O. to determine A.C. and D. C. voltages.
3. study the use of UJT as relaxation oscillator.
4. find fault and its repairing in various electrical motors.

REFERENCE BOOKS:

1. Advanced Practical Physics for Students, B. L. Worsnop and H. T. Flint, Asia Publication House, 1971
2. Practical Physics, S. L. Gupta and V. Kumar, Pragati Prakashan, 27th Edition, 2010.
3. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, New Central Book Agency, 10th edition ,2011
5. Experimental College Physics,White and Manning, McGRAW-HILL Book Company. 3rd edition,1954
6. B.Sc. Practical Physics , H. Singh and P.S. Hemne, S. Chand Publication, 2014
7. Practical Physics , Arora, S. Chand Publication, 1957

SECCPP510: Practical in Numerical Skill in Physics
(Any 10 of following List)

Course Objectives: Student should

1. understand algorithm, flowchart, python program.
2. understand use of WAT.

Experiments:

1. Write an algorithm to find whether a number is even or odd.
2. Draw a flowchart to calculate the sum of the first 10 natural numbers.
3. Write a Python program to Print "Hello" on the screen
4. Write a Python program to display the current date and time.
   Sample Output : Current date and time :2014-07-05 14:34:14
5. Write a program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
6. WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of

the three subjects are to be input by the user.

7. WAP To find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
8. WAP to display the first n terms of Fibonacci series.
9. WAP to find Odd numbers between 1 to n where n is a positive Integer
10. WAP to Swap Two Numbers using Temporary Variable.
11. WAP to find the largest of three numbers.
12. Write a Python program to find those numbers which are divisible by 7 and multiple of 5, between 1500 and 2700 (both included).
13. Write a Python program to find the median of three values. Go to the editor

    Expected Output:

    Input first number: 15

    Input second number: 26

    Input third number: 29

    The median is 26.0

Course Outcomes:

After completion, students are able to

1. write algorithm, flowchart and python program
2. solve the problems by using WAP.

B.Sc. Part-III Semester-VI

Syllabus Structure:

<table>
<tr><td rowspan="2">Paper Title</td><td colspan="3">Theory</td><td colspan="3">Practical</td></tr>
<tr><td>Paper Code</td><td>Lectures Per week</td><td>Credits</td><td>Paper Code</td><td>Lectures per week</td><td>Credits</td></tr>
<tr><td colspan="4">Compulsory Papers</td><td rowspan="3">BPP608</td><td rowspan="3">10</td><td rowspan="3">4</td></tr>
<tr><td>Nuclear and Particle Physics</td><td>BPT 601</td><td>3</td><td>2</td></tr>
<tr><td>Solid State Physics</td><td>BPT 602</td><td>3</td><td>2</td></tr>
<tr><td>Atomic, Molecular and Astrophysics</td><td>BPT 603</td><td>3</td><td>2</td><td rowspan="5">BPP609 + Project</td><td rowspan="5">10</td><td rowspan="5">4</td></tr>
<tr><td colspan="4">Paper-XVI: Elective Papers (Any One)</td></tr>
<tr><td>Solar Energy, Wind and Energy Studies</td><td>BPT 604</td><td rowspan="3">3</td><td rowspan="3">2</td></tr>
<tr><td>Solar Energy and Energy Harvesting</td><td>BPT 605</td></tr>
<tr><td>Solar Energy, Transducers and Sensors</td><td>BPT 606</td></tr>
<tr><td>Entrepreneurship Development</td><td>SECCPT 607</td><td>2</td><td>1</td><td>SECCPP 610</td><td>4</td><td>1</td></tr>
</table>

BPT 601: Nuclear and Particle Physics
Theory: 45 Lectures of 48 minutes (36 Hours)
Marks -50 (Credits: 02)

Course Objectives: Student should

1. enhance the knowledge of particles.
2. learn about the decay phenomenon and the process how they will occur.
3. enhance the knowledge of various model compare to nucleus.
4. enhance the knowledge of detectors and accelerators.

UNIT I

1. General properties of nuclei and nuclear reactions (11)

Composition of nucleus, Nuclear size, Nuclear radius, Nuclear spin, Nuclear magnetic moment, Electric quadrupole moment, Mass defect, Packing fraction, Magic numbers, Binding energy, Binding energy per nucleon and its variation with mass number, Nucleus as a liquid drop, Liquid drop model of nucleus to obtain semi-empirical mass formula.

