M.Sc Physics 2022-23 (R22 Regulations)
Course structure

I SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE	Internal Marks	External Marks	No. of Credits
		L	P	T				
22PH1T1	Classical Mechanics	4	0	0	Core	30	70	4
22PH1T2	Mathematical Physics	4	0	0	Core	30	70	4
22PH1T3	Atomic and Molecular Physics	4	0	0	Core	30	70	4
22PH1T4	Electronics	4	0	0	Core	30	70	4
22PH101	Personality Development through Life Enlightenment Skills	3	1	0	Core	30	70	3
22PH1L1	General Physics – I	0	6	0	Core	30	70	3
22PH1L2	Electronics Lab	0	6	0	Core	30	70	3
TOTAL FOR FIRST SEMESTER						**210**	**490**	**25**

II SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE / DSE/SEC	Internal Marks	External Marks	No. of Credits
		L	P	T				
22PH2T1	Statistical Mechanics	4	0	0	Core	30	70	4
22PH2T2	Quantum Mechanics –I	4	0	0	Core	30	70	4
22PH2T3	Solid State Physics	4	0	0	Core	30	70	4
22PH201	Research Methodology& IPR	3	1	0	SEC	30	70	3
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22PH2D1	Computational Methods and Programming - Matlab	4	0	0	DSE	30	70	4
22PH2D2	Applied Spectroscopy	4	0	0	DSE	30	70	4
22PH2D3	Photonics	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22PH2L1	General Physics – II	0	6	0	Core	30	70	3
22PH2L2	Computational Methods – Matlab	0	6	0	Core	30	70	3
TOTAL FOR SECOND SEMESTER						**210**	**490**	**25**

At the end of 2nd semester, every student must undergo summer Internship/Apprenticeship/Project work/Industrial training/Research based Project work for Six weeks and must prepare a report concerned as per approved project guidelines, and submit the same to the University 14 days before the commencement of third semester end examinations.

III SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE / ID/DS/ SE/OE/ MOOCS	Internal Marks	External Marks	No. of Credits
		L	P	T				
22PH3T1	Quantum Mechanics –II	4	0	0	Core	30	70	4
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22PH3D1	Electromagnetic Theory	4	0	0	DSE	30	70	4
22PH3D2	Lasers and Non linear Optics	4	0	0	DSE	30	70	4
22PH3D3	Condensed Matter Physics – I	4	0	0	DSE	30	70	4
22PH3D4	Thin Film Physics and Technology	4	0	0	DSE	30	70	4
22PH3D5	Microprocessors and Microcontrollers	4	0	0	DSE	30	70	4
22PH3D6	Optical System Design	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22PH3L1	Advanced Physics and Optics	0	6	0	Core	30	70	3
22PH3L2	Electronics IC – Version	0	6	0	Core	30	70	3
OPEN ELECTIVE (INTERDISCIPLINARY/MULTIDISCIPLINARY) COURSES (CHOOSE ANY ONE)								
22OE3PH1	Principles of Analytical Instruments	3	0	0	OEC	30	70	3
22OE3PH2	Introduction to nanomaterials	3	0	0	OEC	30	70	3
22OE3PH3	Physics in everyday life	3	0	0	OEC	30	70	3
TOTAL FOR III SEMESTER						**210**	**490**	**25**

IV SEMESTER

Course Code	Course Name	Teaching Hours/ week			CORE/ID /DS/S/OE/ MOOCS	Internal Marks	External Marks	No. of Credits
		L	P	T				
22PH4T1	Nuclear and Particle Physics	4	0	0	Core	30	70	4
DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY THREE)								
22PH4D1	Analytical Techniques	4	0	0	DSE	30	70	4
22PH4D2	Advances in Materials Science	4	0	0	DSE	30	70	4
22PH4D3	Condensed Matter Physics – II	4	0	0	DSE	30	70	4
22PH4D4	Atmospheric Physics	4	0	0	DSE	30	70	4
22PH4D5	Quantum Field Theory	4	0	0	DSE	30	70	4
22PH4D6	Optical Materials Production and Testing	4	0	0	DSE	30	70	4
LAB PRACTICALS								
22PH4L1	Condensed Matter Physics Lab	0	6	0	Core	30	70	3
ENTREPRENURAL & INNOVATION/IT SKILL RELATED TO DOMAIN SPECIFIC ELECTIVE COURSES (CHOOSE ANY ONE)								
22PH4S1	Optoelectronic devices	3	0	0	SEC	30	70	3
22PH4S2	Introduction to fiber optics	3	0	0	SEC	30	70	3
22PH4S3	Medical Physics	3	0	0	SEC	30	70	3
*** CHOOSE MOOCs FROM SWAYAM/NPTEL SOURCES**								
22PH4M1								4
22PH4P1- PROJECT WORK EVALUATION AND VIVA-VOCE							100	4
TOTAL FOR IV SEMESTER						**180**	**520**	**30**

Note: Students may be allowed to register and appear for MOOCS from the third semester itself. However, students are to complete the MOOCS successfully and submit pass certificate of the same to the University through the Principal of the College concerned for approval and endorsement of the same on grade cards and PCs and ODs as per the regulations of the University.

L – Lecture, T- Tutorial & P – Practicals

P.B. SIDDHARTHA COLLEGE OF ARTS &SCIENCE VIJAYAWADA

Under Choice Based Credit System

Board of studies of

M.Sc., PHYSICS

Semester - I

(With effect from 2022-23)

M.Sc. Physics

(With effect from **2022-23** admitted batch**)**

Name of the Department: PHYSICS

Name of the Programme: Master of Science., Physics

The M.Sc. (Physics) course shall be of two years' duration, extended over four semesters and grading system is followed in linewith national policies and international practices. The candidate shall be allowed a maximum of four years (8 semesters) of duration to be eligible for the award of M.Sc. (Physics) degree, failing which he / she shall have to register once again as a fresh candidate.

