RKUNIVERSITY	SYLLABUS
Course Title	**CLASSICAL MECHANICS**
Course Code	MPH101
Course Credit	Lecture : 04
	Tutorial : 00
	Practical : 00
	Total : 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Lagrangian Formulation** Mechanics of a system of particles; constraints of motion, generalized coordinates, D'Alembert's Principle and Lagrange's velocity—dependent forces and the dissipation function, Applications of Lagrangian formulation.	**06**
2	**Rigid Body Motion** Coordinate system with relative translational motion, rotating coordinate system, Coriolis force, Eulerian Angles and Euler's theorem, infinitesimal rotation, Rate of change of a vector , angular momentum and kinetic energy of a rigid body, the inertia tensor, principal axis transformation, Euler equations of motion, Torque free motion of rigid body, motion of a symmetrical top	**10**
3	**Langrange's Equation** Calculus of Varation principle, application of variational principle , Hamilton's principle, Equivalence of Lagrange's and Newton's equation, Advantage of Langrangian formulation, Lagrange's equation from Hamilton's principle, extension to non-holonomic systems	**08**
4	**Hamilton's Equation** Hamilton's equation of motion, applications of Hamilton's formulations, phase space, problems	**04**
	SECTION-II	
5	**Canonical Transformation** Gauge transformation, Canonical transformation and its examples, Poisson's brackets, Canonical equation in terms Poisson bracket notation, infinitesimal canonical transformation	**07**
6	**Hamilton-Jacobi Theory** Hamilton-Jacobiequations for principal and characteristic functions Action-angle variables for systems with one degree of freedom, problems	**07**

7	**Small Oscillations** General case of coupled oscillations, Eigenvactors and eigenfrequencies, orthogonality of eigenvector, Normal Coordinates, Small oscillation of particle on string	**07**
8	**Special theory of relativity** Newtonian relativity, Micheksib-Morley experiment, Special theory of relativity, Lorentz transformations, mass-energy relation, problems	**07**

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

After Successful completion of the above course, students will be able to:

Recall the concept of Newtonian Mechanic.

Classify different equation of motion.

Use different equations for vector and functions.

Solve problems of oscillation and transformation.

Examine different theory of classical mechanics.

Text book:

1. Classical Mechanics of Particles and Rigid Bodies: K.C. Gupta (Wiley Eastern, New Delhi).
2. Classical Mechanics: N.C. Rana and P.J. Joag (Tata McGraw Hill, New Delhi)

Reference Books:

1. Classical Mechanics: H. Goldstein (Narosa)
2. Mechanics: L.D. Landau and E.M. Lifshitz (Pergamon, Oxford)

RK UNIVERSITY	**SYLLABUS**
Course Title	**MATHEMATICAL PHYSICS**
Course Code	MPH102
Course Credit	Lecture : 04
	Tutorial : 00
	Practical : 00
	Total : 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Curvilinear Coordinates** Orthogonal Curvilinear Coordinates, Gradient, Divergence and Curl, ∇^2inspherical and cylindrical coordinates, Expression for angular momentum L and L^2 in spherical polar coordinates. Dirac delta function, Delta sequences for one dimensional function, properties of delta function, Gamma function, Beta function.	**12**
2	**Complex Variables** Introduction, Cauchy-Riemann conditions, Cauchy's Integral formula, Laurent expansion, singularities, calculus of residues, evaluation of definite integrals, Dispersion relation.	**08**
3	**Differential Equations:** Partial differential equations of theoretical physics, separation of variables, singular points, Second order liner One dimensional equations with variable coefficients, series solutions.	**08**
	SECTION-II	
4	**Bessel Functions:** Bessel functions of first and second kind, Generating function, integral representation and recurrence relations for Bessel's functions of first kind, orthogonality.	**07**
5	**Legendre function** Generating function, recurrence relations and special properties, orthogonality, various definitions of Legendre polynomials. Associated Legendre functions: recurrence relations, parity and orthogonality, Hermite functions, Laguerre functions.	**07**
6	**Fourier Series and Integral Transforms** Fourier series, Dirichlet conditions, General properties, Advantages and applications. Fourier transforms, Development of the Fourier integral, Inversion	**14**

	theorem, Fourier transforms of derivatives; Momentum representation. Laplace transforms, Laplace transforms of derivatives, Properties of Laplace transform, Inverse Laplace transformation.	