2. Nuclear Reactions: (4)

General scheme of nuclear reactions, Q value of reaction and its calculation, Exothermic and **e**ndothermic nuclear reactions, threshold energy, deuteron induced reactions, stripping reaction.

UNIT II

1. Particle Accelerators: (11)

Need of accelerators, Cyclotron- construction, working, theory- expression for energy of cyclotron and its limitations, Principle of phase stable orbits, Synchrocyclotron- construction, working, advantages and disadvantages, Betatron- Principle, construction, working condition, expression of energy gain.

2. Nuclear Detectors: (11)

Ionization chamber, Geiger Muller counter- construction, working and theory, dead time and recovery time, quenching mechanism, photoelectric effect, construction of photo-multiplier tube (PMT), Scintillation detector-principle, construction and working, Wilson cloud chamber, Semiconductor detector, cerenkov radiations, cerenkov detector.

3. Particle Physics: (8)

Elementary particles and their classification into leptons, mesons and baryons, Symmetries and conservation laws: energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness and charm, quark model.

Course Outcomes: After completion, students are able to

UNIT I: 1. explain about the knowledge of particles.

2. explain significance of various decays in the nuclear process..

UNIT II:1**.** understand the spin parity concept & magic no. related to shell.

2. know about the detectors and accelerators.

References:

1. Nuclear Physics, D. C. Tayal, Himalaya Publishing House, Mumbai, (5^{th} edition) 2011.
2. Atomic Physics,Volume II: Electricity, Magnetism, and Atomic Physics, John Yarwood University Tutorial Press, London, UK, (1^{st} edition) 1958.
3. Introduction to Nuclear Physics, H. A. Enge, Addison Wesley Publishing Co., Boston, USA, (1^{st} edition) 1966.
4. Nuclear Physics, J. B. Rajam, S. Chand Publishing Co., New Delhi, (7^{th} edition) 1966.
5. Nuclear Physics, W.E.Burcham, Longman Group Limited, London, UK, (2^{nd} edition) 1973.
6. Concepts of Nuclear Physics, B.L. Cohen, McGraw Hill Company, USA, (1^{st} edition) 1976.
7. Atomic and Nuclear Physics, N. Subramanayam and Brij Lal, S.Chand Publishing Co.New Delhi, (2^{nd} edition) 2013.
8. Basic Nuclear Physics and Cosmic Rays, B. N. Shrivastav, Pragati Prakashan, Meerut, (1^{st} edition) 2019.

BPT602: Solid State Physics
Theory: 45 lectures of 48 min (36 Hours)
Marks-50 (Credits: 02)

Course Objectives: Students should

1. understand types of crystal structure and types of solids.
2. study the X-ray diffraction methods for structural analysis of crystals.
3. understand the origin of bands in solid and distinction between metals, semiconductors and insulators.
4. study the superconductivity and types of superconductor.

UNIT I

1. Crystal Structure: **(10)**

Solids: amorphous, polycrystalline and crystalline materials; lattice, basis, unit cell-primitive, non primitive unit cell, symmetry elements of a cube, Bravais lattices in three and two dimensions, Miller indices and interplaner spacing, simple crystal structures – SC, BCC, FCC and HCP (coordination number, atoms per unit cell and packing fraction).

2. X – Ray Diffraction by Crystals: **(10)**

Reciprocal lattice and its properties, Brillouin zone, Diffraction of X-rays by crystals, Ewald construction, Bragg's law in reciprocal lattice, Experimental methods X-ray diffraction (Laue method, rotating crystal method, powder photograph method), Analysis of cubic crystal by powder crystal method.

UNIT II

1. Elementary Band Theory of Solids: **(13)**

Origin of energy bands, one electron approximation, Bloch theorem (statement only), Kronig-Penny model, Velocity of electrons according to band theory, Effective mass of an electron, Distinction between metals, semiconductors and insulators, Hall Effect- Hall voltage and Hall Coefficient.

