C. U. SHAH UNIVERSITY

WADHWAN CITY

FACULTY OF SCIENCE

M.Sc.

PHYSICS

SEM-I & II

Syllabi (CBCS) of Physics (Core)

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: I**

SUBJECT NAME: Mathematical Physics **SUBJECT CODE: MSCPHC101**

Teaching & Evaluation Scheme:-

Teaching Scheme			Evaluation Scheme								
Th	Pr	Total	Theory					Practical (Marks)			Total
			Sessional Exam		University Exam		Total	External	Internal	Total	
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-

The general purpose of this course is

- To expose the student knowledge of mathematical physics in a different application of solving problems.
- To expose the student knowledge of different differential function.

Prerequisites:-Fundamental knowledge of Bachelor degree in physics.

Course outline:-

Sr. No.	Course Contents
1	Ordinary differential equations, Introduction,Solution of second order differential with variable coefficients (1) Homogenousequations,(2) Inhomogeneous equations,Series integration method of the solution of linear differential equations (Frobenius'method).
2	Legendre differential equation, Bassel differential equation, generating functions,Recurrence relations &orthogonality for above two equations, Rodriguez formula ofLegendre polynomials, Integral representation of $J_n(x)$,values of Bessel function ofhalf odd integers.
3	Hermite differential equations, Integral formula for Hermite polynomials, Recurrenceformula for Hermite Polynomials, orthogonality of Hermite polynomials, RodriguesFormula.

4	Lagurrer's differential equations, integral formula for Lagurrer's polynomial,Recurrence formula for Lagurrer's polynomial, Recurrence formula for Lagurrer'sPolynomials.
5	Integral transform, Laplace transform, some simple properties of Laplace transforms (a) linearity property(b) shifting properties, first & second shifting,Laplace transform of derivatives and integral, Inverse Laplace transform by partialfunctions, The Fourier transform, Fourier sine & cosine transform,simple applicationof Fourier transform.

Learning Outcomes:-

After successful completion of this course, students will be able:

1. To knowledge of differential equations first and second kind its application and Bessel's function and its application in details.
2. To knowledge of Fourier series general properties application and advantages. And Fourier transformation of derivatives.

Books Recommended:-

1. 'Mathematical Methods for Physicists',**G. Arfken and H.J. Weber**, *Academic Press, San Diego.*
2. 'Mathematical Methods in the Physical Sciences', **M.L. Boas**, Wiley, New York.
3. 'Special Functions', **E.D. Rainville**, *MacMillan, New York.*
4. 'Advanced Engineering Mathematics', **Erwin Kreyszig**, *Wiley Eastern Limited*.

E-Resources:-

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com
8. www.fearophysic.com
9. www.hyper physics.com

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: I**

SUBJECT NAME: Classical Mechanics **SUBJECT CODE: MSCPHC102**

Teaching & Evaluation Scheme:-

Teaching Scheme			Evaluation Scheme								
			Theory					Practical (Marks)			
Th	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-The general purpose of this course is

- To expose the student knowledge of Hamilton's principle, Lagrange's equation from Hamilton's principle, and conservation theorems.
- Be able to knowledge of Coriolis force, angular momentum and kinetic energy of a rigid body, Torque free motion of rigid body and small oscillations.
- Be able to knowledge of Canonical transformation and its examples, Poisson's brackets, Equations of motion.
- Be able to knowledge of Hamilton-Jacobi equations for principal and characteristic functions Action-angle variables for systems with one-degree of freedom.

Prerequisites:-Fundamental knowledge of Bachelor degree in physics.

Course outline:-

Sr. No.	Course Contents
1	Momentum conservation Angular momentum conservation, Conservation of energy. Variation Principle,Hamilton's principle,Some techniques of the calculus of variations, Derivation of Lagrange's equationsfrom Hamilton's principle.

2	The equation of motion and first integrals,The differential equation for the orbit,Conditions for closed orbits, Bertrand's theorem, Kepler'sproblem,Inverse squarelaw of force,Classification of orbits,The Virial theorem.
3	Rotating coordinate systems, The coriolis force, Motion on the earth and FoucaultPendulum,Rutherford scattering,Moving coordinate system, Coordinate system with relative translational motions.
4	Small oscillations, general case of coupled oscillations, Eigen vectors andEigen frequencies,Normal co-ordinates, Small oscillations of particles on string,Example of harmonic oscillator,Poisson brackets, properties ofPoisson brackets,The angular momentum Poisson bracket relation.
5	Hamilton-Jacobi theory,Hamilton-Jacobi equation for Hamilton's principal function,Hamilton's characteristic and principal functions,Canonical transformations,Gauge transformation,The equations of canonicalTransformation.

Learning Outcomes:-

After successful completion of this course,

- Students will be able for the knowledge of Lagrangian formulation and its application.
- Theory of Hamilton's principles.
- Conservationtheorem.
- Canonical transformation and its application.

