

PHY1303FM FOUNDATION PHYSICS

(THEORY)

LEARNING OUTCOME:

4 hrs./wk.

On successful completion of the course, the student will be able to

- recall the concepts of vectors in one-dimensional motion
- relate the properties and motion of mechanical waves
- apply the principles of reflection and refraction to explore image formation
- interpret the basic principles of classical thermodynamics
- employ elementary mathematics in circuit analysis

COURSE CONTENT:

UNIT I: KINEMATICS

12 hrs.

Nature of Physics – solving physics problems – vectors and vector addition – components of vectors – displacement, time, and average velocity – instantaneous velocity – average and instantaneous acceleration – freely falling bodies

UNIT II: MECHANICAL WAVES

12 hrs.

Types of mechanical waves – periodic waves – mathematical description of a wave: wave function for a sinusoidal wave – graphing the wave function – speed of a transverse wave using Newton's second law of motion – wave interference, boundary conditions and superposition – standing waves on a string – normal modes of a string.

UNIT III: GEOMETRIC OPTICS

12 hrs.

Reflection and refraction at a plane surface, reflection at a spherical surface: Image formation of a point object by a spherical mirror – focal point and focal length – convex mirrors – refraction at a spherical surface, thin lenses – properties of a lens – image of an extended object: converging lenses – diverging lenses – lens maker's equation – graphical methods for lenses

UNIT IV: THERMAL PHYSICS

12 hrs.

Temperature and thermal equilibrium – thermometers and temperature scales – gas thermometers and Kelvin scale – thermal expansion – quantity of heat – thermodynamic systems – work done during volume changes – paths between thermodynamic states – internal energy and first law of thermodynamics.

UNIT V: ELECTRIC CIRCUITS

12 hrs.

Resistors in series and in parallel – Kirchhoff's rules – electrical measuring instruments – RC circuits – mutual inductance – self-inductance and inductors – magnetic field energy – RL circuit – LC circuit – LRC series circuit.

TEXT BOOK(S):

Hugh D. Young, Roger A. Freedman and A. Lewis Ford, (2017). *Sears & Zemansky's University Physics with Modern Physics*, (13th ed.), New Delhi: Pearson. Print.

1.1,1.2,1.7,1.8,2.1-2.3,2.5,15.1-15.4,15.6-15.8,17.1-17.5, 19.1-19.4,26.1-26.4,30, 34.1-34.4.

REFERENCE BOOK(S):

Harris Benson, (2008). *University Physics*, New Delhi: Wiley India (P) Ltd. Print.

Jerold Touger, (2006). *Introductory Physics - Building Understanding*, New Delhi: Wiley India (P) Ltd. Print.

Paul G. Hewitt, (2015). *Conceptual Physics*, (12th ed.), England: Pearson Education Limited.

Resnick, Halliday and Krane, (2010). *Physics*, (5th ed.), New Delhi: John Wiley & Sons. Print.

Raymond A. Serway and Chris, (2010). *College Physics*, (9th ed.), USA: Charles Hartford.

WEBSITE(S):

Optics - <http://www.upscale.utoronto.ca/GeneralInterest/Harrison/Flash/#optics>

Heat and Thermodynamics - <http://hyperphysics.phy-astr.gsu.edu/hbase/heacon.html>

PHY1501CM MECHANICS

(Theory)

LEARNING OUTCOME

5 Hrs./Wk.

On successful completion of the course, the student will be able to

- understand the principles of various force laws and the concept of energy and momentum
- apply linear momentum conservation principles to different physical systems
- relate linear and rotational motion
- apply conservation of angular momentum to real life situations

COURSE OUTLINE

UNIT-I : NEWTON'S LAWS AND ITS APPLICATIONS

15 Hrs.

Classical mechanics – Newton's first law – force – mass – Newton's second law – Newton's third law – weight and mass – applications of Newton's laws in one dimension – force laws – tension and normal forces – frictional forces – dynamics of uniform circular motion

UNIT-II : CONSERVATION OF MOMENTUM AND COLLISIONS**15 Hrs.**

Collisions – linear momentum – impulse and momentum – conservation of momentum – two body collisions – motion of a complex object – two particle systems – many particle systems – center of mass of solid objects – conservation of momentum in a system of particles

UNIT-III : ROTATIONAL KINEMATICS AND DYNAMICS**15 Hrs.**

Rotational motion – rotational variables – rotation with constant angular acceleration – rotational quantities as vectors – relationships between linear and angular variables: scalar form – vector relationships between linear and angular variables – torque – rotational inertia and Newton's second law – rotational inertia of solid bodies – combined rotational and translational motion

UNIT-IV : ANGULAR MOMENTUM**15 Hrs.**

Angular momentum of a particle – systems of particles – angular momentum and angular velocity – conservation of angular momentum – spinning top – quantization of angular momentum – rotational dynamics: a review

UNIT-V : WORK AND ENERGY**15 Hrs.**

Work and energy – work done by a constant force – work done by a variable force: one dimensional case – work done by a variable force: two dimensional – kinetic energy and work energy theorem – power – conservative forces – potential energy – conservation of mechanical energy

QUALITATIVE ACTIVITIES ON:

- Newton's laws, friction, circular motion
- collision and conservation of momentum in two body system
- torque
- conservation of angular momentum
- conservation of mechanical energy

TEXT BOOK(S)

Resnick, Halliday, Krane, (2002). *Physics*, (5th ed.). Vol.1, New Delhi: John Wiley & Sons (ASIA) Pvt Ltd., Print Chapters: 3,5,6,7,8,9.1–9.3, 9.7,10,11.1– 11.6, 12.1– 12.3.

REFERENCE BOOK(S)

Atam P. Arya, (1979). *Introductory College Physics*, (3rd ed.). New Delhi, Macmillian Publications, Print.
George Gamove & John M. Cleveland, (1978). *Physics: Foundations & Frontiers*, New Delhi: Prentice Hall, India, Pvt. Ltd. Print.

Jerold Touger, (2006). *Physics*, New Delhi: Wiley India (P) Ltd. Print.

Neil Chatterjee, (2009). *Enjoyable Physics, Vol.1*, New Delhi: Macmillan Publishers India Ltd. Print.

PHY1402AA GENERAL PHYSICS

(THEORY)

LEARNING OUTCOME

5 hrs./wk.

On successful completion of the course, the student will be able to

- identify the properties of light and appreciate the wonders of it in nature
- interpret the behavior of matter in electric and magnetic field
- acquire knowledge of crystal structures and the basic function of logic gates

COURSE CONTENT

UNITI: LIGHT

18 hrs.

Nature of Light – sources of light – the speed of light – waves, wave fronts, and rays – reflection and refraction – total internal reflection – dispersion – polarization – polarizing filters – using polarizing filters – polarization by reflection – circular and elliptical polarization.

DEMONSTRATIONS: reflection and refraction, total internal reflection, dispersion of light through prism, polarimeter.

UNITII: ELECTRICITY AND MAGNEITSM

18 hrs.

Electric Charge – conductors, insulators and induced charges – Coulomb's law – electric field and electric forces– electric field lines – Gauss's law – applications of Gauss's law–magnetism – magnetic field – magnetic field line and magnetic flux – motion of charged particles in magnetic field – applications of motion of charged particles.

DEMONSTRATIONS: Magnetic field line of a bar magnet and horseshoe magnet.

UNITIII: MATERIAL SCIENCE

12 hrs.

Fundamental definitions in crystallography – nomenclature of crystal directions – nomenclature of crystal planes: Miller indices – symmetry elements of a crystalline solid – crystal structures of important engineering materials.

DEMONSTRATIONS: Models of crystal structures.

UNITIV: NUCLEAR PHYSICS**12 hrs.**

Properties of nuclei– nuclear density – nuclides and isotopes – nuclear binding and nuclear structure– nuclear force – natural radioactivity – activities and half-lives– biological effects of radiation.

UNITV: DIGITAL ELETRONICS**15 hrs.**

Gates – inverters – OR gates – AND gates – Boolean algebra – NOR gates – NAND gates – De Morgan's first theorem – De Morgan's second theorem – Exclusive OR gates – the controlled inverters – Exclusive NOR gates – Boolean relations –sum of products method –algebraic simplification –Karnaugh maps – pairs, quads and octets –Karnaugh simplification–Don't care conditions.

DEMONSTRATIONS Function of logic gates, De Morgan's theorem.

TEXT BOOK(S)

Albert Paul Malvino, (2012). *Digital Computer Electronics: An introduction to Microcomputers*, (3rd ed.), New Delhi: Tata McGraw–Hill Publishing Company Limited. Print.

Chapters: 2, 3 ,5.

Arumugam M, (2002). *Materials Science*, (3rd ed.), Kumbakonam: Anuradha Publications. Print.

Chapters: 3.1 – 3.6.

Hugh D. Young, Roger A. Freedman, A. Lewis Ford, (2012). *University Physics with Modern Physics*, (13th ed.), San Francisco: Pearson Education. Print.

Chapters: 21.1 –21.4, 21.6, 22.3 – 22.4, 27.1 – 27.5, 33.1 – 33.5, 43.1 (Pg. No:1439–1441), 43.2 (Pg.No: 1444–1446), 43.3 (Pg.No:1454,1455), 43.4, 43.5.

REFERENCE BOOK(S)

Albert Paul Malvino Donald P. Leach, (1996). *Digital Principles and Applications*, (4thed.), New Delhi: Tata McGraw Hill Publishing Company Limited. Print.

Jerold Touger, (2006). *Introductory Physics: Building Understanding*, New Delhi: John Wiley & Sons, Wiley–India Edition. Print.

Mitchel E Schultz, (2011). *Grob's Basic Electronics*, (11thed.), New York: McGraw – Hill International Publications. Print.

Tewari K.K, (1990). *Electricity and Magnetism*, (2nd ed.), New Delhi: S. Chand & Company Ltd. Print.

PHY1202FS COMMUNICATION SKILLS FOR PHYSICISTS

(Theory)

LEARNING OUTCOME 2 Hrs./Wk.

On successful completion of the course, the student will be able to

- develop her vocabulary and reading Physics with understanding
- write continuously in her own words
- assemble key points and develop a bulleted summary of Physics topics

COURSE OUTLINE

UNIT-I : LISTENING

8 Hrs.

Listening to a Physics paragraph / poem to identify key points and concepts (through objective type questions) – focused listening tasks (using prompt questions to enhance understanding) – pre-listening activities (giving same questions before and after the listening task) using Physics content

UNIT-II : SPEAKING

8 Hrs.

Speaking for few minutes on a chosen Physics topic –tense – voice: active & passive –articles in general Physics topics

UNIT-III : READING

7 Hrs.

Vocabulary building: specialized words in Physics and their English equivalent meaning – building understanding through arranging a jumbled paragraph in Physics to a logical sequence –comprehending the Physics concepts: literal comprehension of a passage – drawing inferences –critical evaluation of content through guided questions

UNIT-IV : WRITING

7 Hrs.

Developing hints to write an essay – paraphrasing a passage through guided tasks (skimming, identifying key points, connecting with previous knowledge) –developing bulleted summary in Physics topics

REFERENCE BOOK(S)

Constantin,A. Kassab,M.(2007). *Increasing the motivation for Physics using English as a medium of teaching*, Book of Abstracts, GIREP–EPEC Conference, Opatija, Croatia, Frontiers of Physics Education, Print.

Resnick, Halliday, Krane.(2002).*Physics*, (5th ed.). Volume 1. New Delhi: John Wiley & Sons(ASIA) Pvt Ltd. Print.

Hugh,D. Young, Roger,A. Freedman,A. Lewis Ford , Sears & Zemansky. (2013). *University Physics with Modern Physics* (13th ed.). New Delhi, India: Pearson Education.Print.

WEBSITE(S)

[http://www.scribd.com/doc/925272/English-through-conceptual-Physics-](http://www.scribd.com/doc/925272/English-through-conceptual-Physics-LeThuyHang)

[LeThuyHang-http://www.ets.org/Media/Tests/PRAXIS/pdf/0720.pdf](http://www.ets.org/Media/Tests/PRAXIS/pdf/0720.pdf)

<http://media.otago.ac.nz/r73SjLdJm2/793kw5L8/Effective-Reading-Strategies.pdf>

<http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/reading.pdf>

<http://www.au.af.mil/au/awc/awcgate/navy/writing-skills-test.pdf>

<http://www.bcc.cuny.edu/english/PDF/Student-Handbook-CATW.pdf>

<http://www.kent.ac.uk/careers/sk/written-communication.htm>

STUDY MATERIAL(S)

<http://www.ph.utexas.edu/~gleeson/httpb/httpb.html> – Eric Smith, –*Fundamental Concepts of Century Physics*

Feynmann, R.P., Leighton, R.B& Sands, M.(1986).*The Feynmann Lectures on Physics*, Vol:1–6, New Delhi:Narosa Publishing house. Print.

Hugh,D. Young, Roger,A. Freedman,A. Lewis Ford , Sears & Zemansky. (2013). *University Physics with Modern Physics* (13th ed.). New Delhi, India: Pearson Education. Print.

Jerold,Touger.(2006).*Introductory Physics Building Understanding*. New Delhi: Wiley India Pvt.Print.

Pau,I G. Hewitt.(1989).*Conceptual Physics*(6th ed.). USA:Harper Collins Publishers.Print.

Resnick, Halliday, Krane.(2002).*Physics*, (5th ed.). Volume 1. New Delhi: John Wiley & Sons (ASIA) Pvt Ltd.Print.

Venkataraman, G.(1993-2001).*Vignettes in Physics(A series by Venkatraman)*, New Delhi: India Universities Press Ltd., Print.

Jeyaraj Nirmala, (Er). (2008).*Introduction to Research Methodology*. Madurai: LDC Publications. Print. Chapters: 1,2,3,4,5,7, 8, 10,11.