PROGRAMME OUTCOMES (POs)

On successful completion of the M.Sc Physics programme the student will be able to:

PO1	Understand of the basic concepts of physics systematically
PO2	Apply physical principles and concepts to solve wide range of practical problems.
PO3	Plan and execute physics related investigations to analyze and evaluate the information using suitable methods.
PO4	Able to execute theoretical and experimental project work
PO5	Excel in research related to Physics and Material Characterization
PO6	Develop the ability to work independently and also in a group
PO7	Engage in life long learning and adapt to changing professional and societal needs

M. Sc PHYSICS

(With effect from 2022-23 admitted batch)

Course Summary:

Semester – I

Course Code	Course Name	Teaching Hours/ week			CORE	Internal Marks	External Marks	No. of Credits
		L	P	T				
22PH1T1	Classical Mechanics	4	0	0	Core	30	70	4
22PH1T2	Mathematical Physics	4	0	0	Core	30	70	4
22PH1T3	Atomic and Molecular Physics	4	0	0	Core	30	70	4
22PH1T4	Electronics	4	0	0	Core	30	70	4
22PH101	Personality Developmentthrough Life Enlightenment Skills	3	1	0	Core	30	70	3
22PH1L1	General Physics – I	0	6	0	Core	30	70	3
22PH1L2	Electronics Lab	0	6	0	Core	30	70	3
TOTAL FOR FIRST SEMESTER						**210**	**490**	**25**

L - Lecture, T- Tutorial & P – Practicals

P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010

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CLASSICAL MECHANICS

Offered to : M.Sc.(PHYSICS) **Course Code**: 22PH1T1

Course Type : Core **Course: CLASSICAL MECHANICS**

Year of Introduction : 2004 **Year of offering :** 2022

Year of Revision : 2022 **Percentage of Revision :** Nil

Semester : I **Credits : 4**

Hours Taught : 60 hrs. per Semester **Max.Time** : 3 Hours

Course Description : Classical mechanics (22PH1T1) is introduced for describing the motion of macroscopic objects as well as astronomical objects under the influence of a system of forces. It is concerned with the set of physical laws describing the motions of bodies mathematically and is highly essential for the enhancing the logical and analytical thinking of the students. For objects governed by classical mechanics, if the present state is known, it is possible to predict how it will move in the future as well as how it has moved in the past. The classical mechanics was based the foundational works of Sir Isaac Newton, and the mathematical methods by Leibniz, Lagrange, Leonhard Euler, etc., in the 17th century. Later, more abstract methods were developed, leading to the reformulations of classical mechanics known as Lagrangian mechanics and Hamiltonian mechanics. They are used in all areas of modern physics.

Course Objectives:

1. To understand the Lagrangian equations for simple classical systems
2. To learn the concept of Hamiltonian mechanics for classical systems
3. To learn the Hamilton-Jacobi formalism of simple classical systems.
4. To understand the canonical transformations and passion bracket relations
5. To impart the methods of solving rigid body dynamics

Course Outcomes: At the end of this course, students should be able to:

CO1: Understand the concepts of Lagrangian formulation and can describe the motion of mechanical systems using Lagrangian formulation.

CO2: Apply the Hamilton formalism to solve problems.

CO3: Apply the concepts of canonical transformations and poission brackets formulation on physical systems

CO4: Understand the formulation of Hamilton-Jacobi equation.

CO5: Apply knowledge the concept of rigid body dynamics and rotating frames on different systems.

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**Newtonian Mechanics and Lagrangian mechanics** Newton's laws, Mechanics of a particle: Conservation laws, Mechanics of a system of particles: Conservation laws, Constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function, L-C Circuit, Lagrangian for a Charged Particle Moving in an Electromagnetic field. (CO1)	12
II	**Variational principles** Hamilton's principle, Deduction of Hamilton's equations from modified Hamilton principle, Derivation of Lagrange's equations from variational Hamilton's principle, Simple applications of the Hamilton principle Formulation-Simple pendulum, Principle of Least Action. (CO2)	12
III	**Canonical transformations** Legendre transformations, Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the Poisson bracket formulation, the angular momentum Poisson bracket relations. (CO3)	12
IV	**Hamilton – Jacobi Method** Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function, Action – angle variables in systems of one degree of freedom. (CO4)	12
V	**Dynamics of a rigid body** Independent coordinates of rigid body, The Euler angles, infinitesimal rotations as vectors (angular velocity), components of angular velocity, angular momentum and inertia tensor, principal moments of inertia, rotational kinetic energy of a rigid body, Symmetric bodies, Euler's equations of motion for a rigid body, Torque-free motion of a rigid body. (CO5)	12

Reference Books:

1. Classical Mechanics, H.GOLDSTEIN (Addison Wesley) 2005.
2. Classical Mechanics, J. C.UPADHYAYA (Himalaya Publishing House) 2010.
3. Classical Mechanics, Gupta, Kumar and Sharma, Pragati Prakashan, 2001
4. Classical Mechanics, G. Aruldass, PHI Learning Private Ltd, 2009

Course Delivery method : Face-to-face / Blended
Course has focus on : Employability
Websites of Interest :https://nlist.inflibnet.ac.in/vsearch.php
Co-curricular Activities Quiz.

P.B. Siddhartha College of Arts & Science, Vijayawada - 520 010.
(An Autonomous College in the jurisdiction of Krishna University)
M.Sc., (PHYSICS) Programme – I Semester
Course Code: 20PH1T1 Title: CLASSICAL MECHANICS
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max. Marks: 70**

SECTION-A

Q.NO **Answer All Questions** **5x4=20M**

1. (A)Explain the concept of generalized co-ordinates
   (Or) (CO1) L2
   (B)Explain Newton's laws of motions with examples

2. (A)Discuss about Hamiltonian function (H)
   (Or) (CO2) L2
   (B)Explain variational principle

3. (A) What are Legendre transformations?
   (Or) (CO3) L1
   (B) Define Poisson Bracket.

