JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program: B.Sc.

Proposed Course: Physics

Semester - III

Credit Based Semester and Grading System (CBCS) with effect from the academic year 2020-21

S.Y.B.S.c Physics Syllabus

Academic year 2020-2021

Semester- III			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SPHY301	Mechanics and Thermodynamics- II	2	3
SPHY302	Vector Calculus- II and Analog Electronics	2	3
SPHY303	Applied Physics -I	2	3
SPHY3PR1	Practical -III	2.5	9

Semester III– Theory

Course Code SPHY301	Mechanics and Thermodynamics- II (Credits: 02, Lectures/Week: 03)	
	Course description: To develop quantitative and conceptual understanding of the core areas of mechanics, thermodynamics. **Objectives:** • To understand the concepts of mechanics & properties of matter. • To comprehend the basic concepts of thermodynamics & its applications in physical situation. • To develop problem solving skills.	
Sub Unit	**Unit – I: Mechanics**	**15 L**
1.	Compound pendulum: Expression for time period, maximum and minimum time period, centres of suspension and oscillations , reversible compound pendulum. Kater's reversible pendulum	4
2.	Collision: Introduction, types of collision, laboratory and centre of mass systems, Relationship between displacements and velocities, relationship between angles	5
3.	Bending of beams: Bending moment, Basic assumptions for theory of bending, cantilever, beam supported at its ends and loaded in the middle, I-section girders, determination of Y by bending, Determination of elastic constants by Searle's method	6
	Unit – II: Thermodynamics	**15 L**
1.	Conversion of heat into work, heat engine, Carnot's cycle: its efficiency.	4
2.	Second law of thermodynamics, Statements, Equivalence of Kelvin and Plank statement, Carnot's theorem, Reversible and irreversible process, Absolute scale of temperature.	5
3.	Clausius theorem, Entropy, Entropy of a cyclic process, Reversible process, Entropy change, Reversible heat transfer, Principle of increase in entropy, generalized form of first and second law, entropy change of an ideal gas, entropy of steam, entropy and unavailable energy, entropy and disorder, absolute entropy.	6
	Unit – III: Thermodynamics	**15 L**
1.	Third law of thermodynamics, Nernst heat theorem, Consequences of the third law, Maxwell's thermodynamic relations, Clausius – Clapeyron equation, Thermal Expansion.	6
2.	Steam engine, Rankine cycle, Otto engine, Efficiency of Otto cycle, Diesel cycle, Efficiency of Diesel cycle, Otto and diesel comparison.	4
3.	Low temp Physics: Different methods of liquefaction of gases, methods of freezing, Cooling by evaporation, cooling by adiabatic expansion. Joule - Thompson effect, JT effect of Van der Waal's gas, Liquefaction of helium, properties and uses of liquid Helium.	5

ICA (Internal Continuous Assessment)	Class test, Seminars, Assignments and Class performance.
References:	1. Resnick, Halliday and Walker (9th Ed. 2012). *Fundamentals of Physics.* Wiley. 2. Hans, H. S.and Puri, S. P.((2nd Ed. 2008) *Mechanics.* Tata McGraw Hill. 3. Brijlal, N. Subramanyam, Jivan Seshan ,(2005), *Mechanics and Electrodynamics*, S.Chand Publications, 4. K.R.Symon, (3rd Edition), *Mechanics*, Addition and Wesley publications 5. D.S. Mathur, Hemne P.S. ,(2017), *Mechanics*, S. Chand Publications 6. Gupta A.B. and Roy H. (Reprint 2009) *Thermal Physics*, Book and Allied (P) Ltd. 7. Brijlal, Subramanyam, N., Hemne P.S. (2007), *Heat Thermodynamics and Statistical Physics*. S. Chand.

Course Code SPHY302	Vector Calculus- II and Analog Electronics (Credits: 02, Lectures/Week: 03)	
	Course Description : To develop analytical and quantitative abilities using mathematical physics and comprehend understanding of transistors, operational amplifiers and their applications. **Objectives** • To understand the basic concepts of mathematical physics and their applications in physical situations. • To understand the characteristics and applications of transistors and operational amplifiers. • To understand the basic concepts of oscillators. • To develop quantitative problem solving skills.	
Sub Unit	**Unit – I: Vector Calculus**	**15 L**
1.	Line, Surface and Volume Integrals, The Fundamental Theorem of Calculus, The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence , The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done.	10
2.	Curvilinear Coordinates: Cylindrical Coordinates, Spherical Coordinates	5
	Unit – II: Analog Electronics	**15 L**
1.	Transistor Biasing, Inherent Variations of Transistor Parameters, Stabilisation, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Circuit analysis of Emitter Bias, Biasing with Collector Feedback Resistor, Voltage Divider Bias Method, Stability factor for Potential Divider Bias.	7
2.	General amplifier characteristics: Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance, general theory of feedback, reasons for negative feedback, loop gain.	5
3.	Practical circuit of transistor amplifier, phase reversal, frequency response, Decibel gain and Band width.	3
	Unit – III: Analog Electronics	**15 L**
1.	Oscillators: Introduction, effect of positive feedback. Requirements for oscillations, phase shift oscillator, Wien Bridge Oscillator, Colpitt's oscillator, Hartley oscillator	6
2.	Operational Amplifiers: Introduction, Schematic symbol of OPAMP, Output voltage from OPAMP, AC analysis, Bandwidth of an OPAMP, Slew rate, Frequency Response of an OPAMP, OPAMP with Negative feedback, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower, Summing Amplifier, Applications of Summing amplifier, OPAMP Integrator and Differentiator, Critical frequency of Integrator, Comparator	9