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

Understand the concepts of curvilinear coordinates, complex variables, special functions for orthogonality.

Calculate different example of mathematical physics.

Compare Fourier series and integral transforms.

Apply mathematical physic concepts on different mechanics derivations.

Text book:

1. Mathematical Methods for Physicists: G. Arfken and H.J. Weber (Academic Press, San Diego).
2. Mathematical Physics by B. S. Rajput (Pragati Prakashan, Merruit)

Reference Books:

1. Special Functions: E.D. Rainville (MacMillan, New York).
2. Advanced Engineering Mathematics, Erwin Kreyszig, (Wiley Eastern Limited)

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SYLLABUS

Course Title	**QUANTUM MECHANICS**
Course Code	MPH113
Course Credit	Lecture : 04
	Tutorial : 00
	Practical : 00
	Total : 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Towards Quantum Mechanics** Mechanics of material system, Electromagnetic fields and light, Photoelectric effect, Compton effect, Black body radiation, Matter Waves: De-Broglie's Hypothesis, motion of free wave packet, discussion Uncertainty principle with thought experiments, different forms of uncertainty principle with proof, problems	**10**
2	**The Schrodinger Equation** A free particle in one-dimension, generalization of three dimensions, the operator correspondence, Physical Interpretation & condition on ψ: Normalization and probability interpretation, non-normalized wave function and Box normalization, conservation of probability, problems	**12**
3	**Stationary states** Time-independent Schrödinger equation, a particle in Square well potential, bound state in square well (E<0), non-localized states (E>0), problems	**06**
	SECTION-II	
4	**General formalism of wave mechanics** Schrödinger equation and probability interpretation for an N- particle system, fundamental postulates of wave mechanics, adjoint of an operator and self-adjointness, Eigenvalue problem; degeneracy, eigenvalue and eigenfunction of self-adjoint operator, the Dirac Delta function, physical interpretation of eigen value, eigen function, momentum eigenfuncion	**10**
5	**Exactly Soluble Eigenvalue problem – I** The simple Harmonic oscillator: Schrödinger equation and energy eigen values, energy eigen function, properties of stationary states Angular momentum and parity: angular momentum operator, the eigenvalue equation for L^2, admissibility condition on solution, physical interpretation, problems	**10**

6	**Exactly Soluble Eigenvalue problem – II** The Hydrogen Atom: solution of the radial equation, stationary state wave function, discussion of bound states Other problems in three dimensions: anisotropic oscillator, isotropic oscillator, normal modes coupled systems of particles	**08**

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

Recall the concept of basic optical phenomena.
Relate wave & particle.
Review wave functions.
Solve physical problems using quantum mechanics.

Text book:

1. A text book of Quantum Mechanics by Mathews and Venkatesan
2. Introductory Quantum Mechanics byV.K. Wagh and M.K. Yeole, NiraliPrakashan, Pune
3. Quantum Physics by H C Verma, Surya Publications, Ghaziabad

Reference Books:

1. Quantum Mechanics – Schiff (McGraw Hill)
2. Fundamental of Quantum Mechanics – Vaghmare
3. Modern Quantum Mechanics – J. J. Sakurai
4. Quantum Mechanics – J. P. E. Peebles
5. Quantum Mechanics – K. K. Chopra, G. C. Agarwal