4. (A)What is Hamilton's principle function?
   (Or) (CO4) L1
   (B)What are action-angle variables?

5. (A)Define inertia tensor with examples
   (Or) (CO5) L1
   (B)What are space coordinate systems?

SECTION-B
Answer All Questions **5x10=50M**

6. What are constraints? Classify them with suitable examples.
   (Or)
   State D'Alemberts principle and simply Lagrange's equation of motion from it. (CO1) L2

7. A) State and explain the Hamilton's principle.
   (Or)
   B) Demonstrate Hamilton's equations from modified Hamilton's principle. (CO2) L2

8. A) Apply canonical transformations to the harmonic oscillator problem.
   (Or)
   B) Solve the that Poisson's brackets and their properties from canonical transformations (CO3) L3

9. A) Explain the harmonic oscillator problem using Hamilton-Jacobi method.
   (Or)
   B) Explain the significance of Hamilton's characteristic function. (CO4) L2

10. A) Explain Euler's angles and obtain transformation matrix.
    (Or)
    B) Explain the rotational kinetic energy of a rigid body. (CO5) L2

Note: Question paper contains 5 short answers with internal choice from each unit and 5 long answer questions with internal choice from each unit.

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MATHEMATICAL PHYSICS

Offered to : M.Sc.(PHYSICS) **Course Code**: 22PH1T2

Course Type : Core **Course: MATHEMATICAL PHYSICS**

Year of Introduction : 2004 **Year of offering :** 2022

Year of Revision : 2022 **Percentage of Revision :** 20%

Semester : I **Credits : 4**

Hours Taught : 60 hrs. per Semester **Max.Time** : 3 Hours

Course Description : Mathematical Physics (22PH1T2) course is introduced to give emphasis on Special Functions, Laplace and Fourier Transforms and complex variables as they have wide applications in solving the various problems of physics, electrical engineering, optics, and signal processing. The mathematical methods are developed for solving the problems in physics as well as formulation of physical theories and to inculcate the mathematical vigor/rigor in the students.

Course Objectives:

1. To learn the special type of differential equations with their properties and their solutions.
2. To learn the fundamentals and applications of Laplace transformation
3. To understand the fundamentals and applications of Fourier transformation.
4. To understand the basic properties of complex functions and related theorem.
5. To learn the fundamentals and applications of Tensor analysis.

Course Outcomes : At the end of this course, students should be able to:

CO1: Understand the basic concepts of special functions and apply these functions to solve the solution of problems
CO2: Apply the concept of different transforms and applications in different fields.
CO3: Apply the concepts of Fourier series and its applications
CO4: Understand the basic concepts of complex analysis and evaluation of the contour integrals.
CO5: Understand the concept of tensor analysis.

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**Special Functions** Beta and Gamma Functions – Definitions and properties – Evaluation of integrals- Legendre, Bessel, Hermite and Laguerre differential equations – Solutions - Generating functions, Orthogonal properties of Legendre, Bessel and Hermite Functions (Qualitatively) –Recurrence relations. (CO1)	12
II	**Laplace Transforms** Definition and notation, Properties of Laplace transforms – First and Second shifting theorems - Change of scale property - Laplace transform of derivatives - Laplace transform of integral, Laplace transforms of Dirac delta function and Laplace transform of periodic functions (Square wave, saw tooth wave). Inverse Laplace transforms: Definition, Null function, Properties, Solution of linear differential equations with constant coefficients. (CO2)	12
III	**Fourier Transforms** Fourier series: Evaluation of Fourier coefficients, Half range series, Uses of Fourier series. Fourier Transforms: Infinite Fourier transforms - Fourier sine and cosine transforms, Relationship between Fourier transform and Laplace transform, Properties of Fourier transform and Problems. Finite Fourier Transform - Fourier sine and cosine transforms, Fourier integral theorem. (CO3)	12
IV	**Complex Variables** Complex numbers and their algebra, Variables and Functions – Complex differentiation - Analytic function - Cauchy – Reimann equations –Derivatives of elementary functions – Singular points and classification. Complex integration - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's theorem – Residues - calculations of Residues - Residue theorem –- evaluation of definite integrals.(CO4)	12
V	**Tensor Analysis** Definition – Occurrence of tensors in physics – Notation and conventions - Contra variant vector - Covariant vector – Tensors of second rank (mixed tensors).The algebra of tensors: Equality and null tensor - Addition and subtraction of tensors - Outer product of tensors - Inner product of tensors – Contraction of a tensor - Symmetric and anti-symmetric tensors - Quotient law – Fundamental tensor. (CO5)	12

Reference Books:

1. Special Functions, J.N. Sharma & R.K. Gupta (Krishna Prakashan Media (P) Ltd.)
2. Laplace and Fourier Transforms, J.K. GOYAL and K.P. GUPTA (Pragati Prakashan, Meerut).
3. Mathematical Physics, B.D. GUPTA (Vikas Pub.House).
4. Complex Variables, MURRAY R. SPIEGEL (Schaum'sOutlines).
5. Matrices and Tensors in Physics, A.W. JOSHI (Wiley Eastern Ltd.).
6. GERD KEISEROptical Fiber Communications, TataMcGraw-HillBook, 2000

Course Delivery method : Face-to-face / Blended
Course has focus on : Employability
Websites of Interest :https://nlist.inflibnet.ac.in/vsearch.php
Co-curricular Activities : Quiz.