2. **Superconductivity** **(12)**

Idea of superconductivity, Critical temperature, Critical magnetic field, Meissner effect, Type-I and Type-II superconductors, Introduction of BCS theory, London equation and penetration depth, Isotope effect, Application (magnetic levitation)

Course Outcomes: After completion, students are able to

UNIT I: 1. define various types of solids depending on crystal structure

2. know different methods for structural analysis of crystal

UNIT II: 1. explain concept of energy bands in solid

2. explain superconductivity phenomenon and its types

References:

1. Solid state Physics, S. O. Pillai, New Age Internationl, Publishers, (7th Ed.) 2009.
2. Fundamentals of Solid state Physics, Saxena, Gupta, Saxena and Mandal, Pragati Pakashan, Meerut, (28th Ed.) 2016.
3. Solid State Physics, A. J. Dekker, Macmillan Publishers India Ltd., (1st Ed.) 2000.
4. Introduction to Solid state Physics, Charles Kittel, Wiley India Pvt., (8th Ed.) 2004.
5. Elements of X-ray diffraction, B. D. Cullity and S.Stock, Addison-Wesley, Publishers, (2nd Ed.) 1978.
6. Solid state Physics, R. L. Singhal, Kedarnath Ramnath & Co. Meerut, (7th Ed.) 2001.
7. Solid state Physics, C. M. Kachhava, Tata McGraw-Hill Publishers, (1st Ed.) 2002.
8. Solid state Physics, M.A.Wahab, Narosa Publishing House Pvt.Ltd., (3rd Ed.) 2015.

BPT603: Atomic, Molecular Physics and Astrophysics

Theory: 36 Hours (45 Lectures of 48 minutes)

Marks -50 (Credits: 02)

Course Objectives: Student should study

1. atomic structure, atomic models and atomic spectra.
2. fine structure and Zeeman effect.
3. Rotational spectra and Vibrational spectra.
4. Raman Effect and Characteristic properties of Raman lines**.**
5. Milky Way galaxy and origin of solar system.

UNIT-I

1. Atomic Structure (9)

Revision of atomic models- Rutherford and Bohr model. Electron orbits, Atomic spectra, Bohr atom, Energy level and spectra, Atomic excitation, Vector atom model- quantum numbers, Pauli's exclusion principle.

2. Atomic Spectra (9)

Observed hydrogen fine structure, Spectral notations and optical spectral series for doublet structure, Spectrum of sodium and its doublet fine structure, Selection and intensity rules for fine structure doublets, Normal order of fine structure doublets, Electron spin-orbit interaction, Normal and anomalous Zeeman effect and their explanation from vector atom model, Lande's g factor.

3. Molecular Spectra **(9)**

Molecular bond, Electron sharing, H_2^+ molecular ion, The hydrogen molecule, Rotational energy levels, Rotational spectra, Vibrational energy levels, Vibrational spectra, Vibration – rotation spectra, Electronic spectra of diatomic molecules.

UNIT-II

1. Raman Spectra **(9)**

Raman Effect, Classical and quantum theory of Raman Effect, Characteristic properties of Raman lines, Difference between Raman spectra and infrared spectra.

2. Structure of Universe: **(9)**

Milky Way galaxy, Origin of solar system - Condensation theory; arguments for and against the theory.Hubble law, Big-Bang theory, Steady state theory, Oscillating theory, Cosmological tests.

Course Outcomes: **After completion, students are able to**

UNIT I: 1. understand atomic structure, atomic models and atomic spectra.

2. understand fine structure and Zeeman effect.

UNIT II:1. understand Rotational and Vibrational spectra, Raman Effect and Characteristic properties of Raman lines**.**

2. understand Milky Way galaxy and origin of solar system.

Reference books

1. Modern Physics, J.B. Rajam, S. Chand Publishers, (1st Ed.) 1966.

2. Introduction to Atomic Spectra, H. E. White, McGraw Hill Publishers, 1934.

3. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill Higher Education Publishers, (6th Ed.) 1994.

4. Elements of Atomic and Molecular and LASER Physics, Gupta, Kumar, Sharma, Pragati Prakashan, Meerut, (1st Ed.) 2016.

5. Astronomy: Fundamentals and Frontiers, Robert Jastrow and M. H.Thompson, Wiley NewYork, (2nd Ed.) 1974.

6. Molecular Spectra and Molecular Structure: Spectra of Diatomic Molecules, G. Herzberg, Krieger Pub. Co., (2nd Ed.) 1989.

7. Fundamentals of molecular spectroscopy, Colin N. Banwell and Elaine M. McCash, McGraw-Hill College Publishers, (4th Ed.), 1994

BPT 604: Solar Energy, Wind and Energy Studies
Theory: 45 lectures, 48 minutes (36 Hours)
Marks 50 (Credits: 02)

A: Thermal applications of Solar Energy

Course Objectives: Students should understand

1. the solar dryer in which the grains are dried simultaneously by the heated air from the solar collector.
2. to prepare foods for drying
3. to operate the Solar Food Dryer during the drying process
4. the renewable energy systems, its components and interactions between the components.
5. the knowledge in a special field such as solar energy, storage.