Gupta Santhosh. (2003). *Research Methodology and Statistical techniques*. New Delhi: Deep and Deep Publications. Print. Chapters: 10, 11, 13, 18.

Krishnaswami, O.R. (2007). *Methodology of Research in Social Sciences*, Mumbai: Himalaya Publishing House. Print.

READING AND DISCUSSION IN CLASS:

Shah Amrita and Sarabhai Vikram. (2007). *A Life*. India: Penguin Books. Print.

PHY2202FS DATA ANALYSIS AND REPORTING SKILLS

(THEORY)

LEARNING OUTCOME:

2 hrs./wk.

On successful completion of the course, the student will be able to

- interpret data graphically
- deduce mathematical relationship between variables
- identify uncertainties in measurements using spreadsheets
- develop an effective lab report

COURSE CONTENT:

UNIT I: IDENTIFYING THE NATURE OF GRAPHS

10 hrs.

Recognizing mathematical relationships in different physical phenomena through graphs (linear, parabolic, inverse, inverse square, log, exponential, sinusoidal etc.) – slope and area under the curve and its physical interpretation – linearizing a non-linear curve

UNIT II: PROCESSING RAW DATA

10 hrs.

Decimal places and significant figures – precision and uncertainty - Identifying dependent and independent variables – plotting data with appropriate scale – ignoring faulty data - curve fitting – plotting of graphs using spread sheet – uncertainty in slope and intercept

UNIT III: REPORTING SKILL

10 hrs.

Analysis of experimental results-writing a guided lab report including abstract, introduction, data analysis (mathematical and graphical) - conclusion and sources of error with hypothetical data.

REFERENCE BOOK(S):

John R. Taylor, (1982). *An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements*, USA: University Science Books. Print.

[Paolo Fornasini](#), (2008). *The Uncertainty in Physical Measurements: An Introduction to Data Analysis in the Physics Laboratory*, New York: Springer, Print.

WEBSITE(S):

http://mnrnorton.com/assignment_calendar/GraphingStudentGuide.pdf
<http://store.aqa.org.uk/qual/newgcse/pdf/AQA-4180-W-TRB-RL.PDF>
http://www.staff.fcps.net/kgill/Physics/Graphing_Stu_Guide.pdf
http://www.visionlearning.com/library/module_viewer.php?mid=156#
<http://www.howtodothings.com/education/online-guide-for-error-analysis-in-physics>
<http://nebula.deanza.edu/~newton/labskillsmanual/labskillsmanual.pdf>
http://www.staff.fcps.net/kgill/Physics/Graphin.g_Stu_Guide.pdf
<http://www.physics.pomona.edu/sixideas/labs./LRM/LR05.pdf>
<http://asaphysics.wikispaces.com/file/view/worksheet+interpreting+graphs+ans+key.pdf>
http://panda.unm.edu/Courses/Saul/Physics1/1-ScienceReasoning/07_U1_Reading-sigfigs.pdf
http://modeling.asu.edu/Modeling-pub/Mechanics_curriculum/1-Sci%20Thinking/08_U1%20ws2.pdf
http://modeling.asu.edu/Modeling-pub/Mechanics_curriculum/1-Sci%20Thinking/05_U1%20ws1.pdf
<http://www.phy.ilstu.edu/slh/Common%20Graph%20Forms.pdf>
http://cmapspublic3.ihmc.us/rid=1221423161983_692379701_12565/A01%20-%20Pos%20vs%20Time%20Graphs%20%26%20motion%20maps.pdf
<http://kernphysics.wikispaces.com/file/view/WS+2+Position+v+Time+%26+Velocity+v+Time.pdf>
<http://modelinginstruction.org/wp-content/uploads/2012/04/Mechanics-Unit-2-sample-.pdf>
<http://www.ames.k12.ia.us/staff/elizabethbrenneman/sites/12-13/AP%20Physics%2012-13/Unit%201%20Kinematics%2012-13/Motion%20worksheets%20and%20keys.pdf>
http://www.cusd200.org/2354201110175042790/lib/2354201110175042790/Unit_2_NEW_NEW.pdf
<http://astro.pas.rochester.edu/~aquillen/phy103/Labs/old/P103LabManualF2007.pdf>

PHY2203CP GENERAL LAB I**(LAB)****LEARNING OUTCOME****3 hrs./wk.**

On successful completion of the course, the student will be able to

- use basic measuring instruments
- infer the basic concepts in Mechanics, Optics and Electrical circuits
- develop the skill of observation and make meaningful conclusions.

COURSE CONTENT:**EXPERIMENTS/LAB:**

A minimum of 10 experiments to be done

1. Handling basic laboratory instruments (screw guage, travelling microscope, spectrometer, spherometer)
2. Study of Collisions
3. Study of rigid body oscillations (Torsional/bifilar/compound pendula)
4. Study of frictional forces
5. Study of refraction (Lenses / Prisms)
6. Study of lens system (simple and compound microscope)
7. Eye and its defects
8. Comparing EMF of two batteries using potentiometer
9. Melde's string – standing waves
10. Coefficient of viscosity by flow method
11. Surface tension by capillary rise method
12. Pitch acuity of human ear

REFERENCE BOOK(S):

Arora C.L., (2011). *B.Sc. Practical Physics*, New Delhi: S. Chand & company Ltd. Print.

Bhattacharya C.K., (1984). *University Practical Physics with Viva-Voce*, New Delhi: CBS publishers and distributors. Print.

Chattapadhyay D. and Rakshit P.C., (2005). *An Advanced course in Practical Physics*, (7th ed.), Kolkatta: New Central Book Agency Pvt., Ltd. Print.

Gupta S.L., and Kumar V., (2002). *Practical Physics*, (25th ed.), Meerut: Pragatiprakashan Publication. Print.

Ouseph C.C., Rao U.J. and Viyayendran V., (2010). *Practical Physics and Electronics*, Chennai: S. Viswanathan Printers and Publishers Pvt., Ltd., Print.

Palanisamy P K, (2002). *Physics Laboratory Manual*, Chennai: Scitech Publications (India) Pvt. Ltd., Print.

PHY2201NI ENVIRONMENTAL PHYSICS

(Theory)

LEARNING OUTCOME:

2 Hrs./Wk.

On successful completion of the course, the student will be able to

- relate the connection between physics and human environment [ni]
- recognize the structure, composition of the atmosphere and the global weather conditions [ni]

- identify the use of renewable energy resources

COURSE OUTLINE:

UNIT-I : PHYSICS IN HUMAN ENVIRONMENT

10 Hrs.

Laws of thermodynamics, - thermodynamics and the human body - Energy and metabolism - Energy transfers: Concepts of Conduction, Convection, Radiation and Evaporation - Survival in cold and hot climates

UNIT-II : THE URBAN ENVIRONMENT

10 Hrs.

Townscape – Energy in the city – Transportation – Water for urban environment – Lighting – Urban pollution – Smog – Acid rain – Car as an urban pollutant – Noise pollution

UNIT-III : ENERGY FOR LIVING

10 Hrs.

World energy demand - World energy supplies – Basic concepts of Energy sources: Fossil fuels, Nuclear power: Nuclear fission & fusion, Solar energy, Hydroelectric power, Tidal power , Biomass and biofuels, Geothermal power

TEXT BOOK(S)

Dželalija M, **Lecture Notes on Environmental Physics**, Split, 2004.

Nigel Mason and Peter Hughes, Taylor and Francis, **Introduction to Environmental Physics: Planet Earth, Life and Climate**, London, 2001., Chapters: 2.1 , 2.2, 2.3.1, 2.3.3, 2.3.4, 2.4.1 - 2.4.4, 2.5, 2.6, 4.1 – 4.11, 5.1 - 5.5, 5.7, 5.8, 5.10 - 5.12.

REFERENCE BOOK(S)

Clare Smith, **Environmental Physics**, Haryana, Replica Press Pvt. Ltd, 2004.

Erach Bharucha, **Text book of Environmental Studies**,, Hyderabad,, UGC,University Press (India) Pvt. Ltd, 2013.

PHY2502CM ELECTRONICS - I

(Theory)

LEARNING OUTCOME :

5 Hrs./Wk.

On successful completion of the course, the student will be able to

- recognize the development of electronics in discrete components
- develop a strong foundation in electronics
- design and analyze wave shaping, regulating, amplifier and switching circuits
- compare the functioning of unipolar and bipolar junction transistors

COURSE OUTLINE :

UNIT-I : INTRODUCTION AND DIODE CIRCUITS

20 Hrs.

Thevenin's Theorem – Norton's Theorem - The half- wave rectifier- The transformer- The full- wave rectifier- The Bridge- rectifier- The Choke- input filter- The Capacitor- input Filter- -Clippers and Limiters- Clampers- The Zener Diode- The Loaded Zener Regulator – Second approximation of Zener Diode- Zener Drop- out point

UNIT-II : TRANSISTOR FUNDAMENTALS AND BIASING

20 Hrs.

The unbiased transistor – The biased transistor- transistor currents – The CE Connection - The base curve- Collector Curves- Transistor Approximation – Variation in Current gain – The Load Line – The Operating Point - Recognizing Saturation – The transistor Switch- Emitter Bias - The effect of small changes - Voltage- Divider Bias- Accurate VDB Analysis- VDB Load and Q Point – Two- Supply Emitter Bias- Other Types of Bias - PNP transistor

UNIT-III : VOLTAGE AMPLIFIERS

15 Hrs.

Base- Biased Amplifier- Emitter- Biased Amplifier- small- Signal Operation- AC Beta- AC Resistance of the Emitter Diode- Two transistor Models- Analysing an Amplifier- Voltage gain – The Loading Effect of Input Impedance- Multistage Amplifier- Swamped Amplifier

UNIT-IV : POWER AMPLIFIERS

10 Hrs.

CC Amplifier - Output impedance - Darlington connections - amplifier terms – two load lines – Class A operation – Class B operation – Class B push-pull Emitter Follower

UNIT-V : JFETS AND MOSFETS

10 Hrs.

JFETS- Basic ideas-Drain curves-The transconductance curve-Biasing in the Ohmic region- Biasing in the active region - Transconductance-JFET amplifiers- The JFET analog switch-MOSFETS-The depletion-mode MOSFET- D-MOSFET curves – The enhancement - mode MOSFET - The ohmic region.

TEXT BOOK(S)

Albert P.Malvino, & David J. Bates, **Electronic Principles**, seventh edition, New Delhi: Tata McGraw-Hill Publishing Company Ltd, 2009, Chapters: 1.5, 1.6, 4.1 – 4.6, 4.10, 4.11, 5.1- 5.4, 6.1 – 6.7, 7.1 – 7.6, 7.8, 8.1 -8.5, 8.7, 9.1 – 9.7, 10.1 – 10.4, 11.1, 11.2, 11.4, 12.1- 12.5, 13.1-13.8, 14.1, 14.2, 14.4, 14.5.

REFERENCE BOOK(S)

Bandyopadhyay T.K, **Basic & Applied Electronics (Theory & Practical)**, Kolkata, Books and Allied Pvt. Ltd, 2002..

Horowitz P. and Hill W, **The Art of Electronics**, 2nd ed, India, Cambridge University Press, 1989..

Jacob Millman and Christos C. Halkias, **Electronic Devices and Circuits**, New Delhi, Tata McGraw-Hill Publishing Company Ltd, 2006.

John.D.Ryder, **Electronic Fundamentals and Applications**, 5th ed, New Delhi, Prentice-Hall of India

Private Ltd, 1989..

Kar R.K, **Electronics (Classical and Modern)**, Kolkata, Books and Allied Pvt. Ltd, 2004.

Sedha R.S, **A text book of Applied Electronics**, Revised edition, New Delhi, S. Chand & Company Ltd, 2013.

Theraja B.L, & Dr.Sedha.R.S, **Principles of Electronic Devices and Circuits**, Revised ed, New Delhi, S.Chand & Company Ltd, 2011.

S.L. & V. Kumar, (2002). *Practical Physics*, (25th ed.), Meerut: Pragatiprakashan Publication.

Ouseph C.C., Rao U.J. & Vijayendran V., (2010). *Practical Physics and Electronics*, Chennai: S. Viswanathan Printers and Publishers Pvt., Ltd. Print.

Palanisamy P K, (2002). *Physics Laboratory Manual*, Chennai: Scitech Publications (India) Pvt. Ltd. Print.

MANUAL(S):

Lab manuals are provided by the course teachers

PHY3205CP ELECTRONICS LAB I

(LAB)

LEARNING OUTCOME

3 hrs. / wk.

On successful completion of the course, the student will be able to

- demonstrate the process of converting ac signals to dc using expeyes
- design voltage, current and power amplifiers using transistors and JFETS
- understand and relate data and write concise reports with meaningful conclusions

COURSE CONTENT:

45 hrs.

EXPERIMENTS

(A minimum of 10 experiments)

1. Study of network circuits with resistors (Thevenizing a circuit / Nortonizing a circuit)
2. Diode / Zener Diode characteristics
3. Clippers /Clampers
4. Full wave rectifier / Bridge rectifier & Filter using ExpEYES
5. Voltage Regulator using Zener Diode & IC 7805
6. Transistor biasing- Base bias & Voltage divider bias
7. Transistor biasing – Emitter feedback / Collector feedback & Emitter collector feedback bias
8. Emitter follower / Source follower
9. CE / CS amplifier

10. Swamped amplifier
11. Study of Darlington pair (Using LTspice)
12. JFET characteristics (Using LTspice)

REFERENCE BOOK(S):

Albert P. Malvino & David J. Bates, (2009), *Electronic Principles*, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.

Grob. B., (2007). *Basic Electronics*, (10th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.

