Shri Vile Parle Kelavani Mandal's

MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)

NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),

Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India

Best College (2016-17), University of Mumbai

Affiliated to the

UNIVERSITY OF MUMBAI

Program: Bachelor of Science

Course: Physics

Semester: I and II

Choice Based Credit System (CBCS) with effect from the Academic year 2020-21

PROGRAM SPECIFIC OUTCOMES (PSO'S)

On completion of the B.Sc - Physics, the learners should be enriched with knowledge and be able to-

PSO1: Knowledge: Understand fundamental theories and principles of Physics, which includes Nuclear Physics, Electrodynamics, thermodynamics, waves & optics, materials science, Atomic and Molecular Physics, Classical Mechanics, Quantum Mechanics, Statistical Mechanics, Mathematical Physics, Solid state Physics, Electronics, C++ programming language, AVR microcontroller and its applications in different areas of science and technology.

PSO2: Analytical abilities and practical skills: Develop analytical abilities towards complex problem solving and acquire laboratory practical skill required to transform Physics knowledge into real life applications for society.

PSO3: Skills and Life-long learning: Acquire skills like collaboration, communication, and independent learning and prepares for lifelong learning to overcome challenges ahead

PSO4: Competitive examinations: Clear entrance tests for higher studies and competitive examination for public sectors and Civil service.

PSO5: Conduct investigations of complex problems in physical science: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PSO6: Ethics: Demonstrate professional behaviour such as (i) being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behaviour such as fabricating, falsifying or misrepresenting data or committing plagiarism; (ii)the ability to identify the potential ethical issues in work-related situations; (iii) appreciation of intellectual property, environmental and sustainability issues; and (iv) promoting safe learning and working environment.

PREAMBLE

This is a part of the undergraduate program (Six Semesters) in Physics, to be taught in Semester I & II from the academic year 2020-21 onwards. All the four theory courses are devoted to fundamentals of Physics including Mechanics, Waves, optics, Modern Physics, Electricity, Magnetism and cosmology. The laboratory practical component in course consists of combination of laboratory experiment related to theory topics, skill experiments and demonstration experiment.

This syllabus is planned to hone the learners for understanding of fundamental concepts of Physics along with practical skill required to achieve excellence in recent advances of Physics and its applications to society. This course shall motivate learners for higher studies in Physics and build-up successful career in various branches of science and technology.

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

SYLLABUS

FYBSC, PHYSICS, SEMESTER-I

Program: Bachelor of Science				**Semester : I**	
Course :	**Mechanics**			**Course Code: USMAPH101**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min/lecture	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____ in Question Paper)**
3	-	-	2	25	75

Pre-requisite:

Basic knowledge of Kinematical equation, Newton's law of motion.

Learning Objectives:

1. To develop analytical abilities towards real world problems solving in Newtonian Mechanics.
2. To familiarize with current developments in the field of mechanics and gravitation.
3. To enrich knowledge through hands on activities, study visits, projects etc.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: describe work-energy theorem, simple harmonic motion, elasticity, state Newton's laws of gravitation, Kepler's laws

CO2: explain the motion of rockets, orbital motion of satellites, properties of fluid motion.

CO3: solve problems based on topics covered in the syllabus.

CO4: analyze SHM, damped and forced oscillations, gravitational principle.

CO5: measure energy of SHM system, time period of geostationary satellites, assess applications of Newton's laws.

CO6: derive expression for SHM, derive Bernoulli's Equation velocity or rocket, damped and forced oscillations, rotational motion of bodies.

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration (Lectures of 48 min each)**
1	**Newton's laws**	**15**
2	**Elasticity, fluid dynamics and oscillations**	**15**
3	**Gravitation**	**15**

	Total	**45**

DETAILED SYLLABUS

Unit	Description	Duration
1	**Laws of Motion:** Inertial frames of reference. Newton's laws of motion. Application of Newton's laws, Frictional forces. **Energy and Momentum:** Work and energy, Conservation of energy, Conservation of momentum and collisions, centre of mass, Rocket Propulsion **Rotational Motion:** Angular velocity and angular momentum. Torque, Conservation of angular momentum.	**15**
2	**Elasticity:** Hooke's law - Stress-strain diagram - Elastic Moduli-Relation between elastic constants - Poisson's Ratio, Expression for Poisson's ratio in terms of elastic constants. **Fluid Dynamics:** Density, Pressure in a Fluid, Buoyancy, Surface Tension, Fluid Flow, Equation of continuity, Bernoulli's Equation, Viscosity and Turbulence. **Oscillations:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Forced Oscillations, Resonance.	**15**
3	**Gravitation:** Newton's Law of Gravitation, Weight, Gravitational Potential Energy, The Motion of Satellites, Geosynchronous orbits, Kepler's Laws and the Motion of Planets, Apparent Weight and the Earth's Rotation, Black Holes.	**15**
	Total	**45**

Reference Books:

University Physics, Sears & Zemansky, Young and Freedman, Pearson.