P.B. Siddhartha College of Arts & Science, Vijayawada - 520 010.
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M.Sc., (PHYSICS) Programme – I Semester
Course Code: 22PH1T2 Title: MATHEMATICAL PHYSICS
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max. Marks: 70**

SECTION-A

Q.No **Answer All Questions** **5x4=20M**

1. (a) Define Beta and Gamma functions.
   Or
   (b) Define orthogonal property of Hermite differential equations. (CO1) L1
2. (a) Define Laplace Transform.
   Or
   (b) show that $L\{1\}=\frac{1}{s}$ (CO2) L1
3. (a) Define periodic functions.
   Or
   (b) Define Fourier Transform. (CO3) L1
4. (a) Define analytic function.
   Or
   (b) Discuss about singular points. (CO4) L1
5. (a) Define Tensor.
   Or
   (b) Define dummy suffix notation of Tensors. (CO5) L1

SECTION-B

Q.No **Answer All Questions** **5x10=50M**

6. (a) Obtain the series solution of Legendre differential equations
   (Or)
   (b) Discuss the series solution of Hermite differential equations (CO1) L1

7. (a) Explain first and second shifting theorem of Laplace Transform.
   (Or)
   (b) Discuss the solution of linear differential equations with constant coefficients (CO2) L1

8. (a) Explain the properties of Fourier Transforms.
   (Or)
   (b) Find the Fourier Transform of impulse function. (CO3) L2

9. (a) State and prove Cauchys-Reimann equation
   (Or)
   (b) State and explain Cauchy's residue theorem. (CO4) L2

10. (a) Explain about contravariant and covariant with examples.
    (Or)
    (b) Explain Tensor theory of thermal expansion. (CO5) L2

Note: Question paper contains 5 short answers with internal choice from each unit and 5 long answer questions with internal choice from each unit.

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ATOMIC AND MOLECULAR PHYSICS

Offered to : M.Sc.(PHYSICS) **Course Code**: 22PH1T3

Course Type : Core **Course: ATOMIC AND MOLECULAR PHYSICS**

Year of Introduction : 2004 **Year of offering :** 2022

Year of Revision : 2022 **Percentage of Revision :** Nil

Semester : I **Credits : 4**

Hours Taught : 60 hrs. per Semester **Max.Time** : 3 Hours

Course Description : Atomic and Molecular Physics (22PH1T3) course deals the interaction between matter and electromagnetic radiation. It covers rotational, vibrational and electronic transitions responsible for atomic and molecular spectra. The atomic absorption and emission spectroscopic techniques are introduced for their wide applications in research and development, technology and medicine. A crucial component of this course is to understand, the behaviour of the electrons that surround the atomic nucleus, the way atoms and molecules interact with their environment.

Course Objectives:

1. To learn principles, instrumentation and applications of atomic absorption spectroscopy
2. To learn principles, instrumentation and applications of atomic emission spectroscopy
3. To understand the rotational motion of diatomic molecules and role of dipole moment in molecular spectroscopy
4. To learn the vibration rotation spectra of diatomic molecules
5. To learn the electronic spectroscopy of diatomic molecules

Course Outcomes:

At the end of this course the students should be able to:

CO1: Understand the principle and applications of atomic absorption, emission spectrometer.

CO2: Apply the techniques of the atomic emission spectroscopy and flame photometry to the materials.

CO3: Apply the concept of rotational spectra to find the bond lengths of different molecules.

CO4: Understand the concept of vibrational spectra of different molecules.

CO5: Understand the electronic spectra of diatomic molecules.

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**Atomic Absorption Spectroscopy** Introduction – Principle – Differences between Atomic Absorption Spectroscopy and Flame Emission Spectroscopy– Advantages of Atomic Absorption Spectroscopy over Flame Emission Spectroscopy–Disadvantages of Atomic Absorption Spectroscopy– Instrumentation– Single and Double beam Atomic Absorption Spectroscopy—Applications of Atomic Absorption Spectroscopy. (CO1)	12
II	**Atomic Emission Spectroscopy and Flame Photometry** Introduction – Theory of Emission Spectroscopy –Instrumentation –Spectrographs – Applications of Emission Spectroscopy– Advantages and Disadvantages of Emission Spectroscopy– principle and instrumentation of Inductively coupled plasma - atomic emission spectroscopy (ICP-AES) Principle and Instrumentation of Flame Photometry –Applications of Flame Photometry (CO2)	12
III	**Rotational Spectroscopy** Introduction – Classification of molecules – Rotational spectra of a diatomic molecule – rigid rotator – Isotopic effect in Rotational spectra–Intensity of rotational lines– non-rigid rotor – linear polyatomic molecules – Symmetric top molecules. Moment of Inertia and bond lengths of linear tri-atomic molecule– Microwave spectrometer. Applications of Rotational Spectroscopy - Microwave Oven. (CO3)	12
IV	**Vibrational Spectroscopy** Introduction – Diatomic molecule as simple harmonic oscillator – Anharmonic oscillator – vibrating rotator - Energy levels and spectrum, Effect of isotopic substitution on vibrational bands, Sample handling techniques– FTIR spectroscopy – Principle – FTIR Spectrometer - Applications of vibrational spectroscopy (CO4)	12
V	**Electronic Spectroscopy of Diatomic Molecules** Introduction– Vibrational coarse structure– Vibrational analysis of band systems: Deslandres table – Progressions and sequences information derived from vibrational analysis – Morse potential energy curve – Frank-Condon principle – Rotational fine structure of electronic vibranic spectra- Fortrat Parabolae – Dissociation – Predissociation. (CO5)	12

Text and Reference Books:

1. Atomic and Molecular Spectroscopy, Gurdeep Chatwal, Sharma Anand, Himalaya Publishing House
2. Molecular Structure and Spectroscopy, G. Aruldhas, Prentice- Hall of India, Pvt, New Delhi, (2014).
3. Fundamentals of Molecular Spectroscopy, C.N. BANWELL and E.M. McCASH (Tata McGraw-Hill - 2013).
4. Modern Spectroscopy, J.M. HOLLAS (John Wiley &Sons).
5. Molecular Spectroscopy, J.M. Brown, Oxford Science Publications, Oxford. (1998).