Jacob Millman & Christos C. Halkias, (2006). *Electronic Devices and Circuits*, New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.

MANUAL(S):

Lab manuals are provided by the course teachers

E-BOOK(S):

User's Manual Experiments for Young Engineers and Scientists

<http://expeyes.in/Documents/eyes17-a4.pdf>

Manual Experiments for Young Engineers and Scientists <http://expeyes.in/Documents/eyes17-a4.pdf>

PHY3403AA BASIC PHYSICS

(THEORY)

LEARNING OUTCOME

5 hrs./wk.

On successful completion of the course, the student will be able to

- apply Newton's laws to different physical systems
- interpret the concept of wave phenomena
- acquire knowledge on the fundamentals of electricity and magnetism

COURSE CONTENT:

UNIT I: NEWTON'S LAWS AND APPLICATIONS

15 hrs.

Vectors and vector addition – components of vectors – Newton's first law – Newton's second law – Newton's third laws – applications of Newton's laws

UNIT II: MOMENTUM AND ROTATIONAL DYNAMICS

15 hrs.

Momentum and impulse – conservation of momentum – angular speed and angular acceleration – relationship between angular and linear quantities – centripetal acceleration – torque – relation between torque and angular acceleration

UNIT III: WAVES AND SOUND

15 hrs.

Hooke's law – motion of a pendulum – waves – interference of waves – producing a sound wave – characteristics of sound waves – energy and intensity of sound waves – standing waves – standing waves in air columns – beats – quality of sound

UNIT IV: ELECTRICITY

15 hrs.

Properties of electric charges – Coulomb's law – electric field – electric field lines – electric flux and Gauss law – potential difference and electric potential – applications: electrostatic precipitator, xerography and laser printers

UNIT V: MAGNETISM

15 hrs.

Magnets – Earth's magnetic field – magnetic fields – ampere's law – induced emf and magnetic flux – Faraday's law of induction and Lenz law – generators – application: RL circuits

TEXT BOOK(S):

Raymond A. Serway, Chris Vuille, (2012). *College Physics*, (9th ed.), Vol. 1, Canada: Cengage Learning.

Chapters: 3.1-3.2, 4.2-4.4, 4.5 (88-103), 6.1 (167-171), 6.2, 6.3, 7.1, 7.3, 7.4, 8.1, 8.5 (247- 250), 3.1, 13.5, 13.7, 13.8, 13.10, 14.1, 14.2, 14.4, 14.8, 14.10-14.12, 15.1, 15.3-15.5, 15.9 (533-537), 16.1 (552-555), 16.2, 16.5, 19.1 – 19.3, 19.7, 20.1, 20.2, 20.4, 20.6.

REFERENCE BOOK(S):

Jerold Touger, (2006). *Introductory Physics – Building understanding*, New Delhi: John Willey & Sons. Print.

Nelkon and Parker (1995), *Advanced Level Physics*, (7th Ed.), New Delhi: CBS Publishers & Distributors P Ltd. Print.

Resnick, Halliday, and Krane (2010). *Physics*, (5th ed.), Vol. 1, New Delhi: John Wiley & Sons. Print.

PHY3403CM ELECTRICITY AND MAGNETISM

(THEORY)

LEARNING OUTCOME:

5 hrs./wk.

On successful completion of the course, the student will be able to

- explain the basics of electrostatics and magnetism
- interpret the dielectric behavior of matter in an electric field
- apply vector analysis to electricity
- calculate forces, fields and potentials related to physical situations

COURSE CONTENT:

UNIT I: ELECTRIC CHARGE AND FIELD

15 hrs.

Electric charge – Coulomb’s law – continuous charge distributions – the electric field – electric field of point charges – electric field of continuous charge distributions – electric field lines – a point charge in an electric field – a dipole in an electric field – Nuclear model of the atom

UNIT II: GAUSS’ LAW

15 hrs.

The flux of a vector field – the flux of the electric field – Gauss’ law – applications of Gauss law – Gauss’ law and conductors – experimental tests of Gauss’ law and Coulomb’s law

UNIT III: ELECTRIC POTENTIAL

15 hrs.

Potential energy – electric potential energy – electric potential – calculating the potential from the field – potential due to point charge – electric potential of continuous charge distribution – calculating the field from the potential – equipotential surfaces – the potential of a charged conductor – the electrostatic accelerator

UNIT IV: THE MAGNETIC FIELD AND INDUCTANCE

15 hrs.

Magnetic force on a moving charge – circulating charges – the Hall effect – magnetic force on a current carrying wire – torque on a current loop – inductor – self-inductance – calculation of self-inductance in solenoid, two parallel wires, two coaxial cylinders and toroidal coil.

UNIT V: ELECTRICAL PROPERTIES AND CAPACITANCE

15 hrs.

A conductor in an electric field: dynamic conditions – ohmic materials – ohms law – Insulator in an electric field - capacitors – capacitance – calculating the capacitance – capacitors in series and parallel – energy storage in an electric field – capacitor with dielectric

TEXT BOOK(S):

Halliday, Resnick and Krane (2010), *Physics*, (5th ed.), Volume II, Singapore: John Wiley & Sons, Print. Chapters: 25.2, 25.4, 25.5, 26, 27, 28, 29.3-29.6, 30, 32.2 – 32.6.

Tewari K.K (2013), *Electricity and Magnetism*, (revised ed.), New Delhi, S. Chand & Company Ltd. Print. Chapters: 11.12, 11.13

REFERENCE BOOK(S):

Arthur F. Kip (1969), *Fundamentals of Electricity and Magnetism*, Second edition, USA, McGraw-Hill Inc.

PHY3405CT INTRODUCTION TO PYTHON PROGRAMMING

(LAB CUM THEORY)

LEARNING OUTCOME:

3T + 2L hrs./wk.

On successful completion of the course, the student will be able to

- acquire the skill of working with Python
- apply programming concepts to solve physics problems
- appraise the salient features of Python in physics simulations

COURSE CONTENT:

UNIT I: DATA TYPES, VARIABLES AND OPERATORS

9T + 6L hrs.

Logical data types – numeric data types: integer – floating point numbers – storing a floating-point number – complex numbers – sequences – strings – lists and tuples – sets and frozen sets – concept of variables: rules of naming variables – assignment operator – arithmetic operators – changing and defining data type – order of usage – comparison operators – membership operator – identity operator.

UNIT II: CONTROL STATEMENTS AND LOOPS

9T + 6L hrs.

Boolean expressions – simple if statement – if-else statement – compound Boolean expressions – nested conditionals – multi-way decision statements – conditional expressions – errors in conditional statements – while statement – definite loop vs. indefinite loops – for statement – nested loops – abnormal loop termination – infinite loops.

UNIT III: ARRAYS AND LISTS

9T + 6L hrs.

Numpy – ndarray – automatic creation of arrays – numerical ranges – indexing – slicing – arrays and matrices – basic operations with arrays – lists: introduction – accessing list elements – basic list operations – list methods – list variables – list comprehension.

UNIT IV: FUNCTIONS AND OBJECTS

9T + 6L hrs.

Defining functions – function name – descriptive string – indented block of statements – return statement – multi-input and multi-output functions – namespaces: scope rules – classes and objects – introduction – public and private members – class declaration and object creation – object initialization.

UNIT V: PLOTTING

9T + 6L hrs.

Introduction – matplotlib – pylab versus pyplot– plotting basic plots – plotting more than one graph on same axes – various features of a plot – histograms – bar charts – error bar charts – scatter plots – pie charts – polar plots – plots with text – arrows and annotations – subplots – logarithmic plots – saving a plot to a file.

LAB EXERCISES: (ANY 15 PROGRAMS ON THE FOLLOWING AREAS)

1. Electricity and Magnetism: electrostatic force, RC and RLC circuits
2. Wave Optics: law of refraction, diffraction
3. Electronics: I-V characteristics of a pn junction diode, network theorems
4. Mechanics: force, Newton's law, free fall motion, projectile motion, sound beats
5. Mathematics: basic operations with complex numbers and matrices, solving quadratic equations
6. Nuclear Physics: radioactive decay and exoergic and endoergic reactions.

TEXTBOOK(S):

Sandeep Nagar, (2018). *Introduction to Python for Scientists and Engineers*, New York: Apress. Print.

Unit: I, III (arrays), IV (functions), V

Yashavant Kanetkar & Aditya Kanetkar, (2019). *Let Us Python*, (1st ed.), New Delhi: BPB Publications. Print.

Unit:III (list), IV (objects)

E-BOOK(S):

Richard L. Halterman, (2011), *Learning to program with Python*. Goodreads. (Unit: II)

REFERENCE BOOK(S):

Bill Lubanovic, (2018). *Introducing Python*, Mumbai: Shroff Publishers and Distributors Pvt. Ltd. Print.

John Paul Mueller, (2015). *Beginning Programming with Python for Dummies*, New Delhi: Wiley India Pvt. Ltd. Print.

Mark Lutz, (2011). *Learning Python*, (4th ed.), Mumbai: Shroff Publishers and Distributors Pvt. Ltd. Print.

Mike McGrath, (2013). *Python in easy steps*, Chennai: McGraw Hill Education Pvt. Ltd. Print.

Radha Ganesan P., (2017). *Problem Solving and Python Programming*, Chennai: Chess Educational Publishers. Print.

WEBSITE(S):

https://spoken-tutorial.org/tutorial-search/?search_foss=Python+3.4.3&search_language=English

<https://www.w3schools.com/python/>

<https://www.tutorialspoint.com/python/>

https://www.w3schools.com/python/python_datatypes.asp

https://www.w3schools.com/python/python_while_loops.asp

https://www.w3schools.com/python/python_lists.asp

https://www.tutorialspoint.com/python/python_loops.htm

https://www.tutorialspoint.com/python/python_lists.htm

<https://nptel.ac.in/courses/117106113/34>

<https://www.geeksforgeeks.org/python-programming-language/>

PHY3501CM WAVE OPTICS**(THEORY)****LEARNING OUTCOME:****6 hrs./wk.**

On successful completion of the course, the student will be able to

- recognize the phenomenon of interference, diffraction and polarization
- explain the working of optical instruments
- analyze simple problems in interference, diffraction and polarization

COURSE CONTENT:**UNIT I: INTERFERENCE****18 hrs.**

Wave nature of light – wavelength and frequency – coherence – Young’s double slit experiment – intensity distribution in double slit interference pattern – interference from thin films – multiple films – antireflection coatings – Newton’s rings – Michelson’s interferometer.

UNIT II: FRAUNHOFER DIFFRACTION**18 hrs.**

Diffraction – single slit diffraction – intensity distribution in single slit diffraction – diffraction at a circular aperture – the airy pattern – interference and diffraction at a double slit – multiple slits – diffraction gratings – dispersion and resolving power.

UNIT III: FRESNEL DIFFRACTION**18 hrs.**

Shadows – Fresnel's half period zones – diffraction by a circular aperture – diffraction by a circular obstacle – zone plate – apertures and obstacles with straight edges – strip division of the wave front – Cornu's spiral – Fresnel's integrals – the straight edge.

UNIT IV: POLARIZATION

18 hrs.

Light as an electromagnetic wave – E and B fields – polarization of electromagnetic waves – plane polarized light – polarizing sheets – Malus' Law – polarization by reflection – pile of plates polarizer – polarization by double refraction (birefringence) – wave plates – circular Polarization – polarization by scattering – polarization of sunlight by light scattering in the atmosphere.

UNIT V: OPTICAL INSTRUMENTS

18 hrs.

The human eye – magnifiers – types of magnifiers – spectacle lenses – microscopes – microscope objectives – oculars and eyepieces – astronomical telescopes – Huygens eyepiece – Ramsden eyepiece – grating and prism spectrometers.

TEXT BOOK(S):

Francis A. Jenkins & Harvey E. White (2011), *Fundamentals of Optics*, (4th ed.), USA: McGraw–Hill, Inc., Print.

Chapters: 10.1, 10.8–10.16; 18.1–18.5, 18.7–18.11.

Resnick, Halliday & Krane (2010), *Physics*, (5th ed.), Vol–II, New Delhi: John Wiley & Sons Inc., Print.

Chapters: 41, 42, 43.1–43.3, 44, 46.1.

REFERENCE BOOK(S):

Ajoy Ghatak (2005). *Optics*, (3rd ed.), New Delhi: Tata McGraw–Hill Publishing Company Ltd., Print.

Subrahmanyam N., BrijLal and Avadhaulu M.N. (2006). *A Text Book of Optics*, New Delhi: S.Chand & Company Ltd., Print.

HIPH3201EI SCIENTIFIC PRINCIPLES IN HISTORICAL MONUMENTS

(Theory)

LEARNING OUTCOME:

2 Hrs./Wk.

On successful completion of the course, the student will be able to

- recall the historical background of the monuments
- recognize the different scientific principles in designing, constructing and maintenance of historical monuments
- identify knowledge of scientific principles used by people in the past

COURSE OUTLINE :

UNIT-I : CHARACTERISTICS OF MONUMENTS

7 Hrs.

Definition, Materials used, Purpose-Functions-Types: religious, secular, palaces, forts, tombs, bridges, irrigation systems-need for conservation

UNIT-II : HISTORY OF CONSTRUCTION TECHNOLOGIES

8 Hrs.

Chronological development-Ancient civilizations-Ancient period -Medieval construction-construction in the modern period-technical achievements

UNIT-III : BASIC PHYSICS PRINCIPLES

7 Hrs.

Stability and equilibrium:leaning tower of Pisa –Tension, stress and strain: bridges –Overcoming forces : sledges, pulleys and elevators

UNIT-IV : TECHNIQUES OF CONSTRUCTION

8 Hrs.

Mechanical energy to move large stones –use of counter weights and counter ramps -Hydraulic transport of building material –use of levers and pivot walking

REFERENCE BOOK(S)

A.B.Gupta, College Physics, Volume I, Kolkata, Books & Allied Pvt Ltd, 2005.