ICA (Internal Continuous Assessment)	Class test, Seminars, Assignments and Class performance.
References:	1. Griffith, D.J. (3rd Ed. 2009). *Introduction to Electrodynamics.* PHI Pvt. Ltd. 2. Mehta V. K. and Mehta R. (1st Ed. 2013). *Principles of Electronics.* S. Chand. 3. 3. Mottershead, A. (Reprint – 2013) *Electronic devices and circuits.* PHI Pvt. Ltd.

I WILL & I CAN
Jai Hind

Course Code SPHY303	Applied Physics – I (Credits: 02, Lectures/Week: 03)	
	Course Description : The course offers interdisciplinary & application oriented learning. **Objectives** • To understand the role of Physics in interdisciplinary areas related to Materials, Bio Physics, Acoustics , nanoscience and nanotechnology etc. • To understand the scope of the subject in Industrail & Scientific research.	
Sub Unit	**Unit – I: Acoustics , Lasers and Fibre optics**	**15 L**
1.	Acoustics of Buildings: Reverberation, Sabine's formula (without derivation) Absorption coefficient, Acoustics of Buildings, factors affecting Acoustics of Buildings, Sound distribution in an auditorium.	
2.	Laser : Introduction, transition between Atomic energy states (without derivation), Principle of Laser, Properties of Laser, Helium–Neon Laser, Application of Laser, Holography	
3.	Fibre Optics : Light propagation through Fibres, Fibre Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibres, Applications of Fibres.	
	Unit – II: Biophysics and Magnetisim	**15 L**
1.	Introduction, definition, History & scope of biophysics, biological fluids, physico- chemical properties, viscosity, surface tension, pH, osmosis, osmotic pressure. Diffusion, Ficks' laws of diffusion, dialysis, Cell is unit of life, Fundamentals of transport process through biological membrane, membrane channels. Electrical properties of cell, Action potential, propagation of action potential, methods of measurement of action potential, Nernst equation, Golman equation, voltage clamp technique, Patch clamp technique, cell impedance and capacitance. Properties of materials Magnetic Properties: Origin of magnetism in solids (basic idea), Types of magnetic order (paramagnetism, diamagnetism, antiferro magnetism, ferromagnetism, ferrimagnetism), magnetic hysteresis. Applications: Magnetic Materials: Soft magnets (Transformer steels), Hard magnets for permanent magnets, Magnetic Recording and Storage. Dielectric materials: Piezoelectric, ferroelectric and pyroelectric materials	15

	Unit – III: Materials – Properties and Applications	15 L
1.	NANOTECHNOLOGY Introduction to nanotechnology: Basics and Basis of nanotechnology. Nanomaterials: Carbon Nanoparticles (CNP), Carbon Nano Tubes (CNT), Single Walled Carbon Nano Tubes (SWCNT), Multi Walled Carbon Nano Tubes (MWCNT). Physical Properties of nano materials: Mechanical, electrical and thermal. Approaches and Methods of generation of nanomaterials (Synthesis): Bottom up and top down approaches, Arc discharge method, laser ablation, chemical vapour deposition (CVD). Tools and Techniques : Microscopy tools: Scanning Electron microscope (SEM). Size determination : Dynamic light scattering (DLS) Spectroscopy tools: Fundamentals of UV-Vis spectroscopy.	
2.	Applications (any three): Medicine, Energy sector, Next generation computer, Water purification, Communication sector, Environment, Automobiles.	
ICA (Internal Continuous Assessment)	Class test, Seminars, Assignments and Class performance	
References:	1. Puri, S., (1st Ed. 2017) Modern Physics Concept and Applications. Narosa Publications. 2. Murugeshan, R and Shivaprasath, K. (15th Ed. 2010). Properties of matter and Acoustics. S Chand & Co.Ltd. 3. Gerald Karp.,(6th Ed. 2016). Cellular and Molecular Biology: Concept and Experiment. Wiley publications. 4. Geoffery Cooper, (6th Ed. 2016) The Cell: A Molecular . D.C. : ASM Press; Sunderland, MA : Sinauer Associates. 5. Guyton, (9th Ed. 2011). Medical Physiology. W B Saunders Co. 6. Bruce Albert, (4th Ed. 2014) Molecular Biology of Cell. Garland Science. 7. Roy R.N., (2nd Ed. 2015) Text Book of Biophysics. New Central Book Agency. 8. Rolf E Hummel, (5th Ed.) Electronic Properties of Materials. Springer publications. 9. Raghavan, V., (6th Ed. 2015) Materials Science and Engineering: A First Course. PHI Learning Pvt. Ltd. 10. SulabhaK.Kulkarani, (2nd Ed.):nanotechnology principles and practices.capital publishing company. 11. M.A.Shah, (1st Ed)Principles of Nanoscience and Nanotechnology.narosa publishing house 12. Suhas Bhattacharya, (1st Ed) Introduction to Nanotechnology, Wisdom Press.	