Course Delivery method : Face-to-face / Blended
Course has focus on : Employability
Websites of Interest :https://nlist.inflibnet.ac.in/vsearch.php
Co-curricular Activities : Quiz.

P.B. Siddhartha College of Arts & Science, Vijayawada - 520 010.
(An Autonomous College in the jurisdiction of Krishna University)
M.Sc., (PHYSICS) Programme – I Semester
Course Code: 22PH1T3 Title: ATOMIC AND MOLECULAR PHYSICS
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max. Marks: 70**

SECTION-A

Answer all questions **5x4=20 M**

1. **(A)** What are the difference between atomic absorption spectroscopy and flame emission spectroscopy? CO1, L1

(Or)

(B) What are applications of atomic absorption spectroscopy?

2. (A) What are the applications of emission spectroscopy? CO2, L1

(Or)

(B) What are the applications of photometry?

3. (A) What are the conditions for pure rotational spectrum of a diatomic molecule?

(Or)

(B) What are the features of pure rotational spectrum? CO3, L1

4. (A) What change does the interaction between vibration and rotation cause in the spectrum of a diatomic molecule? CO4, L1

(Or)

(B) What are applications of vibrational spectroscopy?

5. (A)Explain Morse potential energy curve. CO5, L1

(Or)

(B)What are Fortrat parabolae?

SECTION-B

Answer all questions **5x10=50M**

6. (A) Explain the principle of atomic absorption spectroscopy. CO1,L2

(Or)

(B) With a neat schematic diagram explain the construction and working of atomic absorption spectrometer

7. A) Explain the theory of emission spectroscopy with neat diagram. CO2, L2

(Or)

B) Explain the principle of flame photometry and discuss the instrumentation of flame photometry with neat diagram

8. A)Explain the rotational spectrum of a diatomic molecule treating it as a rigid rotator. CO3,L2

(Or)

B) With the help of neat block diagram explain the set up and working of microwave spectrometer.

9. A) Explain the vibrational spectrum of a diatomic molecule treating it as harmonic oscillator and explain isotopic effect in vibration bands.

(Or)

B) Explain the set up and working of FTIR spectrometer with a neat block diagram. CO4, L2

10. A) Explain deslandres table for the band spectrum of a diatomic molecule. CO5, L2

(Or)

B)Explain the fine structure of electronic vibrational transitions

Note: Question paper contains 5 short answers with internal choice from each unit and 5 long answer questions with internal choice from each unit.

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ELECTRONICS

Offered to : M.Sc.(PHYSICS)

Course Code: 22PH1T4

Course Type : Core(TH)

Course: Electronics

Year of Introduction : 2004

Year of offering : 2022

Year of Revision : 2022

Percentage of Revision : Nil

Semester : I

Credits : 4

Hours Taught : 60 hrs. per Semester

Max.Time : 3 Hours

Course Description : Electronics (22PH1T4) is designed to help the students in enhance the expertise in designing of electronic circuits & integrated circuits and operation of electronic systems. This course comprises subjects like Operational Amplifiers, Communication Electronics, Digital Electronics and Microprocessor. This course deals with control of electron flow by amplification and rectification, which has influenced highly the modern society. Practical applications started with the invention of the diode and the triode in the early 1900s, which made the detection of small electrical voltages. They were responsible for the electronics revolution of the first half of the twentieth century. They enabled the construction of equipment that used current amplification and rectification to give us radio, television, radar, long-distance telephony, broadcasting and communications, the music recording industry and many more..

Course Objectives:

1. To know the basic concepts of operational amplifier.
2. To understand the practical op-Amp circuits.
3. To understand the importance of communication electronics.
4. To learn the digital electronic circuits.
5. To learn the working of 8085 microprocessor.

Course Outcomes : At the end of this course, students should be able to:

CO1: Understand the concepts of differential amplifier.
CO2: Analyze the practical applications of Op-Am
CO3: Understand the process in communication electronics.
CO4: Understand the fundamentals of digital electronics.
CO5: Analyze the architecture of 8085 micro processor.

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**Operational Amplifiers** Differential Amplifier – circuit configurations –- DC analysis – Ac analysis, inverting and non-inverting inputs, CMRR, Block diagram of a typical Op-Amp-analysis. Op -Amp Architecture, Open loop configuration inverting and non-inverting amplifiers. Op-amp with negative feedback- voltage series feedback – effect of feedback on closed loop gain, input resistance, output resistance,- voltage follower. (CO1)	12
II	**Practical Op-amps** Input offset voltage- input bias current-input offset current, total output offset voltage, CMRR frequency response. Summing amplifier, Scaling and Averaging amplifiers, integrator and differentiator. Oscillators principles – oscillator types –The phase shift oscillator, Wein bridge oscillator, LC tunable oscillators – Multivibrators- Monostable and astable –comparators – square wave and triangular wave generators- Voltage regulators. (CO2)	12
III	**Communication Electronics** Introduction to communication system–Need for modulation – Amplitude modulation– Generation of AM waves – Demodulation of AM waves – DSBSC modulation. Generation of DSBSC waves. Coherent detection of DSBSC waves, SSB modulation, Generation and detection of SSB waves. Vestigial side band modulation, Frequency Division Multiplexing (FDM). (CO3)	12
IV	**Digital Electronics** Combinational Logic gates- Decoder- encoders- Multiplexer (data selectors)-application of multiplexer - De multiplexer (data distributors), Sequential Logic gates- Flip-Flops; the R-S Flip – Flop, JK Flip-Flop –JK master slave Flip-Flops – T- Flip – Flop – D Flip – Flop , Registers; Buffer registers- Shift registers – synchronous and asynchronous counters, application of counter.(CO4)	12
V	**Microprocessors** Introduction to microcomputers – Input /Output devices – ALU, Timing and Control Unit – registers memory — Pin configuration Description- Architecture and its operations – Address and Data Busses – generating control signals – instruction set – addressing modes - assembly language Programs –looping, counting and indexing – counters and timing delays – stack and subroutine. (CO5)	12

Text and Reference Books:

1. Op-Amps & Linear integrated circuits, RAMAKANTH A.GAYAKWAD (PHI).
2. Electronic Communication Systems, George Kennedy (PHI)
3. Semiconductor Electronics, A.K.SHARMA (New Age International Publishers).
4. Fundamentals of Digital Circuits, A. ANANDA KUMAR, (PHI).
5. Digital principles and applications, MALVINO AND LEECH (TMH).