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Program: Bachelor of Science				**Semester : I**	
Course :	Waves and Optics			**Course Code:** USMAPH102	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min/lecture	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks)**	**Term End Examinations (TEE) (Marks)**
3	-	-	2	25	75

Pre-requisite: Basic knowledge of wave motion and optics**.**

Learning Objectives:

1. To develop analytical abilities to approach problems based on Waves and optics.
2. To familiarize students with recent advance in optics and optical instruments.
3. To enrich knowledge through hands on activities, study visits, projects etc.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: describe sound wave in terms of particle displacement or pressure fluctuations, optical properties, properties of laser describe what happens when two sound waves of slightly different frequencies are combined.

CO2: explain the working of basic optical devices, lasers, discuss the construction of basic optical devices, microscopes, lasers,

CO3: solve problems based on geometrical optics, energy carried by waves, Doppler effect, demonstrate applications of lasers, demonstrate resonance of sound in musical instruments.

CO4: analyze the modes on a string, investigate different physical parameters of propagating waves, analyze Why the pitch of a siren changes as it moves past you.

CO5: measure velocity, energy of waves, intensity of interference pattern, summarize properties of lasers.

CO6:derive expression for standing waves on a string, velocity of sound in different media, design interferometers, lasers.

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration** 48 min/lecture
1	**Waves**	**15**
2	**Optics**	**15**

3	**Laser**	**15**
	Total	**45**

DETAILED SYLLABUS

Unit	**Description**	**Duration**
1	**Waves:** **Mechanical Waves:** Types of Mechanical Waves, Periodic Waves, Mathematical Description of a Wave, Speed of a Transverse Wave, Energy in Wave Motion, Wave Interference, Boundary Conditions, and Superposition, Standing Waves on a String, Normal Modes of a String **Sound Waves:** Speed of Sound Waves, Sound Intensity, Standing Sound Waves and Normal Modes, Resonance and Sound, Interference of Waves, Beats, The Doppler Effect, Shock Waves, Ultrasonic waves and its applications.	**15**
2	**Optics:** **Geometric Optics:** Reflection and Refraction at a Plane Surface, Reflection at a Spherical Surface, Refraction at a Spherical Surface, Lens combinations and cardinal points, Thin Lenses, Cameras, The Eye, The Magnifier, Microscopes and Telescopes. **Interference:** Interference and Coherent Sources ,Two-Source Interference of Light , Intensity in Interference Patterns, Interference in Thin Films, Newton's Ring.	**15**
3	**Laser:** Total Internal reflection, Dispersion, Scattering of light, Introduction to LASERS, transition between Atomic energy states (without derivation), Principle of Laser, Properties of Laser, Types of LASERS-HeNe, Ruby, semiconductor. Application of Laser to Holography, Optical fiber communications system and other applications	**15**
	Total	**45**

Reference Books:

1. University Physics, Sears & Zemansky, Young and Freedman, Pearson
2. A textbook of Optics by N. Subrahmanyam, BrijLal, Avadhanulu, S. Chand Publication.

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science				**Semester : I**	
Course :	**Physics Practical**			**Course Code: USMAPHP112**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (Hours per week) (48 min)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____ in Question Paper)**
--	6	-	2	20	80

Pre-requisite:
Basic knowledge of units and measurements, Conversion to SI and CGS.

Learning Objectives:

1. To give exposure to students to experiments related to mechanics, waves and optics.
2. To learn how to approach experiments in physics: design, observations, data analysis and interpretation.
3. To develop analytical abilities towards real world problems related to experimental Physics

After completion of the course, learners would be able to:

CO1: acquire skills in use of laboratory equipment like Screw gauge, DMM, CRO, spectrometer, travelling microscope.

CO2: apply scientific procedures for performing experiments based on basic concepts in mechanics, sound and optics.

CO3: analyze the experimental data through graph plotting and numerical calculations.

CO4: compare the experimental results with theoretical predictions.