UNIT-I: 1. Solar Drying (11)

Introduction: Drying fundamentals, Sun Vs Solar Drying, Types of Solar Dryers; Direct mode, indirect mode, mixed mode, Solar Dryers in practice: Direct mode natural convection dryers, Direct mode forced convection dryers, Indirect mode forced convection dryers.

2. **Evaluation of Solar Dryers (11)**

Overall System drying efficiency, Pick up efficiency, Solar collection efficiency, Performance of solar dryer, comparative testing. Technical development, costs and design.

B: Energy Studies

UNIT-II: 1. Energy and Wind Energy (11)

Energy, Forms of energy, Man and environment, Energy chains, Classification of energy resources, Energy demands, Age of renewable and alternatives, Wind energy, Wind energy chains, Wind energy quantum, Planning of wind farm, Wind power density, Efficiency factor of wind turbine (P-H graph), Power of wind turbine for a given incoming wind velocity, Types of a wind turbine generator unit, Horizontal axis propeller type wind turbine generator unit.

2. Solar Energy (12)

Solar energy, Solar energy spectrum (UV, Visible and IR), Utilization of solar energy-thermal route, photovoltaic route, Essential subsystems in solar energy plant, Solar constant, Clarity index, Solar insolation, Solar energy from satellite station through microwave to earth station, Solar photovoltaic systems, Merits and limitations of solar PV systems, Prospects of solar PV systems, Power of a solar cell and solar PV panel.

Course Outcomes: After completion, students are able to

UNIT I: 1. design the solar dryer.
2. test foods after drying

UNIT II: 1. perform an initial design of a renewable energy system.

2. identify, define, present and communicate issues within the subject area.

Reference Books

1. Solar Energy Conversion and Photo Energy Systems: Thermal Systems and Desalination Plants (2010), R J Fuller
2. Energy Technology (Non-conventional, Renewable and Conventional): (3rd Ed.), 1994, S. Rao and Dr. Parulekar, Khanna Publishers, Delhi.
3. Non-conventional Energy sources: (6th edition) 1988, G. D. Rai, Khanna Publishers, Delhi.
4. Solar Energy: (4 th Ed.), 2017, S.P. Sukhatme, J.K. Nayak Tata Mc.Graw Hill Ltd, New Delhi.
5. Solar Energy Utilization: (5th edition) 1995, G. D. Rai, Khanna Publishers, Delhi.

BPT 605: Solar Energy and Energy Harvesting

Theory: 45 lectures, 48 minutes (36 Hours)

Marks 50 (Credits: 02)

A: Thermal applications of Solar Energy

Course Objectives: Student should understand

1. the solar dryer and preparation of foods for drying
2. to operate the Solar Food Dryer during the drying process
3. the Piezoelectric energy harvesting applications.
4. the electromagnetic energy harvesting.

UNIT-I

1.Solar Drying (11)

Introduction: Drying fundamentals, Sun Vs Solar Drying , Types of Solar Dryers; Direct mode, indirect mode, mixed mode, Solar Dryers in practice: Direct mode natural convection dryers, Direct mode forced convection dryers, Indirect mode forced convection dryers.

2. **Performance Evaluation of Solar Dryers (11)**

Overall System drying efficiency, Pick up efficiency, Solar collection efficiency, Performance of solar dryer, comparative testing. Technical development, costs and design.

B: Energy Harvesting

Unit II: 1. Piezoelectric Energy harvesting (12)

Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power.

1. Electromagnetic Energy Harvesting **(11)**

Linear generators, recent applications, Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

Course Outcomes: After completion, students are able to

UNIT I: 1. design the solar dryer.

2. test foods after drying.

UNIT II: 1. have deep knowledge on piezoelectric energy harvesting.

2. have deep knowledge on electromagnetic Energy Harvesting

References:

1. Non conventional energy sources, G.D. Rai, Khanna Publishers,New Delhi, (6th Ed.) 1988.
2. Solar enrgy, M. P. Agrawal, S Chand and Co. Ltd, (1st Ed.) 1983.
3. Renewable Energy,Power for a suitable future, Golfrey Boyle, Oxford University Press, (3rd Ed.), 2012 .
4. Solar Energy Resource Assessment Handbook. Renewable Energy Corporation Network for the Asia Pacific, Dr. P, Jayakumar, 2009.