Course Delivery method : Face-to-face / Blended
Course has focus on : Employability
Websites of Interest :https://nlist.inflibnet.ac.in/vsearch.php
Co-curricular Activities : Quiz

P.B. Siddhartha College of Arts & Science, Vijayawada - 520 010.
(An Autonomous College in the jurisdiction of Krishna University)
M.Sc., (PHYSICS) Programme – I Semester
Course Code: 22PH1T4 Title: ELECTRONICS
(w.e.f admitted batch 2022-23)

Time: 3 Hours **Max. Marks: 70**

SECTION-A

Answer All Questions 5x4=20M

1 (A) Explain the construction of differential amplifier CO1 L1

(Or)

(B) What are applications of differential amplifier ?

2 (A) Discuss the typical Op-Amp block diagram CO2 L1

(Or)

(B) What are the applications of operational amplifier ?

3 (A) Explain modulation and de modulation with examples CO3 L2

(Or)

(B) Discuss frequency division multiplexing

4 (A) Explain the construction and working of D and T- flip flops CO4 L2

(Or)

(B) What are the application for shift registers

5 (A) Explain stack and sub routine. CO5 L2

(Or)

(B) What are the addressing modes of 8085 MP?

SECTION - B

6. (A) Discuss the AC analysis of differential amplifier CO1 L2

(Or)

(B) With the help of neat circuit diagram explain the working of voltage-series feedback amplifier and derive expression for closed loop voltage gain

7. (A) Discuss the construction and working of Integrator CO2 L2

(Or)

(B) Explain the construction and working of RC-phase shift oscillator

8 (A) Write a note on generation and detection of AM waves CO3 L2

(Or)

(B) What are the different methods to produce SSB waves? Explain.

9 (A) Explain the construction and working of JK flip flop CO4 L2

(Or)

(B) Discuss the construction and working of synchronous counters.

10 (A) Discuss the architecture of 8085 micro processor CO5 L2

(Or)

(B) Explain the instruction set and addressing modes of 8085

Note: Question paper contains 5 short answers with internal choice from each unit and 5 long answer questions with internal choice from each unit.

P.B. SIDDHARTHA COLLEGE OF ARTS & SCIENCE

Siddhartha Nagar, Vijayawada – 520 010

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Personality Developmentthrough Life Enlightenment Skills

Offered to : M.Sc.(PHYSICS) **Course Code**: 22PG101

Course Type : Core(TH) **Course: Personality Developmentthrough Life Enlightenment Skills**

Year of Introduction : 2004 **Year of offering :** 2022

Year of Revision : 2022 **Percentage of Revision :** 100%

Semester : I **Credits : 3**

Hours Taught : 60 hrs. per Semester **Max.Time** : 3 Hours

Course Prerequisites (if any) :

Course Description : Personality development is the development of your behavior patterns and attitude. It is the result of where we are born, the circle we interact with and our personal temperament. Every person is different. There are some characteristics traits that make you „you". Personality development through life enlightenment course aims to help students identify negative behaviors which may be stopping them from reaching their desired goals. This course will help students both in their personal and desired professional life. The other purposes of personality development through life enlightenment course are to enable you lead stress-free and healthier life, ethical decision making ability, enhanced confidence level, and building a more pleasing personality.

Course Objectives:

1. To learn for achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To learn build positive attitude, self-motivation, enhancing self-esteem and emotionalintelligence
4. To learn develop coping mechanism to mange stress through Yoga and meditationtechniques
5. To awaken wisdom among them.

Course Outcomes : At the end of this course, students should be able to:

CO1: Understand their personality and achieve their highest goals of life.
CO2: Understand the nation and mankind to peace and prosperity
CO3: Understand a versatile personality
CO4: Understand emotional self regulation.
CO5: Understand a positive approach to work and duties

Syllabus		
Unit	**Learning Units**	**Lecture Hours**
I	**Introduction to Personality Development** The concept of personality - Dimensions of Personality – Theories of Personality development (Freud & Erickson) – The concept of Success and Failure – Factors responsible for Success –Hurdles in achieving Success and Overcoming Hurdles — Causes of failure – Conducting SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis. (CO1)	12
II	**Attitude, Motivation and Self-esteem** Conceptual overview of Attitude – Types of Attitudes – Attitude Formation – Advantages/ Disadvantagesof Positive/Negative Attitude - Ways to Develop Positive Attitude. **Concept of motivation:** Definition and Nature of Motivation/Motive – Internal and external motives –Theories of Motivation – Importance of self- motivation- Factors leading to de-motivation.**Self-esteem** - Definition and Nature of self-esteem – Do's and Don'ts to develop positive self- esteem –Low self esteem - Personality having low self esteem - Positive and negative self esteem.(CO2)	12
III	**Other Aspects of Personality Development** Body language - Problem-solving - Conflict Management and Negation skills - Decision-making skills - Leadership and qualities of a successful leader – Character building - Team-work – Time management - Work ethics – Good manners and etiquette – Emotional Ability/Intelligence – Dimensions of Emotional Intelligence – Building Emotional Intelligence.	12
IV	**Neetisatakam-Holistic Development of Personality** Verses- 19,20,21,22 (wisdom) – Verses- 29,31,32 (pride and heroism) – Verses- 26,28,63,65(virtue) **Personality of Role Model – Shrimad Bhagwadgeeta** Chapter2-Verses 17, Chapter 3-Verses 36,37,42 – Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63 (CO4)	12
V	**Yoga & Stress Management** Meaning and definition of Yoga - Historical Perspective of Yoga - Principles of Astanga Yoga by Patanjali – Meaning and Definition of Stress - Types of Stress - Eustress and Distress –Stress Management – Pranayama- Pranayama: Anulom and Vilom Pranayama - Nadishudhi Pranayama– Kapalabhati-Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama – Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT) (Theory & Practical). (CO5)	12