CO5: develop an ability to understand the fundamental Physics concepts through experiments and its applications in science and technology.

List of Practicals:		Duration
1.	**Skill Experiments:** 1. Use of Vernier Caliper and Micrometre Screw Gauge. 2. Use of Travelling Microscope. 3. Use of DMM. 4. Spectrometer: Schuster's Method. 5. Use of CRO.	Per week 2 sessions of 144 min
2.	**Demonstration Experiment:** 1. Fraunhoffer and Fresnel Diffraction 2. Lloyd's mirror 3. Optical fiber communication system	
3.	**Regular Experiments:**	

Group:A

1. Determination of surface tension Jaeger's Method.
2. To determine g by Bar Pendulum.
3. Torsional Oscillations
4. Bifilar pendulum
5. Young's modulus by vibration.
6. Young's modulus by bending.
7. To determine g by free fall.

Group:B

1. To study Lissajous Figures using CRO.
2. Spectrometer: Determination of angle of prism.
3. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
4. Helmholtz resonator.
5. Combination of Lens.
6. Measurement of velocity of sound waves.
7. Determination of refractive index of water using LASER
8. Newton's ring.
9. Wedge shaped film.

Reference Books:

1. Advanced course in Practical Physics D. Chattopadhya, PC. Rakshit & B. Saha. (6th Edition) Book & Allied Pvt. Ltd.
2. BSc Practical Physics – Harnam Singh S. Chand & Co. Ltd. – 2001
3. A Text book of advanced Practical Physics – Samir Kumar Ghosh, New Central Book Agency – (3rd edition)
4. B Sc. Practical Physics – CL Arora (1stEdition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics – CL Squires – (3rdEdition) Cambridge University Press.
6. University Practical Physics – D C Tayal. Himalaya Publication.
7. Advanced Practical Physics – Worsnop & Flint.

Any other information:

Minimum 4 regular experiments from each group and all skill/demonstration experiments should be completed in the semester.

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SYLLABUS

FYBSC, PHYSICS, SEMESTER-II

Program: Bachelor of Science				**Semester : II**	
Course :	Electricity and Magnetism			**Course Code:** USMAPH201	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week) 48 min	**Practical (Hours per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
3	-	-	2	25	75

Pre-requisite:
Basic knowledge of laws in electrostatics and magnetostatics

Learning Objectives:

1. To develop analytical abilities towards real world problems of Electrostatics and Magnetostatics.
2. To familiarize with current and recent scientific and technological developments.
3. To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

Learning Outcomes:
On successful completion of this course students will be able to:

CO1: understand concepts in electrostatics, magnetostatics and direct and alternating current.
CO2: explain Gauss's law, mutual inductance, Hall effect and Ampere's law.
CO3: acquire quantitative problem solving skills in all the topics covered.
CO4: demonstrate the experiment based on electrostatics, magnetostatics and LCR circuits.
CO5: analyze resonance in LCR circuit, analyze forces acting on moving charge in electric and magnetic, analyze magnetic field of Helmholtz coils.
CO6: derive expressions for electric and magnetic fields for different charge and current distributions.

Outline of Syllabus: (per session plan)

Unit	**Description**	**Duration 48 min each**
1	**Electrostatics**	**15**
2	**Magnetostatics**	**15**
3	**Direct and Alternating Current**	**15**

	Total	**36**
DETAILED SYLLABUS		
1	**UNIT I: Electrostatics** Electric charge, Conductors, insulators and electric charges, coulombs law, electric fields and electric potential, electric field lines, electric dipoles, Charge and electric flux calculation, Gauss law and its applications, charges on conductors, Electric potential energy, electric potential, equipotential surfaces, potential gradients.	**15**
2	**UNIT II: Magnetostatics** Magnetic field, motion of charged particle in magnetic field and its application, magnetic force on current carrying conductor force and torque on current carrying loop, direct current motor, Hall effect. Magnetic field of moving charges, current elements, straight current carrying conductors, force between parallel conductors, magnetic field of circular current loop, Helmholtz coils**,** Ampere law and its application.	**15**
3	**Unit III: Direct and Alternating Current:** **Direct current:** R-C Circuit, Mutual and self-inductance, L-R Circuit, LC Circuit, LCR circuits. **Alternating current:** Phasors and alternating currents, resistance and reactance, LCR series circuit, Power in alternating current circuits, Resonance in alternating current circuits, Transformers.	**15**
	Total	**45**

Reference Books:

1. University Physics, Sears & Zemansky, Young and Freedman, Pearson
2. Fundamentals of Physics, Halliday and Resnick.

Program: Bachelor of Science	**Semester : II**
Course : Modern Physics and Cosmology	**Course Code: USMAPH202**
Teaching Scheme	**Evaluation Scheme**

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Lecture (per week) 48 min per lecture	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE) (Marks)	Term End Examinations (TEE) (Marks)
3	-	-	2	25	75

Pre-requisite: Basic knowledge of light and its nature, atom and nucleus.