Course Code SPHY3PR	Practical-III	2.5 Credits
	Objectives: • To correlate theory concepts. • Develop basic experimental skills through conduct of experiments.	
	SEMESTER-III PRACTICALS	
Group-A	1. Y by bending 2. Bar pendulum 3. Helmholtz resonator: determination of unknown frequency 4. Verification of Stefan's law (electrical method) 5. LCR parallel resonance 6. Figure of merit of a mirror galvanometer	
Group-B	1. Passive low pass filter (with roll over) 2. Passive high pass filter (with roll over) 3. Passive band pass filter. 4. Opamp: Inverting amplifier with different gains 5. Opamp: Non – inverting amplifier with different gains and voltage follower 6. Colpitt's oscillator	
Group-C	1. Laser experiments: (Ruler grating, single slit) 2. Concept of beats 3. Logarithmic decrement 4. Surface tension by Jaeger's method 5. Understanding UV-Visible spectra of a protein 6. Literature survey (equivalent to 2 practical sessions). OR Visit to research institutes (equivalent to 2 practical sessions).	

Skills	1. Soldering technique 2. Wiring of simple circuit using bread board 3. Use of oscilloscope 4. Spectrometer: optical leveling and Schuster's method 5. Drawing of graph on semi logarithmic / logarithmic scale	
ICA (Internal Continuous Assessment)	Continuous practical evaluation /seminar / Journal Report and Viva-voce.	
References:	1. D. Chattopadhya, PC. Rakshit & B. Saha, (8th Edition), Advanced course in Practical Physics: Book & Allied Pvt. Ltd. 2. Harnam Singh, (17 th edition 2001), BSc Practical Physics: S. Chand & Co. Ltd. 3. Samir Kumar Ghosh, (4th edition), A Text book of Practical Physics: New Central Book Agency 4. C. L. Arora, (1st Edition) – 2001), B Sc. Practical Physics: S. Chand & Co.Ltd. 5. C. L. Squires, Practical Physics: (3rd Edition) , Cambridge University Press. 6. D C Tayal,(1st edition, 2000) , University Practical Physics: Himalaya Publication. 7. Worsnop & Flint, Advanced Practical Physics:	

Note:

Students will come for three turns of two and half hours per week for the laboratory session (Performing practical)

ii) Regular Physics Experiments: A minimum of **five experiments** from each group of the practical course are to be performed and reported in the journal.

iii) Skills: Five skills are to be performed in the laboratory and students should be encouraged to participate and make observations wherever possible.
The certified journal must contain a minimum of **twelve regular** experiments, four from each group and **four** skills. A separate index and certificate in the journal is a must for each course in each semester.

Evaluation Scheme

[A] Evaluation scheme for Theory courses SPHY301, SPHY302 and SPHY303

- **Continuous Assessment (C.A.) - 40 Marks**
  - C.A.-I : Test – 20 Marks of 40 mins. Duration
  - C.A. –II: Assignment of problems/seminar/class performance
- **Semester End Examination (SEE)- 60 Marks**

[B] Evaluation scheme for Practical course

Total marks : 150						
Continuous Internal Assessment (CIA) 40% (60 marks)			**Semester End Examination (SEE) 60% (90 marks)**			**Total**
Rough journal	**Journal**	**Viva-voce**	**Exp -I**	**Exp- II**	**Exp -III**	
(10+10+10)	**15**	**15**	**30**	**30**	**30**	**150**

External practical evaluation: Students will be evaluated on the basis of experiments performed from each group of 2 hours duration (Group A and B experiments). For Group C the evaluation would be on the basis of an experiment of 2 hours or seminars on Literature survey.

Note: Certified journal is a must for the student to appear for practical examination.