PRACTICAL COMPONENTS:

1. Students should identify different types of personality to know their own personality. Students are to describe the characteristics of their personalities and submit the same for assessment.
2. Students are to form in groups (a group consists of 4-6 students) to identify and write a brief note on famous personalities of India and World.
3. Students are required to identify different types of attitudes and give any five examples ofeach.
4. Students are expected to check their attitudes and develop ways to improve their attitudesatwork place and home.
5. Students are required to identify keys to self-motivation to achieve their goals.
6. Students are expected to identify at least seven types of body language and conduct activities with the following:

S. No.	Pose	Possible Interpretations
1	Standing with your hands on your hips	Aggressive, disgusted
2	Standing upright	Confidence
3	Arms crossed on your chest	Defensive
4	Resting your hand on your cheek	Thinking
5	Touching or rubbing your nose	Doubt, lying
6	Resting your head in your hands	Boredom, tired
7	Tapping your fingers	Impatience
8	Biting your nails	Nervous, insecure
9	Playing with your hair	Insecure
10	Rubbing your eyes	Disbelief, doubt

Conduct the following exercise to develop communication skills –Negotiation Skillsand Empathy<u>Exercise: Card Pieces</u>

In this activity, team members trade pieces of playing cards to put together completecards.

<u>Use</u>s-This exercise is useful for showing team members others' perspectives. It builds communication and <u>negotiation skills</u> **, and helps people to develop** <u>empathy</u> **.**

<u>People and Materials</u>

i) Enough people for at least three teams of two.
ii) Playing cards – use between four and six for each person.
iii) A private room.

Time -15 minutes.

Instructions:

1. Cut each playing card into half diagonally, then in half diagonally again, so you have fourtriangular pieces for each card.
2. Mix all the pieces together and put equal numbers of cards into as many envelopes as you haveteams.
3. Divide people up into teams of three or four. You need at least three teams. If you're short ofpeople, teams of two will work just as well.
4. Give each team an envelope of playing card pieces.
5. Each team has three minutes to sort its pieces, determine which ones it needs to makecomplete cards, and develop a bargaining strategy.
6. After three minutes, allow the teams to start bartering for pieces. People can barter on theirown or collectively with their team. Give the teams eight minutes to barter.
7. When the time is up, count each team's completed cards. Whichever team has the mostcards wins the round.

Advice for the Teacher/Facilitator

After the activity, ask your team members to think about the strategies they used. Discussthesequestions

1) Which negotiation strategies worked? Which didn't?

2) What could they have done better?
3) What other skills, such as **active listening** or **empathy** , did they need to use?

Conduct following Time management activity - Ribbon of Life

Take a colored ribbon length of approximately 1 meter/100 cm. and scissors.Start with the following questions:

1. If the life span of an individual is say, 100 years. Consider that each cm represents one year. The response will be that few live that long. Assuming a life of 75 to 90 years, cut 10 to 25 cm off the ribbon, accordingly.
2. What is the average age of the participants sitting here, the response would be 25 to 30 depending on the group, in that case, cut another 25 cms of the ribbon and say that is gone you cannot do anything.
3. What is left is 50 years? People will say, "Yes," but the answer is NO.
4. Every year we have 52 weeks, that is 52 Sundays. If we multiply that by 50 years, it comes to 7.14 years. Reduce the ribbon by another 7.14 cm.
5. We also usually have Saturdays off, so reduce another 7. cms.
6. Public/National holidays are 10 multiple with 50 years. That comes to another 1.5 years. Reduceribbon by another 1.5 cms.
7. Your casual leave, sick leave, and annual holidays approx. 40 days a year, multiplied by 50. Cut off another 5 cms. Now you are left with about 29.5 years. But, the calculation is not over yet.
8. You sleep an average of 8 hours daily; multiply that by 365 days and again by 50 years (i.e. 122 days X 50 = almost 17 years). Cut off another 17 cm.
9. You spend time eating lunch, breakfast, snacks, and dinner total 2 hours daily (i.e. 30 days a year X 50 years= 4 years or so). Cut off another 4 cm.
10. Last, let‟s figure we spend about 1 hour a day traveling from place to place for activities and such. (that‟s about 2 more years). We‟re down to 6 (SIX) years of life to make itor break it.

- **Exercise Decision making skills - Create Your Own**

In this exercise, teams must create their own, brand new, problem-solving activity.

Uses: This game encourages participants to think about the problem-solving process. It builds skills such as creativity, negotiation and decision making, as well as communication and time management. After the activity, teams should be better equipped to work together, and to think on their feet.

What You'll Need

- Ideally four or five people in each team.
- A large, private room.
- Paper, pens and flip charts.

Time -Around one hour.

Instructions:

1. As the participants arrive, you announce that, rather than spending an hour on a problem-solvingteam building activity, they must design an original one of their own.
2. Divide participants into teams and tell them that they have to create a new problem-solving teambuilding activity that will work well in their organization. The activity must not be one that they have already participated in or heard of.
3. After an hour, each team must present their new activity to everyone else, and outline its keybenefits.