Books Recommended:

1. 'Classical Mechanics', **H. Goldstein**, *Narosa publication.*
2. 'Classical Mechanics of Particles and Rigid Bodies', **K.C. Gupta**,*Wiley Eastern, New Delhi.*
3. 'Classical Mechanics', **L.D. Landau and E.M. Lifshitz**,*Pergamon, Oxford.*
4. 'Classical Mechanics',**N.C. Rana and P.J. Joag**,*Tata McGraw Hill, New Delhi.*
5. **'**Introduction to Classical Mechanics,**R.G. Takwale&Puranik,** *Tata McGraw-Hill Education.*

E-Resources:

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com
8. www.fearophysic.com
9. www.hyper physics.com

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FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: I**

SUBJECT NAME: Quantum mechanics-I **SUBJECT CODE: MSCPHC103**

Teaching & Evaluation Scheme:-

Teaching Scheme			Evaluation Scheme								
			Theory					Practical (Marks)			
Th	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-After completion of this unit students will able to knowledge of quantum mechanics.

- Be able for knowledge of Schrodinger equation and its solution, power series solution, matrix representation of an operator.
- Be able for knowledge of Angular momentum commutation relation and Time independent perturbation theory.
- Be able for knowledge of Approximation methods and Application of WKB approximation.

Prerequisites:-Basic Knowledge of Physics.

Course outline:-

Sr. No.	Course Contents
1	One-dimensional harmonic oscillator by Schrodinger equation-power series solution,Plotting of harmonic oscillator,wave functions-classical correspondence-operatorMethods.

2	Angular momentum commutation relation, Coordinate transformation, Angularmomentum operators and its Eigen value problems in position representation,Spherical harmonics, Solution of Schrodinger equation in three dimension separableVariable method,Applications to (I) Square well (II) Attractive coulomb potential(III) Hydrogen atom.
3	Dirac delta function, Bra and Ket notations,Matrixrepresentation of an operator, The Unitary transformation.
4	Time independent perturbation theory,Stationary perturbation,Degenerate and noDegenerate case, Application such as stark effect,Time dependent perturbation. Time independent perturbation theory:
5	General formulation and the first order theory, PeriodicPerturbation and Fermi Golden Rule. Interaction of electromagnetic field with atom,Variational method,WKB approximation, Solution of one-dimensional Schrodingerequation.

Learning Outcomes:-After completion of this course

- Students will be able for the knowledge of quantum mechanics.
- Be able for Knowledge of Schrödinger equation and its application.

Books Recommended:

1. 'Quantum Mechanics', **L.I. Schiff**, *McGraw –Hill International Editions.*
2. 'A Text book of Quantum Mechanics', **P.M. Mathews and K. Venkatesan**,*Tata McGraw Hill, New Delhi.*
3. 'Quantum Mechanics',**AmitGowsami, *Waveland press INC.***
4. 'Fundamental of Quantum Mechanics',**Vaghmare**,*Wheeler.*
5. 'Modern Quantum Mechanics', **J.J. Sakurai**, *Addison Wesley.*
6. 'Quantum Mechanics',**J. P. E. Peebles** *library of congress cataloging in publication.*
7. 'Quantum Mechanics', **K. K. Chopra, G. C. Agarwal,** *Advanced Zoology Publications.*

E-Resources:

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com
8. www.fearophysic.com
9. www.hyper physics.com

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DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: I**

SUBJECT NAME: Electronic Device and Circuits **SUBJECT CODE: MSCPH104**

Teaching & Evaluation Scheme:-

Teaching Scheme			Evaluation Scheme								
			Theory					Practical (Marks)			
Th	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-

- To expose the student knowledge of semiconductor and different special types of diodes.
- To expose the student knowledge of transistor and its types.
- To expose the student knowledge of basic electricity and its application.
- To expose the student knowledge of photonic device and microwavedevice.

Prerequisites:- Knowledge solid state physics and electronics **.**

Course outline:-

Sr. No.	Course Contents
1	Brief review of semiconductor theory, P-N junction, equilibrium conditions, contactpotential diode current equations under forward and reverse bias conditions, reversesaturation current, reverse bias break down, transition and diffusion capacitance,Reverse recovery time, diode as a switch, Zener effect, Zener diode.
2	Bipolar junction transistor, current flow mechanism, transistor amplifying action,common emitter configuration and Ebers-Moll equations, analysis of CE amplifiercircuit, maximum symmetrical swing, arbitrary Q-point placement, emitter bypassCapacitor and AC coupled load, Emitter follower, Small signal and low frequencyanalysis of CE and CB amplifiers and Emitter Follower circuit using hybridparameter equivalent circuits.