BPT 606: Solar Energy, Transducers and Sensors

Theory: 45 lectures, 48 minutes (36 Hours)

Marks 50 (Credits: 02)

A: Thermal applications of Solar Energy

Course Objectives: To Understand

1.the solar dryer in which the grains are dried simultaneously by the heated air from the solar collector.

2. to prepare foods for drying

3. to operate the Solar Food Dryer during the drying process

4. to elucidate sensors and signal conditioning circuits.

5. the different types sensors and transducers

UNIT-I :

1. Solar Drying **(11)**

Introduction: Drying fundamentals, Sun Vs Solar Drying , Types of Solar Dryers; Direct mode, indirect mode, mixed mode, Solar Dryers in practice: Direct mode natural convection dryers, Direct mode forced convection dryers, Indirect mode forced convection dryers.

2. **Performance Evaluation of Solar Dryers** **(11)**

Overall System drying efficiency, Pick up efficiency, Solar collection efficiency, Performance of solar dryer, comparative testing. Technical development, costs and design.

B: Transducers and Sensors

UNIT-II

1. Mechanical and Electromechanical Transducers: **(11)**

Introduction of Transducers, classification- Active and Passive transducers, Characteristics, Mechanical and electromechanical Transducers: LVDT, Resistive Potentiometer, strain gauge-inductive Transducer, capacitative Transducer, Ultrasonic Transducer.

2. Sensors Basic characteristics **(12)**

Types of photosensistors/photodetectors, X-ray and Nuclear radiation sensors, Fibre optic sensors, Smart sensors, Applications of sensors, Introduction-primary sensors, Excitation amplification, Filters, converters-data communication, standards for smart sensor interface, Film sensors, MEMS sensors, Nano sensors, Applications of sensors.

Course Outcomes: Students are able to

UNIT I: 1. design the solar dryer.

2. test foods after drying

UNIT II: 1. Ability to analyse, formulate and select suitable sensor for the given industrial applications.

2. Acquire In depth Knowledge on different types of sensors and transducers.

Reference Books

1.Solar Energy Conversion and Photo-energy Systems, R J Fuller

2.D. Patranabis, Sensors and Transducers, Prentice-Hall of India, (2nd Ed.), 2005**.**

3.M.J. Usher, Sensors and Transducers, Macmillan, London, 1985.

SECCPT607: Entrepreneurship Development (EDP)
Theory: 24 lectures, 48 minutes (18 Hours)

Course Objectives:

1. Identification of opportunities for development

2. To learn the mechanism of finance and fund raising

3. To understand the importance of marketing for better business opportunities

4. To understand procedure of energy audit.

Unit I : Entrepreneurship Development **06**

Introduction to entrepreneurship, Identification of opportunities for entrepreneurship, Concept of different occupations: - business, employment and profession. Functions of an

entrepreneur. Business idea and plan, Types of businesses / ownerships – Sole Proprietorship, Partnership, Private limited company, Public limited company, Joint stock Company, Co-operative society.

Unit II: Sources of Finance **05**

Preparation of project report for business, Sources of finance – government and nongovernment agencies, Working capital, Cash flow, Fund flow, Preparation of basics of financial statements, costing and pricing, Policies and incentives.

Unit III: Marketing Management **06**

Small business management and entrepreneurship, Woman entrepreneurship, Features of small business firms, Process of management in small business, Concept of data and information, Information as acommodity, Study of marketing strategy and marketing mix, Decision-making models, Types of decisions, Decision Support Systems, Introduction to e-commerce, types – B2B, B2C, C2B, C2C. Case study on Small scale industries in India.

UNIT IV: Energy Audit **07**

Need of Energy audit - Types of energy audit - Energy management (audit) approach - understanding energy costs - Bench marking - Energy performance - Matching energy use to requirements - Maximizing system efficiencies - Optimizing the input energy requirements - Duties and responsibilities of energy auditors - Energy audit instruments - Procedures and Techniques.

Course Objectives: After completion, students are able to

understand about Entrepreneurship, Creativity & Opportunities.

1. avail the financial and marketing skill
2. to prepare the proposal for small scale industry.
3. to study procedure of energy audit.

Reference Books

1. Energy Management, W.R.Murphy, G.Mckay, Butterworth-Heinemann Ltd., 1981.
2. Energy Management Principles, Craig Smith Kelly Parmenter, Elsevier Publishers., 2015.
3. Efficient Use of Energy, I.G.C.Dryden, Elsevier Publishers, (2nd Ed.) 1982.
4. Energy Economics, A.V.Desai, New Age Publishers, 1996.
5. Entrepreneurship, Alpana Trehan, Wiley India Publishers, (1st Ed.) 2011.
6. Complete guide to successful Entrepreneurship, G.N.Pande, S.Chand (G/L) & Company Ltd ., 1994.