Learning Objectives:

1. To teach fundamentals of origin of quantum theory, production of X rays, Compton Effect, nuclear properties, particle physics and cosmology.
2. To develop analytical abilities towards real world problems of Modern physics.
3. To familiarize with current and recent scientific and technological developments.
4. To enrich knowledge through problem solving, hands on activities, study visits, projects etc.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: define mass defect, binding energy, packing fraction, describe different types of particles, quarks, etc. list their properties, describe wave and particle pictures of light, describe Heisenberg uncertainty principle.

CO2: explain properties of nuclei, nuclear magnetic moment, types of radioactivity and its applications, particle interactions, Grand Unified theory, Hubble's law, explain the experiments involving the photoelectric effect, explain the atomic energy levels

CO3: solve the numerical based on all concepts discussed in the units, demonstrate matter waves: Davisson-Germer experiment, G. P. Thompson experiment, demonstrate Light Scattered as Photons: Compton Scattering,

CO4: examine nuclear stability and calculate binding energies. Inspect conservation of lepton, baryon numbers.

CO5: investigate origin of nuclear magnetic moment, investigate how Einstein's photon picture of light explains the photoelectric effect. Evaluate universe temperatures, energy, red shifts etc.

CO6: assess interaction of nuclear magnetic moment with external magnetic field, estimate biological effects of radiation, derive the equation for critical density and other formulas.

Outline of Syllabus: (per session plan)

Unit	Description	Duration (48 min per lecture)
1	**Light and matter waves**	**15**
2	**Introduction to Nuclear Physics**	**15**
3	**Particle Physics and Cosmology**	**15**
	Total	**45**

DETAILED SYLLABUS

Unit	Description	Duration
1	**Light and matter waves:** Light absorbed as Photons, The Photoelectric Effect, Light Emitted as Photons, X-Ray Production, Light Scattered as Photons: Compton Scattering and Pair Production Wave–Particle Duality, Probability and Uncertainty Electron Waves, Davisson-Germer experiment, G. P. Thompson experiment, The Nuclear Atom and Atomic Spectra, Energy Levels and the Bohr Model of the Atom.	**15**
2	**Introduction to Nuclear Physics:** Properties of Nuclei, nuclear magnetic moment, interaction of nuclear magnetic moment with external magnetic field and origin of nuclear magnetic resonance (NMR), Nuclear Binding and Nuclear Structure, Nuclear Stability and Radioactivity, Binding energy curve and explanation of energy release in nuclear fusion and fission, Activities and Half-Lives, Biological Effects of Radiation, Carbon dating, Radiometric dating and types of nuclear reactions in that case.	**15**
3	**Particle Physics and Cosmology:** Fundamental particles: electron, proton, photon, neutron, positron, particles as force mediators, mesons, particles and interactions, introduction to quarks, leptons, hadrons. Expanding universe: Hubble's law, big bang, expanding space, critical energy, dark matter, dark energy and accelerating universe, beginning of time.	**15**

Reference Books:

1. University Physics, Sears & Zemansky, Young and Freedman, Pearson
2. Concepts of Modern Physics (SIE) 7th Edition (English, Paperback, Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury)

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: Bachelor of Science				**Semester : II**	
Course :	**Physics Practical**			**Course Code: USMAPHP212**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (Hours per week)	**Practical (per week) 48 min**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment and Evaluation (CAE) (Marks - _____)**	**Term End Examinations (TEE) (Marks- _____)**
--	6	-	2	20	80

Pre-requisite:

Measuring units, Conversion to SI and CGS. Familiarization with Vernier calliper, Screw gauge, Spectrometer, travelling microscope, thermometer, LCR meter, DMM and CRO. Instruments accuracy, precision, sensitivity, resolution range. Errors in measurements.

Learning Objectives:

1. To teach how to perform experiments in Electrostatics, Magnetostatics and Modern Physics.
2. To develop analytical abilities towards real world problems related to experimental Physics.
3. To familiarize with current and recent scientific and technological developments.