Antoine Picon, Construction History: Between Technological and Cultural History, in Construction History, volume 21, Barcelona, Yale University Press, 2005.

Donald Friedman, A Historical Building Construction: Design, Materials, and Technology, Second Edition, New York, W. W. Norton & Company, 2010.

H.T.Pledge, History of Science, New Delhi, DIT Publishers, 1978.

J.D.Bernal, Science in History, London, CA Watts Company Ltd, 1965.

James Edgar Swain, A History of World Civilization, New Delhi, Eurasia Publishing House, 1980.

Pearce F.G, An Outline History of Civilization, London, Oxford University Press, 1965.

VarheseJeyaraj S, History of Science and Technology, Uthamapalayam, Enns Publication, 2004.

Venkatraman R, History of Science and Technology, Madurai, Ennes Publication, 1988.

WEBSITE(S):

<http://www.catchpenny.org/mmbuild.html> <http://www.arvindguptatoys.com/arvindgupta/physicsperiments.pdf>

sciencefair.math.iit.edu/projects/pisa

www.apeg.bc.ca/services/branches/documents/pr/Bridge_Engineering_Principles.pdf

<http://ignoringfriction.blogspot.in/2008/12/physics-behind-famous-bridge-collapses.html>

<http://www.ancient-wisdom.co.uk/extremasonry.htm#transportation>

<http://www.ascensoresdomingo.com/english/historia.htm>

CBPH3201EI CONSUMER AWARENESS ON EVERYDAY APPLIANCES

(Theory)

LEARNING OUTCOME

2 hrs./wk.

On successful completion of the course, the student will be able to

- improve her quality of buying by acquiring a working knowledge of the multiple gadgets and devices used in daily life
- understand differences between products from multiple brands and make intelligent purchase decisions
- learn the basics of marketing of gadgets used in daily life as a career option

COURSE OUTLINE

UNIT I: POWER GADGETS AT HOME AND WORK

6 hrs.

The electric power grid – single and three phase connection – UPS – Voltage stabilizers – lighting – energy saving devices and techniques (fluorescent, CFL, LED, solar panels) – paying for electricity – household equipment: – simple maintenance – safety precautions – understanding power ratings and power consumption of devices (electric fan, air cooler, air conditioner, refrigerator, microwave oven, washing machine, rice cooker, gas stove, induction stove)

UNIT II: COMMUNICATION AND ENTERTAINMENT ELECTRONICS

9 hrs.

Telephone – Facsimile – Cell phone – Photocopier – Scanner – Printer

High fidelity sound reproduction – microphones – CD/DVD/Blu-ray players – portable media players – compressed audio – amplifiers – loud speakers – crossover circuits (active and passive) others – graphic equalizers – surround sound formats (matrix surround, Dolby 5.1, DTS) – use of headphones – home theatre systems

Satellite TV/Radio and DTH/WiFi and networking – display monitors (CRT, Plasma, LCD, LED, OLED) – display resolution (SD, HD, UHD).

Understanding specifications of equipment on information/data sheets

UNIT III: PRODUCT INFORMATION**10 hrs.**

Brand name and brand mark – selection of good brand – Corporate brand and product brand – Packing, packaging and package – essentials of good package – labeling – types of labels – contents of good label – product guarantee and warranty – standardization – product servicing – after sales services – legal issues and laws on product information – Issues in advertising, pricing and promotions

UNIT IV: ONLINE RESOURCES**5 hrs.**

Apps, cloud based resources – e-commerce and productivity tools – access patterns – Comparing products online – choosing websites and online stores – awareness on terms and conditions – privacy policy – Disclaimer – billing, guarantee and delivery – significance of social networking sites, browsers and cookies – email scams – knowledge on complaint procedure and disputes settlement – security issues on payment portals

REFERENCE BOOK(S)

Pillai, R.S.N. and Bahavathi. *Modern Marketing Principles & Practice*. New Delhi: S.Chand and Company Ltd., 2010.

Memoria, C.B. and Joshi. *Principles and Practices of Marketing*. New Delhi: Kitab Mahal, 2012.

Kleinert, Eric. *Troubleshooting and Repairing Major*. 3rd ed. Tab Electronics, 2012.

Zmetana, Katherine. *Time-Life Books Complete Fix-It-Yourself Manual*. 1st ed. Prentice Hall Trade, 1989.

The Editors of Time-Life Books, *How Things Work in Your Home: And What to Do when They Don't*, Holt Paperbacks, 1987.

ENPH3202EI READING SCIENCE FICTION FILMS**(Theory)****LEARNING OUTCOME****2 Hrs./Wk.**

On successful completion of the course, the student will be able to

- relate science fiction stories with scientific facts
- discuss the depiction of science in literature
- interpret the scientific and societal relevance of science fiction

COURSE OUTLINE**UNIT-I: INTRODUCTION TO FILM ANALYSIS****3 Hrs.**

Definition – characteristics of science fiction movies – types of science fiction movies – adaptations of fiction into movie – possibilities and hindrances (outline) – literary aspects to look

for in a movie – 3 part structure – imagery, themes, and symbols, characterisation, interpreting and analysing a science fiction movie – technicalities in shooting science fiction movies – screen shot, mis-en-cene, pan shot, computer graphics, green screening, motion capture

UNIT-II: SPACE AND EARTH SCIENCE

9 Hrs.

Analysis of the movies in terms of character, plot, themes, symbol and imagery.

Origin of the universe – star formation – life cycle of stars – blackhole – alternate reality – distance in time/light years

Movie – Star Trek

UNIT-III: HUMAN AND MACHINE INTERFACE

9 Hrs.

Significance of time machine in literature – analysis of the movies in terms of character, plot, themes, symbols and imagery

Relativity – time travel – twin paradox – grandfather paradox – energy for space shuttle (nuclear) – biofuel

Movie – Back to the Future I

UNIT-IV: ENVIRONMENTAL EFFECTS

9 Hrs.

Analysis of the movies in terms of character, plot, themes, symbols and imagery

Greenhouse effect – effects of global warming – sea level, threat to wild life and humans – deforestation and its effects

Movie – Wall-E

SUGGESTED MOVIES:

Interstellar, Back to the Future II & III, Lorax, Avatar

REFERENCE BOOK(S)

Seed, David, ed. *A Companion to Science Fiction*. Blackwell, 2005. Print.

Edward, James, and Farah Mendlesohn. *The Cambridge Companion to Science Fiction*. N. p.: Cambridge University Press, 2003. Print.

Jameson, Fredric. *Archaeologies of the Future: This Desire Called Utopia and Other Science Fictions*. London and New York: Verso, 2005. Print.

Raja, Masood Ashraf, Jason W. Ellis and Swaralipi Nandi. *The Postnational Fantasy: Essays on Postcolonialism, Cosmopolitics and Science Fiction*. N. p.: McFarland, 2011. Print.

Westfahl, Gary. *The Greenwood Encyclopedia of Science Fiction and Fantasy: Themes, Works, and Wonders* (three volumes). Westport, Conn: Greenwood Press, 2005. Print.

PHY4502CM MATHEMATICAL PHYSICS

(THEORY)

LEARNING OUTCOME

5 Hrs./Wk.

On successful completion of the course, the student will be able to

- illustrate the difference and similarities between different mathematical series
- identify the use of complex numbers in explaining physical realities
- recognize the applications of integrals in solving physics problems
- apply the basic concepts of vectors to physical systems

COURSE OUTLINE

UNIT-I: MATRICES

15 Hrs.

Matrix operations – special matrices – linear combinations, linear functions, linear operators – linear transformations and orthogonal transformations – eigenvalues and eigenvectors.

UNIT-II: POWER SERIES

15 Hrs.

Convergent and divergent Series – convergence tests: preliminary, comparison and ratio tests – alternating series – power series – interval of convergence – techniques for obtaining power series expansions.

UNIT-III: COMPLEX NUMBERS

15 Hrs.

Complex algebra – elementary functions of complex numbers – Euler's formula – the exponential and trigonometric functions – logarithms – inverse trigonometric functions.

UNIT-IV: VECTOR ANALYSIS

15 Hrs.

Vectors – fields – directional derivative – gradient – expressions involving gradient: divergence and curl of vector fields – Laplacian of scalar fields.

UNIT-V: APPLICATIONS

15 Hrs.

Complex Numbers: Motion of a particle – Electricity – Optics – Simple Harmonic motion – vectors: Moment of a force – velocity of a rotating body – work done by a conservative and non-conservative forces – Electric Potential – Matrices: Stretching of an elastic membrane.

TEXT BOOK(S)

Charlie, Harper. (2007). *Introduction to Mathematical Physics*(2nded.). New Delhi: Prentice Hall of India, Private limited. Print. Chapters: 2.4, 2.6

Kreyszig, E. (2013). *Advanced Engineering Mathematics*(9thed.). New Delhi: Wiley India Pvt. Ltd. Print. Chapters:9.3(pages 380-381)

Mary, L. Boas. (2007).*Mathematical Methods in the Physical Sciences* (3rded.). New York: John Wiley & Sons. Print.Chapters: 3.7, 3.11 (Pg no. 148-149, 159) 1.4, 1.5, 1.6 (Pg No.10,13,14) 1.7,1.10,1.13A, 1.13B, 1.13C, 2.5, 2.8, 2.9, 2.11, 2.13, 2.15, 3.4, 6.5-6.7, 6.8, 2.16. Print.

REFERENCE BOOK(S)

Gupta, B.D. (2004). *Mathematical Physics* (3rd ed.). Delhi: Vikas Publication House Pvt. Ltd. Print. Prakash, Sathya. (2002). *Mathematical Physics* (4th ed.). New Delhi: Sultan Chand. Print. Weber and Arken.(2005). *Essential Mathematical Methods For Physicists*. New Delhi: Academic Press. Print.

Feynmann, Leighton and Sands, (2008). *The Feynmann Lectures on Physics*, Vol. (1-3), New Delhi: Narosa Book Distributors Pvt. Ltd. Print.

PHYQ4501CM NON-CONVENTIONAL ENERGY SOURCES

(Theory)

LEARNING OUTCOME:

5 hrs./wk.

On successful completion of the course, the student will be able to

- compare different forms of energy
- acquire knowledge of different methods of harvesting energy
- recognize the use of alternate sources of energy

COURSE CONTENT:

UNIT I: SOLAR ENERGY

15 hrs.

The Sun –The Earth – Sun Earth radiation spectra – Extraterrestrial and Terrestrial Radiations–Solar time– Basic Sun–Earth Angles–Solar Radiation Data – Measurement of Solar Radiation data–Solar collectors–Solar water Heater–Solar cookers–Solar Greenhouse effect – Solar Cell fundamentals – a typical solar electric installation for home (solar panels, battery and inverter)

UNIT II: WIND ENERGY

15 hrs.

Origin of wind – Nature of wind – Wind Turbine Siting – Major Applications of Wind Power– Main components of the horizontal axis wind turbine –Wind Energy Conversion systems – Wind–Diesel Hybrid System.

UNIT III: BIOMASS ENERGY**15 hrs.**

Introduction –Photosynthesis Process–Biofuels–Biomass Resources–Biomass conversion technologies– Urban Waste to Energy Conversion –Biomass Gasification –Biomass to Ethanol production–Biogas Production from Waste Biomass.

UNIT IV: GEOTHERMAL ENERGY AND OCEAN ENERGY**15 hrs.**

Applications–Origin and Distribution of Geothermal Energy–Types of Geothermal sources–Exploration and Development of geothermal Resources– Tidal energy–Wave Energy–Ocean Thermal Energy– Thermoelectric power from waste heat

UNIT V: CHEMICAL ENERGY SOURCES**15 hrs.**

Fuel cells– design and principle of operation of a fuel cell– Classification of fuel cells– Types of Fuel cells– Hydrogen and fossil fuel cell– Advantages and disadvantages of fuel cells– Batteries Introduction– basic battery theory–Different types of battery arrangement– classification of batteries – Lead–Acid battery – Nickel cadmium battery – Li-ion battery – batteries used in portable devices (laptops, cell phones, pace makers) – Hydrogen energy.

TEXT BOOK(S):

Khan B.H (2006), *Non-Conventional Energy Resources*, New Delhi: Tata McGraw –Hill Publishing Company limited, Chapters: 4.2– 4.5, 4.7, 4.8, 4.12 ,4.16 ,5.2, 5.3, 5.7, 5.9, 6.2, 7.2 –7.5, 7.8.1–1, 7.9, 7.10, 8.1– 8.9, 9.2–9.5,10.2–10.4, 12.3. Print.

Rai G.D (2009), *Non-Conventional Energy Sources*, (4th ed.), New Delhi: Khanna Publishers, Chapters: 10.2.2 –10.2.5, 10.3.1, 10.3.2, 10.3.5, 10.3.6. Print.

REFERENCE BOOK(S):

Chauhan D.S. and Srivastava S.K (2006), *Non-conventional energy resources*, (2nd ed.), New Delhi, New Age International (P) Ltd, publishers, Print.

Hasan Saeed S. and Sharma D. K (2008), *Non-Conventional Energy Resources*, New Delhi, S.K.Kataria & Sons publications, Print.

Singal R.K (2009), *Non-conventional energy resources*, New Delhi, International Publishing House Pvt. Ltd, Print.

Sukhatme.S.P (2005), *Solar energy*, (2nd ed.), New Delhi, Tata McGraw –Hill Publishing Company limited, Print.