3	Junction Field Effect Transistor (JFET), basic operation, drain-source and transferCharacteristics, JFET parameters, MOSFETS,MOSFET biasing, JFET small signal model,common source amplifier circuits, source follower, small signal operation with sourceresistance and loading effects.
4	PNPN devices, Silicon controlled rectifier, basic operation and theory, anode currentequation, regenerative effect,I-V Characteristic, triggering methods, applications,TRIAC and its modes of operations, DIAC, Unijunction Transistor(UJT), Programmable UJT,Thermistor and its applications.
5	Photonic devices, Radioactive and no-radioactivetransitions, Photo detectors, bulk type andjunction type, Light dependent resistor (LDR), diode photo detectors, PINphotodiode, solar cells, fill factor, Light emitting diode(LED) & its operation,semiconductor Laser, population inversion at junction optical gain and threshold current for lasing, Microware devices, Tunnel diode, Transfer electron devices (Gunn diode) Avalanche and transit time devices, IMPATT diodes, parametric amplifiers.

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Learning Outcome:-Students will be able for

- To expose the student knowledge of Electronic circuits.
- To expose the student knowledge of semiconductor and special type of diode and its application.
- To expose the student knowledge of transistor and its types and its application.
- To expose the student knowledge of Photonic device and microwave device.

Books Recommended:

1. **'**Electronic Circuits: Discrete and Integrated', **Donald Schilling & Charles Belove**,*MaGraw Hill.*
2. ' Electronic devices and circuit theory', **Robert Boylestad& Louis Nahselsky**, *PHI Publication.*
3. 'Solid State Devices and integrated circuits', **W.D. Cooper Weisbecker**, *Reston Publication (USA).*
4. 'Solid state Devices & applications', **Frederick Driscoll & Robert Coughlin**,*Prantice Hall.*
5. 'Digital Systems: Principles and Applications', **Ronald J. Tocci**, *PHI Publication.*

E-Resources:

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com
8. www.fearophysic.com

C. U. SHAH UNIVERSITY

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DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: I**

SUBJECT NAME: Physics Practical-I **SUBJECT CODE: MSCPHP101**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)			Evaluation Scheme								
			Theory					Practical (Marks)			
Th	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
			Marks	Hrs	Marks	Hrs					
0	12	12	--	--	--	--	--	150	50	200	200

Objectives: -The objective of this course is to learn,

- The technique to Design circuits of zener voltage regulator, common-emitter amplifier.
- To determine V-I characteristics of p-N, Zener,Photodiode,LDR.
- To Study regulated and unregulated power supply.
- To determine BJT,UJT,FET,MOSFET,SCR characteristics.
- To calculate half life time of Indium and G.M tube characteristics.
- To measure wavelength of LASER and thickness of wire from it.

More generally, the students will improve their ability to think critically, to analyze a real problem and solve it and Designing circuits using a practical knowledge of Physics.

Prerequisites:-

Before performing these practicals students have basic practical knowledge of B.sc physics andcomponent and instrument which used in laboratories.

Course outline:-

Sr. No.	Course Contents
	(Any 12 to be performed)
1	V-I characteristics, max power dissipation of the Germanium diode.
2	V-I characteristics, breakdown voltage, dynamic resistance of the Zenerdiodes.
3	R-C time constant.
4	Unregulated power supply.
5	Regulated power supply.
6	Zener diode voltage regulator (designing).
7	Designing common-emitter amplifier.
8	Network theorems: Thevenin's,Norton's, Superposition.
9	Study of bias stability.
10	V-I characteristics of the UJT.
11	Transistor (BJT) Characteristics and determination of h-parameters.
12	JFET current – voltage characteristics.
13	JFET transfer characterizes.
14	MOSFET characteristics.
15	Characteristics & application of LDR and photodiode.
16	Characteristics & applications of the SCR.
17	BJT in CE configuration: Characteristics.
18	BJT in CB configuration: Characteristics.
19	Maximum power transfer theorem.
20	Testing goodness of fit of Poisson distribution to cosmic ray bursts bychi-square fit.
21	Counting Statistics.
22	Determination of e/m of electron by normal Zeeman effect using FebryPerot Etalon.
23	Measurements of wavelength of He-Ne laser light using ruler.
24	Measurements of the thickness of wire with laser.
25	Determination of half-life of In.
26	G.M. tube characteristics.

Learning Outcomes:-

After the successful completion of the course, students will be able to

- Understand V-I characteristics of different semiconductor devices.
- Find out unknown wavelength.
- Design different circuits.

- Calculate half life time of In.
- Draw graphs related to these practical.
- Analyze differential equations.

Books Recommended:-

1. 'Practical Physics',**L.Arora**, *S. Chand Comp.*
2. 'Advanced Practical Physics',**Chauhan& Sing,***PragatiPracatio.*
3. 'Experimental Physics',**University Granth.**
4. **'***Nirman Board*Practical Physics',**Chattopadhya**,*Rakshit&Saha.Current Distributors.*
5. 'Digital principles and Applications',**A.P. Malvino and D.P. Laach** *Tata Ma-Graw Hill.*

E-Resources:-

1. www.physic.about.com
2. www.physic.org
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8. www.fearophysic.com
9. www.hyper physics.com