Advice for the Teacher/Facilitator:

There are four basic steps in problem solving : defining the problem, generating solutions, evaluating and selecting solutions, and implementing solutions. Help your team to think creatively at each stage by getting them to consider a wide range of options. If ideas run dry, introduce an alternative brainstorming technique, such as brain writing . This allows your people to develop one others' ideas, while everyone has an equal chance to contribute.

After the presentations, encourage teams to discuss the different decision-making

processes they followed. You might ask them how they communicated and managed their time . Another question could be about how they kept their discussion focused. And to round up, you might ask them whether they would have changed their approach after hearing the other teams' presentations.

i) Students are asked to recite verses: 26,28,63,65 (virtue) of Neetisatakam-Holisticdevelopment of personality.
ii) Students are asked to identify personality of role Mmodels from Shrimad Bhagwadgee taandportray the roles of the same.
iii) Students are asked to practice Yoga and meditation techniques

Text and Reference Books:

1. Hurlock, E.B. Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill,2006.
2. Gopinath,Rashtriya vairagya, New Delhi, 2010
3. Swami Swarupananda Sanskrit Sansthanam P, Bhartrihari"s ThreeSatakam, Niti-sringar-
4. , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata, 2016.
5. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
6. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
7. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House.2005.
8. Smith, B . Body Language. Delhi: Rohan Book Company. 2004
9. Yogic Asanas for Group Training - Part-I: Janardhan Swami Yogabhyasi Mandal,Nagpur.
10. Rajayoga or Conquering the Internal Nature by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.
11. Nagendra H.R nad Nagaratna R, Yoga Perspective in Stress Management, Bangalore,Swami Vivekananda Yog

GENERAL PHYSICS – I

Offered to : M.Sc.(PHYSICS) **Course Code**:

Course Type : Core (P) **Course:** GENERAL PHYSICS – I

Year of Introduction : 2004 **Year of offering :** 2022

Year of Revision : 2022 **Percentage of Revision : 10%**

Semester : I **Credits : 4**

Course Description : This course (22PH1L1) will provide practical knowledge on the topics include electrical, magnetical and optical properties of the materials.

Course Objectives:

1. To understand the various magnetic material properties.
2. To learn the electrical properties of the semiconductor materials.
3. To learn the dielectric properties of properties materials.

Course Outcomes : At the end of this course, students should be able to:

CO1: Understand the different concepts of physics through experiments.
CO2: To apply the concepts of condensed mater physics to understand the properties of different materials
CO3: To analyse the results obtained from different experiments through graphical analysis.

22PH1L1: GENERAL PHYSICS – I
(Minimum 10 experiments are to be done)

1. Characteristics of electromagnetic coils (a) by varying distance between the coils and(b) byvarying current CO1 L3
2. Measurement of band gap of semiconductor CO2 L3
3. Determination of dielectric constant of a solids CO2 L3
4. Determination of Planck's constant using photodiode CO1 L3
5. Stefan's constant CO2 L3
6. |B – H Curve CO3 L3
7. Hall effect CO3 L3
8. Heat Capacity of solids CO2 L3
9. Lattice dynamics CO2 L3
10. I-V characteristics of solar cells. CO3 L3
11. Diffraction grating – determination of wavelength of laser.CO1 L3
12. Two Probe Method for Resistivity Measurement CO2 L3
13. Any two online virtual lab experiments with in the syllabus have to be carried out (using MHRD web resource).CO2 L3

Continuous Internal Assessment will be done for each student on basis of performance for each practical. The total marks for CIA is evaluated for 20 marks. An internal will be conducted after the completion of course for 10 marks, Total marks for CIA will be 30 marks (continues assessment 20+ internal 10).The external examination is evaluated for 70 marks. Total marks 70(External)+30(CIA)=100 marks

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ELECTRONICS LAB

Offered to : M.Sc.(PHYSICS) **Course Code**: 22PH1L2

Course Type : Core (P) **Course:** ELECTRONICS LAB

Year of Introduction : 2004 **Year of offering :** 2022

Year of Revision : 2022 **Percentage of Revision : 10%**

Semester : I **Credits : 4**

Course Prerequisites (if any) :

Course Description : This course focuses on the construction and verification of electronic circuits using transistor ,IC Op-Amp 741

Course Objectives:

1. To understand the construction of logic gates
2 To learn the construction and working of transistors
3 To learn the working of IC-741 in various circuits

Course Outcomes : At the end of this course, students should be able to:

CO1: To apply the concepts of electronics for different circuits
CO2: To analyze the the variation between theoretical and practical circuits.
CO3 To analyze the results obtained from different experiments through graphical analysis

22PH1L2: ELECTRONICS LAB
(Minimum 10 experiments are to be done)

1. Verification of truth tables of various logic gates: AND, OR, NOR and NOT using NAND gateand NOT gate. CO2, L3
2. Construction and verification of the truth tables for De Morgan's theorems CO2, L3
3. Verification of truth tables of R-S, J-K, flip-flops CO3, L3
4. R-C Phase shift oscillator CO2, L3
5. Astable Multivibrator using transistor.CO1, L3
6. Determination of practical op amp parameters CO1, L3
7. Op amp Inverting amplifier CO2, L3
8. Op amp non-inverting configurations.CO2, L3
9. Astable Multivibrator using Op-amp.CO1, L3
10. Summing and difference amplifier CO2, L3
11. Any two online virtual lab experiments with in the syllabus have to be carried out (using MHRD web resource)., L3
12. Wien's Bridge Oscillator.CO1, L3
13. JFET based amplifier.CO2, L3
14. UJT-Characteristics CO1, L3
15. Zener Diode as voltage Regulator CO1, L3

Continuous Internal Assessment will be done for each student on basis of performance for each practical. The total marks for CIA is evaluated for 20 marks. An internal will be conducted after the completion of course for 10 marks, Total marks for CIA will be 30 marks (continues assessment 20+ internal 10).The external examination is evaluated for 70 marks. Total marks 70(External)+ 30(CIA)=100 marks