(THEORY)

LEARNING OUTCOME

5 Hrs. /Wk.

On successful completion of the course, the student will be able to

- recognize the principles involved in astrophysical measurements
- identify the basic principles behind the formation, evolution and death of stars
- explain the different theories of the origin of universe

COURSE OUTLINE

UNIT-I: OUR SOLAR SYSTEM

15 Hrs.

Terrestrial and Jovian planets – thermonuclear energy – a model of the Sun – solar seismology – the photosphere – the chromosphere– the corona –Sunspots–the Sunspot cycle –the active Sun.

UNIT-II: INTERPLANETARY VAGABONDS AND MEASUREMENT TOOLS OF ASTRONOMY

15 Hrs.

The discovery of the asteroids –Jupiter and the asteroid belt – the nature of asteroids – impacts of asteroids on earth – classifying meteorites– meteorites and our origins – comets –the refracting telescope – reflecting telescope – angular resolution – charge – coupled devices – spectrographs – radio telescopes.

UNIT-III: NATURE AND BIRTH OF STARS

15 Hrs.

Stellar distances and parallax–apparent brightness and luminosity – the magnitude scale–star colors and temperatures – spectral classes – the sizes of stars – the Hertzsprung-Russell diagram – spectroscopic parallax – the interstellar medium –protostars and dark nebulae –reaching the main sequence

UNIT-IV: STELLAR EVOLUTION

15 Hrs.

Evolution on the main sequence – red giants – helium fusion – a second red-giant phase – dredge-up and carbon stars – planetary nebulae – white dwarfs – the creation of heavy elements – core-collapse supernovae –neutron stars– black hole: structure and properties

UNIT-V: GALAXIES AND COSMOLOGY

15 Hrs.

Our place in the galaxy – the galaxy's shape and size – spiral arms – the Sun's orbit and dark matter – the distances to galaxies – classifying galaxies – the distance ladder – the Hubble law – the dark night sky – the expanding universe – the big bang – the cosmic microwave background – Gravitational waves.

TEXT BOOK(S)

William, J. Kaufman III. Roger, A. Freedman and Robert, M. Geller. (2014). *Universe* (10thed.). USA: W.H. Freeman Company. Print.

Chapters: 6.1–6.6, 7.1,15.1–15.7, 16.1–16.3,16.5–16.10,17.1–17.8,18.2–18.4,19.1–19.3,20.1–20.6,20.11, 21.2 (Pg:611), 21.7, 22.1–22.3,23.2–23.5,25.1–25.4.

REFERENCE BOOK(S)

Abhayankar, K.D. (2001).*Astrophysics, Stars and Galaxies*. India: Universities Press. Print.

BaidyanathBasu, TanukaChattopadyay and Sudhindranath Biswas. (2011). *An introduction to Astrophysics* (2nd ed.). New Delhi: PHI learning private Ltd. Print.

Bhattacharya, Joardar A.B., Bhattacharya S., R. (2010). *Astronomy and Astrophysics*. India: Overseas Press Pvt. Ltd. Print.

SwamyKrishna, K.S. (2007). *Astrophysics: A Modern Perspective*. New Delhi: New Age International (P) Limited. Print.

Michael, A. Seeds. (2001).*Foundations of Astronomy*. USA: Brooks/Cole Thomson learning. Print.

Sasidharan, G.K. (2008). *The Great Universe*. New Delhi: S. Chand & Company Ltd. Print.

Srinivasan, G. (2011). *Can stars find peace?*. India: Universities Press. Print.

PHY4202SP CONCEPTUAL PHYSICS THROUGH FOSS

(Lab)

LEARNING OUTCOME :

2 Hrs./Wk.

On successful completion of the course, the student will be able to

- recognize the concepts of looping, branching and plotting functions in SCILAB
- identify the versatility of SCILAB in physics
- acquire knowledge to write efficient and documented programs in SCILAB
- develop problem solving skill in physics through SCILAB

COURSE OUTLINE :

EXPERIMENTS / LAB EXERCISES :

30 Hrs.

1. Getting familiarized with Working directory, variables, startup Commands, the Scilab menu bar
2. Temperature conversion
3. Carbon 14 dating
4. Hyperbolic cosine functions

5. Energy stored in a spring
6. The ideal gas law
7. Refraction
8. High pass filter
9. Geometric mean
10. RMS average
11. Harmonic mean
12. Decibel
13. Air craft turning radius
14. Antenna gain pattern
15. Plotting orbits
16. Current through a diode
17. Tension on a cable
18. Maximum power transfer to a load
(OR)
19. Output power of a motor
20. Frequency response of a low pass filter
(OR)
21. Selectivity of radio receiver
22. Fitting a line to a set of noisy measurements (velocity of a falling object)
(OR)
23. The flight of a ball using graphic commands
24. Determining wall thickness of a box using polynomial
(OR)
25. Floating height of buoy using polynomials

TEXT BOOK(S)

Hema Ramachandran & Achutsankar S.Nair, *SCILAB*, First edition, New Delhi: S.Chand & company Ltd., 2012.Print.

REFERENCE BOOK(S)

Amos Gilat, *MATLAB: An Introduction with Applications*, U.K: John Wiley & Sons, Inc., 2009. Print.

Kirani Singh Y & Chaudhuri B.B., *MATLAB Programming*, New Delhi: Prentice Hall of India Pvt. Ltd., 2008. Print.

Raj Kumar Bansal, Ashok Kumar Goel & Manoj Kumar Sharma, *MATLAB and its Applications in Engineering*, New Delhi: Dorling kindersely Pvt. Ltd., 2009. Print.

Stephan J. Chapman, *MATLAB Programming for Engineers*, New Delhi: Cengage Learning India Pvt. Ltd., 2008. Print.

PHY4205CP ELECTRONICS LAB II

(LAB)

LEARNING OUTCOME:

3 hrs./wk.

On successful completion of the course, the student will be able to

- explain the internal architecture and characteristics of an op-amp
- analyse the linear and nonlinear applications of op-amps
- design electronic circuits using ExpEYES and open source software
- develop the skill of observation, analysis and data interpretation
- write an effective lab report with meaningful conclusions

COURSE CONTENT:

EXPERIMENTS

45 hrs.

(A minimum of 10 experiments)

1. Differential amplifier
2. Input offset voltage, input bias current, input impedance & CMRR of an op-amp
3. Op-amp circuits (Inverting amplifier, Non-inverting amplifier & Voltage follower)
4. Linear op-amp applications (Summing, difference and averaging amplifiers)
5. Non-linear op-amp applications (Comparators & Schmitt trigger)
6. Integrator/ Differentiator circuits
7. Astable Multivibrator using ExpEYES / VCO
8. Phase shift oscillator / Wien bridge oscillator
9. Active clippers
10. Second order low pass / high pass filters (LTspice)
11. VCIS and ICVS amplifiers (LTspice)
12. First order lowpass and high pass filter

REFERENCE BOOK(S):

Albert P. Malvino & David J. Bates, (2009). *Electronic Principles*, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.

Grob B., (2007). *Basic Electronics*, (10th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.

Jacob Millman & Christos C. Halkias, (2006). *Electronic Devices and Circuits*, New Delhi: Tata McGraw-Hill Publishing Company Ltd. Print.

WEBLINK(S):

<http://www.expeyes.in/Documents/eyes17-a4.pdf>

http://www.simonbramble.co.uk/lt_spice/ltspice_lt_spice_tutorial_2.htm

PHY4504CM ELECTRONICS - II

(THEORY)

LEARNING OUTCOME

5 hrs./wk.

On successful completion of the course, the student will be able to

- identify the development of ICs in electronics
- use differential amplifier in building op-amps
- design and analyze linear and non-linear op-amp circuits

COURSE CONTENT:

UNIT I: DIFFERENTIAL AMPLIFIERS

15 hrs.

Long – tailed pair – differential amplifier – DC analysis of a differential amplifier – AC analysis of a differential amplifier – characteristics of the differential amplifier – common mode gain – current mirror – loaded differential amplifier

UNIT II: OPERATIONAL AMPLIFIERS

15 hrs.

Introduction to Op Amps – 741 Op Amp – Inverting amplifier – noninverting amplifier – two op amp applications – four types of negative feedback– bandwidth – inverting amplifier circuits – noninverting amplifier circuits – inverter/non-inverter circuits

UNIT III: LINEAR OP-AMP CIRCUITS

15 hrs.

Differential amplifiers – summing amplifier circuits – active filters – ideal responses – passive filters – first order stages – VCVS unity gain second order low pass filters – VCVS high pass filters.

UNIT IV: NONLINEAR OP-AMP CIRCUITS

15 hrs.

Comparators with zero reference – comparators with nonzero references – comparators with hysteresis – window comparator – Integrator – waveform conversion – waveform generation - differentiator.

UNIT V: OSCILLATORS

15 hrs.

Theory of sinusoidal oscillation – Wien-Bridge oscillator – Colpitts oscillator – quartz crystals – 555 timer – astable operation of the 555 timer.

TEXT BOOK(S):

Albert P. Malvino, and David J. Bates, (2009). *Electronic Principles*, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Ltd., Print.

Chapters: 17.1-17.5, 17.7,17.8, 18.1-18.5,19.1,19.7,20.1-20.4,20.6,21.1,21.3,21.4,21.5, 21.8,22.1-22.7,22.10, 23.1, 23.2, 23.4, 23.6-23.8.

REFERENCE BOOK(S):

John. D. Ryder, (1999). *Electronic fundamentals and applications*, (5th ed.), New Delhi, Prentice-Hall of India Private Ltd., Print.

Ramakant A. Gayakwad, (2000). *Op-Amps and linear integrated circuits*, (4th ed.), New Delhi, PHI Learning private Ltd., Print.

Salivahanan S, and Kanchana Bhaaskaran V.S, (2011). *Linear Integrated Circuits*, seventh reprint, New Delhi, Tata McGraw-Hill Publishing Company Ltd., Print.

Sedha R.S, (2013). *A text book of Applied Electronics*, Revised edition, New Delhi, S.Chand & Company Ltd., Print.

PHY4503CM ATOMIC, QUANTUM AND NUCLEAR PHYSICS

(THEORY)

LEARNING OUTCOME

5 hrs./wk.

On successful completion of the course, the student will be able to

- relate the wave and particle nature of matter and light
- explain the development of the structure of atoms from a semi classical physics
- employ the concepts of nuclear energy for constructive applications

COURSE CONTENT:

UNIT I: THE NATURE OF LIGHT AND MATTER

15 hrs.

Introducing the photon – photoelectric effect – Compton effect – matter waves – testing de Broglie's hypothesis – waves and particles – Heisenberg's uncertainty principle

UNIT II: THE SCHRODINGER'S EQUATION

15 hrs.

Wave function – Schrödinger's equation – barrier tunneling – electrons, free and bound – an electron trapped in a potential well – an electron trapped in a finite well – an electron trapped in an atom – ground state of the hydrogen atom – angular momentum of electrons in atoms – an excited state of hydrogen atom – counting the states of hydrogen

UNIT III: ATOMIC STRUCTURE

15 hrs.

X-ray spectrum of atoms – X-rays and the numbering of the elements – building atoms – periodic table – atomic magnetism – Stern-Gerlach experiment – nuclear magnetic resonance

UNIT IV: NUCLEAR PHYSICS AND ENERGY FROM NUCLEUS

15 hrs.

Discovering the nucleus – some nuclear properties – radioactive decay – alpha decay – beta decay – measuring ionizing radiation – natural radioactivity – nuclear reactions – nuclear models – atom and the nucleus – nuclear fission: the basic process – theory of nuclear fission.

UNIT V: NUCLEAR REACTORS AND PARTICLE PHYSICS

15 hrs.

Nuclear reactors: the basic principles – natural reactor – thermonuclear fusion: the basic process – particle interactions – families of particles – conservation laws

TEXT BOOK(S):

Halliday, Resnick and Krane, (2005). *Physics*, (5th ed.), New York: John Wiley & sons, Print.

Chapters: 45.1,45.3,45.4, Ch.46, Ch.47, Ch. 48.1 – 48.7, Ch. 50, Ch. 51.1-51.6, Ch. 52.1 – 52.3.

REFERENCE BOOK(S):

Kenneth Krane, (1998). *Modern Physics*, (2nd ed.), New York: John Wiley & Sons, Print.

Richard P. Feynmann, Robert B. Lighton and Matthew Sands, (1986). *Lectures on Physics*, 3, New Delhi: Narosa Publishing House. Print.

ENPH4201EI READING SCIENCE FICTION FILMS

(Theory)

LEARNING OUTCOME

2 Hrs./Wk.

On successful completion of the course, the student will be able to

- relate science fiction stories with scientific facts
- discuss the depiction of science in literature
- interpret the scientific and societal relevance of science fiction

COURSE OUTLINE:

UNIT-I: INTRODUCTION TO FILM ANALYSIS

3 Hrs.

Definition –characteristics of science fiction movies –types of science fiction movies –adaptations of fiction into movie –possibilities and hindrances (outline) –literary aspects to look for in a movie –3 part structure –imagery, themes, and symbols, characterisation, interpreting and analysing a science fiction movie –technicalities in shooting science fiction movies –screen shot, mis-en-cene, pan shot, computer graphics, green screening, motion capture

UNIT-II: SPACE AND EARTH SCIENCE

9 Hrs.

Analysis of the movies in terms of character, plot, themes, symbol and imagery. Origin of the universe –star formation –life cycle of stars –blackhole –alternate reality –distance in time/light years Movie–StarTrek

UNIT-III: HUMAN AND MACHINE INTERFACE

9 Hrs.

Significance of time machine in literature –analysis of the movies in terms of character, plot, themes, symbols and imageryRelativity –time travel –twin paradox –grandfather paradox –energy for space shuttle (nuclear) –biofuel Movie–Back to the Future I

UNIT-IV: ENVIRONMENTAL EFFECTS

9 Hrs.

Analysis of the movies in terms of character, plot, themes, symbols and imagery Greenhouse effect –effects of global warming –sea level, threat to wild life and humans –deforestation and its effects 377 Movie–Wall-ESUGGESTED MOVIES: Interstellar, Back to the Future II & III, Lorax, Avatar

REFERENCE BOOK(S)

Seed, David, ed. A Companion to Science Fiction.Blackwell, 2005. Print.