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SYLLABUS

Course Title	**ELECTRONICS DEVICES & CIRCUIT**
Course Code	MPH104
Course Credit	Lecture : 04
	Tutorial : 00
	Practical : 00
	Total : 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Vacuum Tubes** Thermionic Emitter. Gas filled tube. Thyratron. Application of Thyratron, Triode. Vacuum Tube Voltmeter. Cathode Ray Oscilloscope.	**04**
2	**Basics and Circuit** Introduction to electronics (i.e. Rectification, Amplification, Control, Generation only definitions). Voltage Source, Current Source, Maximum Power Transfer theorem. Thevenin's Theorem. Nortan's Theorem.	**06**
3	**Solid State Devices for Special Applications** PN Junction diode, Zener diode, Varactor diode, Schottky diode, Voltage dependent resistors, Silicon controlled rectifier, DIAC, TRIAC, Uni-Junction transistor, UJT-relaxation oscillator, Thermistors, Photo voltaic cells	**08**
4	**Optoelectronic Devices** Classification, Radiative and non-radiative transitions, Light emitting diodes, seven-segment displays, Light dependent resistors, photoconductive cells, Photo-diode, semiconductor Laser, population inversion at junction optical gain and threshold current for lasing, PIN Photodiode, Photo-transistor, Liquid crystal displays, Opto-couplers.	**10**
	SECTION-II	
5	**Field Effect Transistor** Introduction to BJT, Junction Field Effect Transistors, Comparison with BJT, basic Construction, polarity conventions, Characteristics, JFET parameters, JFET-biasing, Common source amplifier, Source-follower.	**08**
6	**MOSFETS** MOSFETS, DE-MOSFETS: Construction and Characteristics, E-MOSFETS: Construction and Characteristics, Complementary MOS (CMOS).	**06**

7	**Combinational logic Circuits Designing Using SSI** Various gates, Review of Boolean algebra, De-Morgan's theorems, Canonical and standard Boolean functions, Designing of combinational logic circuits using gates, Various implementations, Design examples	**08**
8	**Integrated Logic** Characteristics of Digital IC, DTL logic, The RTL logic family, The TTL logic family, Loading and fan-out, MOS digital ICs, CMOS ICs.	**06**

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

Recall the concept of basic electronics.
Review electrical and electronic circuit.
Analyze different circuits.
Choose proper component for circuits.
Design electronic circuit using Boolean algebra.

Text book:

1. Principal of Electronics, V.K. Mehta & Rohit Mehta, S. Chand Publication
2. Electronic Principles, Albert Malvino & David Bates, Tata McGraw-Hill Publishing

Reference Books:

1. Electronic Circuits: Discrete and Integrated, Donald Schilling & Charles Belove, MaGraw Hill International
2. Electronic devices and circuit theory, Robert Boylestad & Louis Nahselsky, PHI
3. Solid State Devices and integrated circuits, W.D. Cooper Weisbecker, Reston Pub (USA)
4. Solid state Devices & applications, Frederick Driscoll & Robert Coughlin, Prantice Hall
5. Digital Systems: Principles and Applications, Ronald J. Tocci, PHI
6. Electronics devices and circuits by J.B. Gupta, 3rd Edition, S.K. Kataria & Sons

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SYLLABUS

Course Title	**PHYSICS EXPERIMENTS – I**
Course Code	MPH105
Course Credit	Lecture : 00
	Tutorial : 00
	Practical : 09
	Total : 09

Detailed Syllabus:

Sr. No	Name of Experiments	Session Allotted
1	To design & study series, parallel & mixed combinations of resistor using PCB	
2	To design & study unregulated DC power supply using bridge rectifier using PCB.	
3	To design &study Thevenin theorem for given network using PCB.	
4	To design & study Norton theorem for given network using PCB.	
5	To design & study RC charge and discharge characteristics using PCB.	
6	To design PN junction diode, Zener diode & LED characteristics using PCB.	
7	To design & study CE characteristic for NPN transistor using PCB.	
8	To design & study diode clipper and clampers.	
9	To design & study NPN transistor as an amplifier.	
10	To design & study UJT characteristics.	
11	To design & study the characteristics of photo transistor.	
12	To design & study AND gate, OR gate using DDL circuit and NOT gate using TTL circuit.	
13	To design & prove NAND gate as a Universal gate using DDL & TTL circuit.	
14	To design & prove NOR gate as a Universal gate using DDL & TTL circuit.	
15	To solve five problems related to Fourier series.	
16	To solve five problems related to Laplace transform.	
17	To calculate the expectation value of observables for the given wave function.	
18	To solve the Schrodinger equation for a given potential.	
19	To find the generating function using canonical transformation.	
20	To find the Langrangian and solve the equation of motion of a given physical system	

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

- **Identify** active and passive components.
- **Apply** experimental skill during practical session
- **Calculate** the unknown physical quantity using obtained data.
- **Explain** the obtained result using scientific background.