BPP 608: Practical Paper VII

Course Objectives: Student should understand

1. experimental determination of wavelength of sodium by various optical methods.
2. absorption spectrum of a liquid $KMnO_4$ solution.
3. practical use of optical fiber.

Experiment

1. Cardinal points by turn table method
2. Measurement of temperature of Na flame
3. Diffraction at a Single Slit
4. Diffraction at cylindrical obstacle
5. Lloyd's single mirror
6. Double refracting prism
7. Diameter of Lycopodium powder
8. Absorption spectrum of a liquid ($KMnO_4$ solution)
9. Study of divergence of LASER beam
10. Determination of Thickness of air film by interference.
11. Measurement of Numerical Aperture
12. Design of fiber optic Transmitter/ Receiver.

Course Outcomes: After completion, students are able to

1. Determinate wavelength of sodium by various optical methods.
2. understand absorption spectrum of a liquid $KMnO_4$ solution.
3. know practical use of optical fiber.

BPP 609: Practical Paper VIII

(Note: Any 12 of the following List)

Course Objectives: Student should understand

1. experimental determination of Self and Mutual Inductance by various methods.
2. calibration of wire by various electrical methods.
3. practical use of solar energy.

Experiment

1. Self Inductance by Owen's Bridge
2. Self Inductance by Rayleigh's Method
3. Measurement of B_H, B_V and θ using Earth Inductor
4. Mutual inductance using Ballistic galvanometer.
5. Resistance of B.G. by half deflection method

6. Calibration of wire by Carey Foster bridge
7. Calibration of wire by Griffith's method
8. Absolute capacity of condenser
9. I-V characteristics of Solar Cell
10. Study of solar collector.
11. Study of solar hot air collector/ solar dryer.
12. Performance evaluation of box type and concentrating type solar cooker.
13. Determination of efficiency of DC/AC inverter.
14. Study of Performance of Solar Lamp.
15. Determination of "Star Rating" of Refrigerator.

Course Outcomes: After completion, students are able to

1. determine Self and Mutual Inductance by various methods.
2. calibrate wire by various electrical methods.
3. use solar energy in practical life.

REFERENCE BOOKS:

1. Advanced Practical Physics for Students, B. L.Worsnop, H. T. Flint, Asia Publ. House., 1971
2. Practical Physics, S. L. Gupta and V. Kumar, Pragati Prakashan., (27th Ed.), 2010.
3. An Advanced course in Practical Physics, , D. Chattopadhyay and P. C. Rakshit, New Central Book Agency, (10th Ed.), 2011.
4. Experimental College Physics, White and manning, McGraw-Hill Book Comp., (3rd Ed.), 1954.
5. B.Sc. Practical Physics, H. Singh and P.S. Hemne, S. Chand Publication, (4th Ed.), 2011.
6. Practical Physics, C.L. Arora, S. Chand Publication, 2010.

SECCPT610: Project Work

Project Proposal Writing/Preparation of entrepreneurship Proposal and Presentation/ Industrial Visits.

Revised Scheme of Practical Examination for B. Sc. Part-III

1. Practical examination are conducted semester wise.
2. There are two practical groups for each semester.
3. Every candidate should perform one experiment from each Practical Paper.
4. Practical examination are conducted for 1.5 days per batch (No. of Students = 12)
5. The examination are conducted in two sessions per day and each session are of three hours duration.

6. Study tour is compulsory.

7. At least 80% practical's must be completed by the student.

8. S**cheme of marking for practical examination B. Sc.III Semester V/VI:**

Semester V	**Marks**	**Semester VI**	**Marks**
BPP 508 (50 marks)		BPP 608 (50 marks)	
One experiment	35	One experiment	35
Submission1: Certified laboratory journal	10	Submission1: Certified laboratory journal	10
Submission 2: Educational Tour/Seminar Report	5	Submission2: Educational Tour/Seminar Report	5
BPP 509 (50 marks)		BPP 609 (50 marks)	
One experiment	35	One experiment	35
Submission: Students Performance	5	Submission: Students Performance	5
Project Report	10	Project Report	10
Total Marks	**100**	**Total Marks**	**100**