Edward, James,and Farah Mendlesohn.The Cambridge Companion to Science Fiction.N. p.: Cambridge University Press, 2003. Print.

Jameson, Fredric.Archaeologies of the Future: This Desire Called Utopia and Other Science Fictions.London and New York: Verso, 2005. Print.

Raja, Masood Ashraf, Jason W. Ellis and Swaralipi Nandi. The Postnational Fantasy: Essays on Postcolonialism, Cosmopolitics and Science Fiction.N. p.: McFarland, 2011. Print.

Westfahl, Gary. The Greenwood Encyclopedia of Science Fiction and Fantasy: Themes, Works, and Wonders(three volumes). Westport, Conn: Greenwood Press, 2005. Print.

COPH4201EI CONSUMER AWARENESS ON EVERYDAY APPLIANCES

(Theory)

LEARNING OUTCOME**2 hrs./wk.**

On successful completion of the course, the student will be able to

- improve her quality of buying by acquiring a working knowledge of the multiple gadgets and devices used in daily life
- understand differences between products from multiple brands and make intelligent purchase decisions
- learn the basics of marketing of gadgets used in daily life as a career option

COURSE OUTLINE**UNIT I: POWER GADGETS AT HOME AND WORK****6 hrs.**

The electric power grid – single and three phase connection – UPS – Voltage stabilizers – lighting – energy saving devices and techniques (fluorescent, CFL, LED, solar panels) – paying for electricity – household equipment: – simple maintenance – safety precautions – understanding power ratings and power consumption of devices (electric fan, air cooler, air conditioner, refrigerator, microwave oven, washing machine, rice cooker, gas stove, induction stove)

UNIT II: COMMUNICATION AND ENTERTAINMENT ELECTRONICS**9 hrs.**

Telephone – Facsimile – Cell phone – Photocopier – Scanner – Printer

High fidelity sound reproduction – microphones – CD/DVD/Blu-ray players – portable media players – compressed audio – amplifiers – loud speakers – crossover circuits (active and passive) others – graphic equalizers – surround sound formats (matrix surround, Dolby 5.1, DTS) – use of headphones – home theatre systems

Satellite TV/Radio and DTH/WiFi and networking – display monitors (CRT, Plasma, LCD, LED, OLED) – display resolution (SD, HD, UHD).

Understanding specifications of equipment on information/data sheets

UNIT III: PRODUCT INFORMATION**10 hrs.**

Brand name and brand mark – selection of good brand – Corporate brand and product brand – Packing, packaging and package – essentials of good package – labeling – types of labels – contents of good label – product guarantee and warranty – standardization – product servicing – after sales services – legal issues and laws on product information – Issues in advertising, pricing and promotions

UNIT IV: ONLINE RESOURCES**5 hrs.**

Apps, cloud based resources – e-commerce and productivity tools – access patterns – Comparing products online – choosing websites and online stores – awareness on terms and conditions – privacy policy – Disclaimer – billing, guarantee and delivery – significance of social networking sites, browsers and cookies – email scams – knowledge on complaint procedure and disputes settlement – security issues on payment portals

REFERENCE BOOK(S)

Pillai, R.S.N. and Bahavathi. *Modern Marketing Principles & Practice*. New Delhi: S.Chand and Company Ltd., 2010.

Memoria, C.B. and Joshi. *Principles and Practices of Marketing*. New Delhi: Kitab Mahal, 2012.

Kleinert, *Troubleshooting and Repairing Major*. 3rd ed. Tab Electronics, 2012.

Zmetana, Katherine. *Time-Life Books Complete Fix-It-Yourself Manual*. 1st ed. Prentice Hall Trade, 1989.

The Editors of Time-Life Books, *How Things Work in Your Home: And What to Do when They Don't*, Holt Paperbacks, 1987.

PHY5202CM INTRODUCTION TO RESEARCH METHODOLOGY

(THEORY)

LEARNING OUTCOME:

2 hrs./wk.

On successful completion of the course, the student will be able to

- identify a suitable method of formulating the research problem
- recognize a relevant method for data collection
- apply statistical methods to process the observed data

COURSE CONTENT:

UNIT I: FORMULATION OF RESEARCH PROBLEM

6 hrs.

Characteristics of research – methods of research – experimental method – historical method – case study method – survey method – formulating and stating the problem – hypothesis – definition – sources and types.

UNIT II: DATA COLLECTION METHODS

6 hrs.

Primary sources of data – methods of data collection – interview and questionnaire – secondary sources of data – precautions in the use of secondary data.

UNIT III: PRESENTATION OF DATA**6 hrs.**

Tabulation – definition – rules – advantages and limitations – diagrams – bar and pie diagrams – merits and demerits.

UNIT IV: STATISTICAL ANALYSIS OF DATA**6 hrs.**

Measures of central tendency – arithmetic mean – median – mode – measures of dispersion – range – mean deviation – standard deviation – correlation – Karl Pearson's and rank correlation coefficients – regression coefficients.

UNIT V: REPORT WRITING**6 hrs.**

Steps in report writing – general format – preliminary – main and reference sections – general rules for typing a report.

ACTIVITY:

A mandatory guest lecture on basics of research metrics.

TEXTBOOK(S):

Santhosh Gupta, (2003). *Research Methodology and Statistical techniques*, New Delhi: Deep and Deep Publications. Print.

Chapters: 1 (pg. 6-7), 2 (pg. 18-41), 3 (pg.62-68), 6 (pg.128-129, 133-150), 7 (pg. 165-170), 10 (pg. 210-223), 11 (pg.227-239), 13 (pg. 258-278), 20 (pg. 383-401).

REFERENCE BOOK(S):

Arumugam & Isaac, (2009). *Statistics*, Palayamkottai: New Gamma Publication House. Print.

Krishnaswami O.R, (2007). *Methodology of Research in Social Sciences*, Mumbai: Himalaya Publishing House. Print.

USEFUL WEBSITE(S):

<http://eagri.org/eagri50/STAM101/pdf/lec02.pdf>

<https://www.toppr.com/guides/business-economics-cs/descriptive-statistics/diagrammatic-presentation-of-data/>

PHYQ5402CM MOLECULAR SPECTROSCOPY**(THEORY)****LEARNING OUTCOME:****5 hrs./wk.**

On successful completion of the course, the student will be able to

- identify the symmetry of molecules using IR and Raman spectra
- analyse various spectroscopic techniques in identifying molecular structures
- recognize the applications of resonance spectroscopy in medical diagnostics and research

COURSE CONTENT:

UNIT I: SPECTROSCOPIC METHODS

12 hrs.

Electromagnetic spectrum – types of molecular energies – elements of practical spectroscopy – spectral line width – absorption and emission of radiation – Einstein's coefficients – laser.

UNIT II: MICROWAVE SPECTROSCOPY

15 hrs.

Classification of molecules – interaction of radiation with rotating molecule – rotational spectra of rigid diatomic molecules – isotope effect in rotational spectra – intensity of rotational lines – non-rigid rotator – vibrational excitation effect – linear polyatomic molecule – symmetric top molecules – microwave spectrometer – information derived from rotational spectra.

UNIT III: INFRARED SPECTROSCOPY

15 hrs.

Vibrational energy of a diatomic molecule – infrared spectra – infrared selection rules vibrating diatomic molecule – diatomic vibrating rotator – asymmetry of rotation vibration band – vibrations of polyatomic molecules – Fermi resonance – hydrogen bonding interpretation of vibrational spectra – group frequencies – IR spectrophotometer – instrumentation – sample handling techniques – Fourier transform infrared spectroscopy applications.

UNIT IV: RAMAN SPECTROSCOPY

15 hrs.

Rayleigh & Raman scattering – rotational Raman spectra – vibrational Raman spectra – mutual exclusion principle – Raman spectrometer – sample handling techniques – Fourier Transform Raman spectrometer – polarization of Raman scattered light – structure determination using IR and Raman spectroscopy.

UNIT V: ELECTRONIC SPECTRA & SPIN RESONANCE SPECTROSCOPY

18 hrs.

Born – Oppenheimer approximation – vibrational coarse structure – Frank Condon principle rotational fine structure of electronic vibration spectra – fortrat parabola dissociation – predissociation – magnetic properties of nuclei – resonance condition – NMR instrumentation – relaxation processes – chemical shift – indirect spin – spin interaction – interpretation of certain NMR spectra – principle of ESR.

TEXTBOOK(S):

Aruldhas G., (2001). *Molecular structure and spectroscopy*, New Delhi: Prentice Hall of India Pvt. Ltd., Print.

Chapters: 1.1 – 1.7, 6.1 – 6.9, 6.14, 6.15, 7.1 – 7.7, 7.9, 7.10, 7.14, 7.16 – 7.18, 7.19.1, 7.19.4, 8.1 – 8.7, 8.9, 8.10, 8.12, 8.15, 9.2, 9.6, 9.7, 9.8, 9.9, 9.10, 10.1 – 10.3, 10.5, 10.8, 10.9, 10.20, 11.1, 11.2.

REFERENCE BOOK(S):

Colin N. Banwell & Elaine M. McCash, (2016). *Fundamentals of Molecular Spectroscopy*, (4th ed.) New Delhi: Tata McGraw Hill Publishing Company Limited. Print.

Gurdeep R. Chatwal & Sham K. Anand, (2016). *Spectroscopy*, (5th ed.), Mumbai: Himalaya Publishing House Pvt. Ltd. Print.

Straughan B.P. & Walker. S., (1994). *Spectroscopy*, New York: Halsted press. Print.

PHY5501CM DIGITAL ELECTRONICS (Theory)

LEARNING OUTCOMES:

5 Hrs./Wk.

On successful completion of the course, the student will be able to

- understand binary codes & Boolean algebra
- design simple arithmetic & logic circuits
- design synchronous sequential logic circuits
- understand the principles of analog to digital & digital to analog conversion

COURSE OUTLINE :

UNIT-I : BINARY SYSTEM, BOOLEAN ALGEBRA & LOGIC GATES

15 Hrs.

Binary numbers-Number base conversions-Octal & hexadecimal numbers-Complements-Signed binary numbers-Binary codes-Binary storage and registers-Binary logic-Basic definition-Axiomatic definition of Boolean algebra-De-morgans theorems and properties of Boolean algebra-Boolean functions-canonical and standard forms-other logic operations-Digital logic Gates-Integrated circuits

UNIT-II : GATE LEVEL MINIMIZATION

15 Hrs.

The Map method-Four Variable map-Five Variable map-Products of sums simplification-Don't care conditions-NAND & NOR implementation-Other two level implementation-Exclusive OR function

UNIT-III : COMBINATIONAL LOGIC CIRCUITS

15 Hrs.

Combinational circuits-Analysis procedure-Design procedure-Binary Adder subtractor-Decimal adder-Binary multiplier-Magnitude comparator-Decoder-Demultiplexer-Encoder-Multiplexer

UNIT-IV : SEQUENTIAL LOGIC CIRCUITS

15 Hrs.

Sequential circuits-Latches-Flip Flops-Design Procedure-Registers-Shift registers-Ripple counters-Synchronous counters-other counters

UNIT-V : PROGRAMABLE LOGIC, D/A & A/D CONVERTORS

15 Hrs.

Introduction-Read only memory-Programmable Logic Array-Programmable Array Logic-Variable, resistor networks, Binary ladder, D/A converters, D/A accuracy and resolution, A/D converter-simultaneous conversion, counter method-Dual slope A/D conversion-A/D accuracy and resolution.

TEXT BOOK(S)

Malvino & Leach, Digital Principles and Applications, New Delhi: Tata McGraw Hill book company Ltd., 2006, Chapters: 12.1-12.6, 12.9, 12.10. Print.

Morris Mano M., Digital Design, New Delhi: Prentice Hall of India Pvt. Ltd., 2003, Chapters: 1.2-1.9, 2.1-2.8, 3.1-3.8, 4.1-4.10, 5.1-5.3, 5.7, 6.1-6.5, 7.1, 7.5-7.7. Print.

REFERENCE BOOK(S)

Nagrath I.J, Electronics Analog and Digital, New Delhi: Prentice Hall of India Pvt. Ltd, 2001. Print.

Nagrath I.J., Electronics Analog and Digital, New Delhi: Prentice Hall of India Pvt. Ltd, 2001. Print.

William H. Gothmann P.E, Digital Electronics, New Delhi: Prentice Hall of India Pvt. Ltd, 1992. Print.

PHY0602LM ELECTRICAL ENERGY AUDIT

OBJECTIVES

- To facilitate students to appreciate her academic learning through experiential learning by disciplinary and interdisciplinary community engagements thereby enhancing their civic responsibilities in society
- To empower students with appropriate academic strategies and innovative assessment and evaluation criteria to facilitate experiential learning for students to discover real life values
- To transform each student to be productive caring citizens of our global society through the vibrant, community-based action research programme

LEARNING OUTCOME:

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

- assess the societal energy demands
- identify the areas that require energy saving interventions
- acquire knowledge about the existing measures in saving energy
- relate theoretical knowledge to practices in the community
- identify the community needs and suggest suitable remedial measures
- develop the awareness of the energy consumption in the community
- prepare the community to reduce energy consumption

SECTION I:

15 hrs.

COMMON UNIT

Understanding Life Frontier Engagement – a)Service-Learning and Life Frontier Engagementb)Principles – engagement, reflection, reciprocity, public disseminationc)Meaning of community and understanding of community dynamics d)Programme planning in Life Frontier Engagement – stages: Need analysis, Problem identification, Goal setting, Concept finalization, planning for stages of research, research and analysis, reflection and dissemination of results.

e)Ethical concerns in Life Frontier Engagement – Confidentiality, Conflict of interest, Informed consent.