Course Outcomes:

After completion of the course, learners would be able to:

CO1: acquire skills in use of laboratory equipment like Screw gauge, DMM, CRO, spectrometer, travelling microscope and use of computer for graph plotting.

CO2: demonstrate the use of ExpEYES Kit in Physics experiments.

CO2: apply scientific procedures for performing experiments based on electrostatics, magnetostatics and some modern concepts in Physics.

CO3: analyze the experimental data through graph plotting, numerical calculations.

CO4: compare the experimental results with theoretical predictions.

CO5: develop an ability to experimentally understand the fundamental concepts in electrostatics, magnetostatics, LCR circuits and its applications in modern science and technology.

List of exeriments:		Duration
	Skill Experiments: 1. Laser beam divergence, Intensity profile. 2. Charging and discharging of a capacitor using ExpEYES Kit. 3. Use of semi log/ log-log graph plotting. 4. Use of PC for graph plotting.	Per week 2 sessions of 144 min each

	Demonstration Experiments: Nuclear Magnetic Resonance (NMR).	
	Audio-visual documentary lab: 1. Documentary on cosmology. 2. Documentary on wave particle duality.	
	Regular Experiments: **Group: A** 1. To study L-R and C-R circuit. 2. LCR series resonance. 3. Determination of equipotential surfaces. 4. Frequency of ac mains. 5. To study the variation of magnetic field along the axis of Helmholtz coil. 6. Measurement of Mutual inductance of two coils. 7. Measurement of earth's magnetic field using tangent galvanometer. **Group: B** 1. To study spectral characteristics of photoelectric cell. 2. To verify Inverse-square law of a radiation using photoelectric cell. 3. Determination of k/e using transistor. 4. Study of solar cell characteristic. 5. To find absorption coefficient of alpha/beta/gamma particles using a GM counter. 6. Determination of electron charge to mass ratio by Thomson's method.	

4. Reference Books:

1. Advanced course in Practical Physics D. Chattopadhya, PC. Rakshit & B. Saha. (6th Edition) Book & Allied Pvt. Ltd.
2. BSc Practical Physics – Harnam Singh S. Chand & Co. Ltd. – 2001
3. A Text book of advanced Practical Physics – Samir Kumar Ghosh, New Central Book Agency – (3rd edition)
4. B Sc. Practical Physics – CL Arora (1stEdition) – 2001 S. Chand & Co. Ltd.
5. Practical Physics – CL Squires – (3rdEdition) Cambridge University Press.
6. University Practical Physics – D C Tayal. Himalaya Publication.
7. Advanced Practical Physics – Worsnop & Flint.

Any other information:

Minimum 4 regular experiments from each group and all skill/demonstration experiments should be completed in the semester. Certified journal is a must to be eligible to appear for the semester end practical examination.

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EVALUATION PATTERN

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Continuous Evaluation – 25% of the total marks per theory course:

Particulars	**Percentage**
Component I -Class test	15
Component II - Assignment / Project/ VIVA	10

b) Semester end Examination-75% of the total marks per theory course:

i) Duration – These examinations shall be of a duration of two and a half hours.

ii) Question paper pattern of semester end examination for FYBSc, Semester-I and II, to be implemented from academic year 2020-21.

Question No.		**Instruction/question**	**Marks**
Q.1		**Attempt <u>any two</u>:** (Questions on unit- I : Theory and problem solving)	**(20)**
	a)		10
	b)		10
	c)		10
Q.2		**Attempt <u>any two</u>:** (Questions on unit- II : Theory and problem solving)	**(20)**
	a)		10
	b)		10
	c)		10
Q.3		**Attempt <u>any two</u>:** (Questions on unit- I : Theory and problem solving)	**(20)**
	a)		10
	b)		10
	c)		10
Q.4		**Attempt <u>any three</u>: (**minimum one Questions on unit I,II and III: Short answer theory question and problem solving**)**	**(15)**
	a)		5
	b)		5

	c)		5
	d)		5

c) Semester end Examination- 80 % of the total marks per practical course:

A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination. The duration of the practical examination will be two hours per experiment. There will be two experiments, each of 40 marks, one from each Group, through which the candidate will be examined in practical.

d) Continuous Evaluation – 20% of the total marks per practical course:

Practical Skill in performing experiments, data presentation, log book, analysis and interpretation of results.

Signature	Signature	Signature
HOD	Approved by Vice Principal	Principal