ACTIVITY MODULE FOR SECTION I:

a)(i) Making students understand the concept of Service-Learning and Life Frontier Engagement based on the information in the reading material given using student centered learning activities.(ii) Interacting with a local

community (Example: Children, adolescents, adults within or outside college) to identify community dynamics.(iii) Need based analysis done on the community by framing a questionnaire for base line socio economic survey.b)(i)Asking students to prepare a programme plan based on the sub-themes and target group identified by the department.(ii) Presentation by teams by refining the ideas of students based on program planning stages.c)Activity based on case studies relevant to ethical issues in community engagement.

CONCEPT SECTION II: THEMATIC CONCEPTS

15 hrs.

Site Assessment and Planning: A Conceptual Approach
Classification concept:•List of electrical appliances, energy consumption measurements
Correlation concept:•Higher energy consumption levels result in lower cost optimization.
Theoretical concept:•Economic well-being of the community is affected by higher energy consumption. •Effective measures can be suggested to face the increasing energy demands.

ACTIVITY MODULE FOR SECTION II:

- identify the load and energy demand assessment
- Safety and protection measures•handling Watt-hour power meter/Power Guard meter•measure energy consumption at various places on campus
- suggestive measures for energy saving•formulations of plans for final studies

SECTION III: COMMUNITY ENGAGEMENT PROCESS

105 hrs.

A community exposed to the energy threat is identified and a baseline study of energy saving is made. This is compared to theoretical standard level. A questionnaire is prepared to assess the awareness and importance of energy saving in the community. The data is analyzed and intervention strategies are formulated in collaboration with the community and other agencies. Final documentation or presentation will be done by individual groups.

PHY5502CM INTRODUCTION TO MICROCONTROLLERS (Theory)

LEARNING OUTCOME: 5hrs./wk.

On successful completion of the course, the student will be able to

- know the need for microcontrollers.
- acquire the knowledge on the working of a microcontroller.
- recognize skill of using assembly language in programming a software using microcontroller.
- interpret the concepts of interfacing techniques to standard computer ports

COURSE CONTENT:

UNIT I: 8051 ASSEMBLY LANGUAGE PROGRAMMING

15 hrs.

Introduction to 8051 Assembly programming – Assembling and running an 8051 program – the program counter and ROM space in the 8051 – 8051 data types and directives – 8051 flag bits and the PSW register – 8051 register banks and stack.

UNIT II: JUMP, LOOP, AND CALL INSTRUCTIONS

15 hrs.

Loop and jump instructions –Call instructions –Time delay for various 8051 chips–Demo& Practical exposure to Loop operations

UNIT III: I/O PORT PROGRAMMING & 8051 ADDRESSING MODES **15 hrs.**

8051 I/O programming – I/O bit manipulation programming – Immediate and register addressing modes – Accessing memory using various addressing modes – Bit addresses for I/O and RAM –Extra 128–byte on–chip RAM in 8052– Demo & Practical exposure to Bi Addressable Operations &Branch instructions

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UNIT IV: ARITHMETIC, LOGIC INSTRUCTIONS AND PROGRAMS **15 hrs.**

Arithmetic instructions – Signed number concepts and arithmetic operations – Logic and compare instructions – Rotate instruction and data serialization – BCD, ASCII, and other application programs. Demo & Practical exposure to Arithmetic & Logical operations

UNIT V: 8051 TIMER PROGRAMMING IN ASSEMBLY **15 hrs.**

Programming 8051 timers – Counter programming

TEXT BOOK(S):

Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay (2005), The 8051 Microcontroller and Embedded Systems, (2nd ed.), New Delhi: Prentice Hall of India, Print, Chapters: 2,3,4,5,6,9.1,9.2.

REFERENCE BOOK(S):

Ajay v Deshmukh (2005), Microcontrollers Theory & Applications, New Delhi: The Tata McGrawHill, Print.

Kenneth J. Ayala (2005), The 8051 Microcontroller, (2nd ed.), Mumbai: Penram International Publishing, Print.

Myke Predko (1998), Programming and customizing the 8051 Microcontroller, New Delhi: Tata McGraw Hill Publishing Company Ltd., Print.

PHY5203CP GENERAL LAB III

(LAB)

LEARNING OUTCOMES: **3 hrs./wk.**

On successful completion of the course, the student will be able to

- identify the tools and techniques to formulate physics experiments
- set up experiments to study the concepts in optics, elasticity, electricity and magnetism
- develop the skill of observation, troubleshooting and data interpretation
- analyse the data and their uncertainty levels using numerical and graphical methods

- prepare a lab report with meaningful conclusion

COURSE CONTENT:

45 hrs.

EXPERIMENTS

A minimum of 10 experiments to be done

1. Determination of resolving power of grating
2. Determination of wavelength of monochromatic source of light using Fresnel biprism
3. Study of Magnetic field due to a current carrying circular coil
4. Measurement of specific rotation of the given solution using polarimeter
5. Determination of rigidity modulus using static torsion method
6. Verification of Stefan's law
7. Determination of wavelength of a monochromatic source of light using Lloyd's mirror
8. Determination of value of a high resistance by the method of leakage
9. Study of phasor diagrams of LR, RC and LCR circuits
10. Measurement of wavelengths of Fraunhofer lines in solar spectrum
11. Self-inductance measurement using ballistic galvanometer / Determination of strength of a magnetic field with a search coil
12. Humidity measurements

REFERENCE BOOK(S):

Arora C.L., (2011). *B.Sc. Practical Physics*, New Delhi: S.Chand & company Ltd. Print.

Chattapadhyay D. & Rakshit P. C., (2005). *An Advanced course in Practical Physics*, (7thed), Kolkatta: New Central Book Agency Pvt. Ltd. Print.

Gupta S.L. & Kumar V., (2002). *Practical Physics*, (25th ed), Meerut: Pragatiprakashan Publication. Print.

Ouseph C.C., Rao U.J. & Vijayendran V., (2010). *Practical Physics and Electronics*, Chennai: S.Viswanathan Printers and Publishers Pvt. Ltd. Print.

Palanisamy P. K., (2002). *Physics Laboratory Manual*, Chennai: Scitech Publications (India) Pvt. Ltd. Print.

WEBLINK(S):

Wiz Science. (2015, September 10). Optical rotation-Video Learning - WizScience.com [Video file]. Retrieved from <https://www.youtube.com/watch?v=JVP76sBaJnw&t=51s>.
CC BY License.

Library For Engineers. (2020, May 3). Virtual lab rigidity modulus lab session [Video file].

MAPH5401DM FOURIER TRANSFORM AND ITS APPLICATIONS

(Theory)

LEARNING OUTCOME :

4 Hrs./Wk.

On successful completion of the course, the student will be able to •expand a function in Fourier series

- solve partial differential equations using Fourier transforms
- apply the concept of Fourier series and transforms
- to simple electronics systems, thermo dynamical problems and diffraction studies in optics

COURSE OUTLINE :

UNIT-I :FOURIER SERIES

12 Hrs.

Euler's formulae, even and odd functions, Dirichlet's conditions, Complex form of Fourier series, Applications: half wave/full wave rectified wave function, rectangular wave and square wave-Gibb's phenomena.

UNIT-II : FOURIER TRANSFORMS

12 Hrs.

Definition, Fourier Integral Theorem, Fourier sine and cosine integrals, Complex form of Fourier, integrals, Fourier integral representation of a function, Fourier Transforms, Fourier sine and cosine transforms, Finite Fourier sine and cosine transforms-FFT -frequently used 1-D functions and their Fourier transforms:sinc function, comb function(qualitative), delta function

UNIT-III : PROPERTIES OF FOURIER TRANSFORMS

12 Hrs.

Linear property, Change of scale property, shifting property, Modulation theorem, Convolution theorem, Parseval's identity, Fourier Transforms of the derivatives of a function

UNIT-IV : APPLICATIONS I: HEAT CONDUCTION PROBLEMS

12 Hrs.

Heat Equation –Solution by Fourier series –special case of laterally insulated bar and bar insulated at the ends- solution by the method of Fourier integrals, transforms and convolution

UNIT-V : APPLICATIONS II: FRAUNHOFER DIFFRACTION PATTERNS

12 Hrs.

Fraunhofer diffraction-single slit diffraction-interference pattern between two point sources-interference patterns between two slits-transmission diffraction grating-diffraction at an aperture with a prism.

TEXT BOOK(S)

Kreuzig E., Advanced Engineering Mathematics, New Delhi: Wiley India (P) Ltd, 2007, Chapters: 10.2(P532-533), 10.3(P538-540), 11.5, 11.6. Print.

Grewal B.S., Grewal J.S, Higher Engineering Mathematics, New Delhi: Khanna Publishers, 2009, Chapters: 10(10.1 to 10.3, 10.6, 10.10), 22(sections 22.1 to 22.7, 22.9). Print.

J F James, A student's guide to Fourier transforms with applications in Physics and Engineering, UK: Cambridge University Press, 2011, Chapters: 1.7.2, 1.7.5, 1.7.7, 3.2.1-3.2.3, 3.2.5, 3.2.7. Print.

REFERENCE BOOK(S)

Eugene Hecht, Schaum's Outline of Theory and Problems of Optics, USA: McGraw Hill, 1975. Print.

Joseph W. Goodman, Introduction to Fourier Optics, 3rd Ed, USA: Roberts & Company Publishers, 2005. Print.

CHPH5403DM FUNDAMENTALS OF ENERGY CONVERSION AND STORAGE

(THEORY)

LEARNING OUTCOME:

4 hrs./ wk.

On successful completion of the course, the student will be able to

- apply the electrochemical principles to batteries and fuel cells
- analyze the properties of energy storage systems
- acquire knowledge of photovoltaic devices and their performances
- describe the principles of nuclear reactors

COURSE CONTENT:

UNIT I: FUEL CELLS AND HYDROGEN STORAGE

12 hrs.

Fuel cells – history – classification – alkaline fuel cells – phosphoric acid fuel cells – solid oxide fuel cells – molten carbonate fuel cells – direct methanol fuel cells – proton exchange membrane fuel cells – microbial fuel cells – description, working and components of alkaline fuel cell and direct methanol fuel cells – applications – stationary power plants – fuel cells in electric vehicles – hydrogen vehicles – portable power systems.

Hydrogen storage – hydrogen production – hydrogen as an engine fuel – methods of hydrogen storage – storage via chemical reactions – hydrogen energy economy – hydrogen storage technologies

UNIT II: PRIMARY BATTERIES

12 hrs.

Components of cells and batteries – operation of a cell – theoretical cell voltage, capacity, and energy (concepts only) – electrochemical principles and reactions – types and characteristics of primary batteries – voltage and discharge profile – specific energy and specific power – zinc/air batteries: general characteristics – construction (basic details) – performance characteristics – lithium batteries: general characteristics

UNIT III: SECONDARY BATTERIES AND ELECTROCHEMICAL CAPACITORS

12 hrs.

Types and characteristics of secondary batteries: Lead Acid Batteries, Alkaline Secondary batteries: Nickel-cadmium batteries, Lithium-ion batteries – voltage-discharge profile – effect of discharge rate on performance – lead acid batteries: introduction (general characteristics only) – lithium-ion batteries: introduction (general characteristics only) – intercalation processes – capacity fade in C/LiMn₂O₄ cells – electrochemical capacitors (ECs): introduction – EC operation.

UNIT IV: PHOTOVOLTAIC SYSTEMS

12 hrs.

Properties of solar radiation – the solar constant – spectrum of the sun – air mass – band model of semiconductors – charge transport in semiconductors – doping of semiconductors – pn Junctions – structure and characteristics of a photodiode – method of function of the solar cell – photocurrent – characteristic curve and characteristic dimensions – crystalline silicon cells – amorphous silicon cells – thin film cells: cadmium telluride – applications: space PV cells.

Unit V: NUCLEAR REACTORS AND RADIATION PROTECTION

12 hrs.

Nuclear fission – the fission chain reaction – nuclear reactor fuels – components of nuclear reactors – power reactors and nuclear steam supply systems: light water reactors and pressurized water reactors – nuclear cycles: LWR once-through fuel cycle – radiation units: exposure, the Roentgen, exposure rate, imparted energy, adsorbed dose, adsorbed dose rate, Kerma, equivalent dose, equivalent dose rate, population dose – quantitative effects of radiation on the human species – calculations of radiation effects – computations of exposure and dose: dose from neutrons – external exposure – nuclear reactor shielding

TEXT BOOK(S):

Konrad Martens, (2014). *Photovoltaics: Fundamentals, Technology and Practice*, (1st ed.), John Wiley & Sons, Print.

(Unit IV) Relevant sections in Chap 3, 4, 5

(2.1,3.2,3.3,3.4,3.5,4.1.1,4.2,4.3,4.4,5.1,5.2,5.3,5.3.1)

Lamarsh, J. R., Baratta A. J., (2001). *Introduction to Nuclear Engineering* (3rd ed.), Prentice-Hall Inc, New Jersey, Print.

(Unit V) Relevant sections in Chap 3 (3.7), 4 (4.1, 4.2, 4.4, 4.5 (up to Pg. 143), 4.6 (up to Pg. 188)), 9,10 (9.2, 9.5, 9.6, 9.9 (Pg. 516 – 520),10.6)

Linden, D., Thomas B Reddy, (2002). *Handbook of Batteries*, (3rd ed.), McGraw Hill, Print.

(Unit II) Relevant sections in Chap 1, 2, 7, 13, 14 (1.1, 1.3, 1.4, 2.1, 2.2, 2.3, 2.4, 7.2, 7.3.2, 7.3.3, 13.1, 13.2, 13.3 (up to Pg. 13.4), 13.4.1 - 13.4.5,14.1, 14.2)

(Unit III) Relevant sections in Chap 22, 23, 35 (22.2, 22.3.2, 22.3.3, 23.1 (up to Pg. 23.3), 23.2.1, 35.1 (up to Pg. 35.3), 35.2.1, 35.2.3)

Puri, B.R, Sharma, L.R., Pathania, S., (2015). *Principles of Physical Chemistry*, (47th ed.), Vishal Publishing Co., Jalandhar, Print.

(Unit I) Chap 24.

Viswanathan, B., Aulie Scibioh M., (2006). *Fuel Cells Principles and applications*, University Press PVT Ltd, Print.

(Unit I) Relevant sections in Chap 1, 3, 7, 10, 11(1.2, 1.6, 3.1, 3.2, 3.3, 7.4, 7.5, 7.6, 10.1,10.3, 10.4.4, 11.6, 11.7)

Winter, M., Brodd, R. J., Chemical Reviews, (2004). *What Are Batteries, Fuel Cells, and Supercapacitors?*

(Unit III) pages: 4266,4268

REFERENCE BOOK(S):

Singal, R. K., (2014). *Nuclear Reactors*, (1st ed.), New Age International (P) Ltd, New Delhi, Print
Vaidyanathan, G., (2013). *Nuclear Reactor Engineering, (Principles and Concepts)*, (1st ed.), S. Chand and Co. Pvt. Ltd., New Delhi, Print.

WEBSITE(S):

https://www1.eere.energy.gov/hydrogenandfuelcells/education/pdfs/thomas_fcev_vs_battery_e_vs.pdf (Unit I)

http://www.fuelcelltoday.com/media/1711108/fuel_cell_electric_vehicles_-_the_road_ahead_v3.pdf (Unit I)

<http://nptel.ac.in/courses/108103009/download/M9.pdf> (Unit II)

http://cdn.intechopen.com/pdfs/36830/InTech-Photovoltaic_systems_and_applications.pdf (Unit

CHPH6401DM ORGANIC ELECTRONICS (Theory)

LEARNING OUTCOME :

4 Hrs./Wk.

On successful completion of the course, the student will be able to

- compare organic and inorganic semiconductor devices
- appreciate the integration of electronics with organic molecules and materials
- understand the principles of organic solar cells, organic Field Effect Transistor, and organic LED's

COURSE OUTLINE :

UNIT-I : Electronics Concepts: An Overview

12 Hrs.

Electrons and conduction-role of electrons & holes-intrinsic semiconductor-n&p type semiconductor-junction diode-depletion region-forward & reverse biasing- majority & minority carriers- terminal current-breakdown region-bipolar junction transistor-base & collector characteristic curve-amplifier-MOSET-characteristic curves- IC's-printed circuits-organic semiconductor-differences from conventional one.

UNIT-II : Charge Transport in Organic Molecules and Materials

12 Hrs.

Chemical Bonding in Organic Molecules: Electron Delocalization in Molecules with p - Conjugated Systems- molecular orbital view of covalent bond, molecules with several multiple bonds (Cumulative, conjugated), electronic structure and MO representation of linear and cyclic conjugated systems, charge generation and transport in molecules and bulk materials: band models from the perspective of organic chemistry,

degenerate ground states in poly (acetylene), and formation of solitons in crystalline conjugated polymers, bands in crystals of conjugated molecules and crystalline organic semiconductors.

UNIT-III : Synthesis and Properties of Conjugated Molecules and Polymers **12 Hrs.**

General methods of synthesis of conjugated oligomers and polymers, synthesis, physical and electronic properties of Conducting polymers: Poly(acetylene)s oligo(phenylene)s and poly(phenylene)s, oligo(thiophene)s and poly(thiophene)s Macromolecules: pentacenes, porphyrins Nanomaterials: fullerenes, carbon nanotubes and graphene.

UNIT-IV : Plastic Electronics **12 Hrs.**

Introduction to solar cells-energy levels in molecular materials-comparison with inorganic semiconductor-excited states in molecular material-basics process of organic solar cell-light absorption-exciton transport-charge separation-charge transport-charge collection-organic solar cells-dye sensitized solar cells-double layer cells-bulk heterojunction cells-metal insulator semiconductor structures-idealized MIS devices-organic MIS structures-field effect transistors-organic light emitting devices-device efficiency-full colour displays-electronic paper.

UNIT-V : Physical & Chemical Aspects of OFET **12 Hrs.**

Assembly, structure, and performance of an Organic Field -Effect Transistor (OFET) of oligothiophenes – optical and thermal properties-OFET studies- pentacene – layout of pentacene organic field effect transistors –analysis of the electrical characteristics-overview of VD-ID characteristics-temperature dependence of the mobilities-detailed analysis of the field effect mobilities as a function of VD and VG and CNTs - physical and electronic structure of CNT-role of capacitances & doping

TEXT BOOK(S)

Christof Woll, *Physical and Chemical Aspects of Organic Electronics: from fundamental to functioning devices*, Weinheim: WILEY-VCH Verlag GmbH & Co. KGaA, 2009, Chapters: 1.1,5,8,26. Print.

Jerrold H.Krenz, *Electronic Concepts An Introduction*, Cambridge,UK: Cambridge University Press, 2005, Chapters: 1.7, 2.1-2.4, 3.1. Print.

Jonathan Clayden, Nick Greeves and Stuart Warren, *Organic Chemistry*, New York: Oxford University Press Inc., 2012, Chapters: 7, 8. Print.

Michael C.Petty, *Molecular Electronics From Principles to Practice*, England: John Wiley & Sons, Ltd, 2008, Chapters: 9. Print.

Wenping Hu, Fenglian Bai, Xiong Gong, Xiaowei Zhan, Hongbing Fu and Thomas Bjornholm, *Organic Optoelectronics*, Weinheim: WILEY-VCH Verlag GmbH & Co. KGaA , 2012, Chapters: 1, 3, 5. Print.

PHZO6401DM BIOMEDICAL INSTRUMENTATION

(THEORY)

LEARNING OUTCOME:**4 hrs./wk.**

On successful completion of course, student will be able to

- know the physiology of human system
- inquire the basic principle and mechanism of biomedical instruments
- relate the use of biomedical devices in monitoring the diseases

COURSE CONTENT:**UNIT I: CELLULAR MEASUREMENTS AND SURFACE CHARACTERIZATION****12 hrs.**

Cell structure and components – microscopy – light, resolution & magnification – light and dark field microscopy electron microscopy – cellular markers – confocal laser scanning microscopy – two photon excitation microscopy –image processing – single cell measurement – oculometer and fluorescence activated cell sorting (FACS).

UNIT II: MEDICAL IMAGING OF NEURO-MUSCULAR SYSTEM**12 hrs.**

Anatomy and function of brain and neuron – resting and action potential – impulse conduction – brain waves – electroencephalography (EEG) – evoked potential – brain imaging – X ray, CT (Computed Tomography), magnetic resonance imaging (MRI) – nuclear imaging – muscular system – types of muscles – mechanism of muscle contraction and its types (isotonic and isometric) – neuromuscular junction – electromyography (EMG).

UNIT III: SENSORY AND BEHAVIORAL MEASUREMENTS**12 hrs.**

Structure and function of eye (rods and cones, mechanism of photoreception & rhodopsin cycle) – visual field – eye pressure – ophthalmoscope – potential acuity meter (PAM) – vision enhancers (lens): anatomy of ear – mechanism of hearing and equilibrium – audiometry – otoscopy.

UNIT IV: ASSISTING AND THERAPEUTIC EQUIPMENTS IN CIRCULATORY SYSTEM**12 hrs.**

Structure of heart – mechanism and conduction of heart beat – stethoscope – electrocardiogram (ECG) – ECG monitoring – electrograms – Blood vessels – types – circulation – blood pressure: direct and indirect measurement – vessel distension.

UNIT V: PULMONARY FUNCTION ANALYSER IN RESPIRATORY SYSTEM**12 hrs.**

Structure of respiratory organ–lungs –principle of gas exchange – artificial respiration – heart – lung machine (HLM) – cardiac – pulmonary volume – measurement of pulmonary volume – spirometry – body plethysmograph – impedance plethysmography – inductance plethysmography.

TEXT BOOK(S):

Ahuja V.M., (2011). *Textbook of Medical Physiology*, (2nd ed.) New Delhi: Ane Books Pvt. Ltd. Print.

Guyton A.C., Hall J.E., (2001). *Textbook of Medical Physiology*, (10th ed.), New Delhi: W.B. Saunders company. Print.

Webster J.G., (2004). *Bioinstrumentation*, Singapore: John Wiley & Sons. Print.

Chapters: 6.2, 7.2 - 7.6, 7.10.4, 7.10.5, 7.11, 7.12.2, 8.2.2, 8.2.3, 8.5.1, 8.9, 8.10, 9.2.

REFERENCE BOOK(S):

Arumugam M., (2001). *Biomedical Instrumentation*, Anuradha Agencies Publishers. Print.

Carr J.J., Brown J.M., (2011). *Introduction to Biomedical equipment technology*, (4th ed.), New Delhi: Pearson Education, Inc. Print.

Cromwell L., Weibell F.J., and Pfeiffer E.A., (1992). *Biomedical Instrumentation and Measurements*, (2nd ed.), New Delhi: Prentice- Hall of India. Print.

Pattabhi V. Gautham N., (2010). *Biophysics*, New Delhi: Narosa Publishing House. Print.

Pandey O.N., Rakesh Kumar., (2008). *Biomedical Electronics and Instrumentation*, S.K Kataria & Sons. Print.

Sherwood L., (2004). *Human Physiology from cells to systems*, (5th ed.), USA: Thomson- Brooks/Cole. Print.

Waugh A., Grant A., (2001). *Anatomy and Physiology in Health and Illness*, (9th ed.), UK: Churchill Livingstone. Print.

LIFE FRONTIER ENGAGEMENT COURSE

Semester V

Total Hours: 4 hrs./week

Semester VI

Total Hours: 5 hrs./week

PHY0602LM ELECTRICAL ENERGY AUDIT

OBJECTIVES

- To facilitate students to appreciate her academic learning through experiential learning by disciplinary and interdisciplinary community engagements thereby enhancing their civic responsibilities in society
- To empower students with appropriate academic strategies and innovative assessment and evaluation criteria to facilitate experiential learning for students to discover real life values
- To transform each student to be productive caring citizens of our global society through the vibrant, community- based action research programme

LEARNING OUTCOME:

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

- assess the societal energy demands
- identify the areas that require energy saving interventions
- acquire knowledge about the existing measures in saving energy
- relate theoretical knowledge to practices in the community
- identify the community needs and suggest suitable remedial measures
- develop the awareness of the energy consumption in the community
- prepare the community to reduce energy consumption

SECTION I:

15 hrs.

COMMON UNIT

Understanding Life Frontier Engagement –

- a) Service-Learning and Life Frontier Engagement
- b) Principles – engagement, reflection, reciprocity, public dissemination
- c) Meaning of community and understanding of community dynamics
- d) Programme planning in Life Frontier Engagement – stages: Need analysis, Problem identification, Goal setting, Concept finalization, planning for stages of research, research and analysis, reflection and dissemination of results.
- e) Ethical concerns in Life Frontier Engagement – Confidentiality, Conflict of interest, Informed consent.

ACTIVITY MODULE FOR SECTION I:

- a) (i) Making students understand the concept of Service-Learning and Life Frontier Engagement based on the information in the reading material given using student centered learning activities.
(ii) Interacting with a local community (Example: Children, adolescents, adults within or outside college) to identify community dynamics.
(iii) Need based analysis done on the community by framing a questionnaire for base line socio economic survey.
- b) (i) Asking students to prepare a programme plan based on the sub-themes and target group identified by the department.
(ii) Presentation by teams by refining the ideas of students based on program planning stages.
- c) Activity based on case studies relevant to ethical issues in community engagement.

CONCEPT SECTION II: THEMATIC CONCEPTS

15 hrs.

Site Assessment and Planning: A Conceptual Approach

Classification concept:

- List of electrical appliances, energy consumption measurements

Correlation concept:

- Higher energy consumption levels result in lower cost optimization.

Theoretical concept:

- Economic well-being of the community is affected by higher energy consumption.
- Effective measures can be suggested to face the increasing energy demands.

ACTIVITY MODULE FOR SECTION II:

- identify the load and energy demand assessment
- Safety and protection measures
- handling Watt-hour power meter/Power Guard meter
- measure energy consumption at various places on campus
- suggestive measures for energy saving
- formulations of plans for final studies

SECTION III: COMMUNITY ENGAGEMENT PROCESS

105 hrs.

A community exposed to the energy threat is identified and a baseline study of energy saving is made. This is compared to theoretical standard level. A questionnaire is prepared to assess the awareness and importance of energy saving in the community. The data is analyzed and intervention strategies are formulated in collaboration with the community and other agencies. Final documentation or presentation will be done by individual groups.

PHY6502CM ELECTROMAGNETISM

(Theory)

LEARNING OUTCOME :

5 Hrs./Wk.

On successful completion of the course, the student will be able to

- gain knowledge on the magnetic effect of current
- understand and analyse the effects of a current loop
- analyse the behavior of simple circuits in the presence of an AC source and
- appreciate the concept of electromagnetic waves

COURSE OUTLINE :

UNIT-I : AMPERE'S LAW

15 Hrs.

The magnetic field due to a moving charge – the magnetic field of current – Lorentz force – Biot-Savart Law - A straight wire segment, A circular loop – two parallel currents - The interaction between parallel currents – the magnetic field of a solenoid – Ampere's law – Applications of Ampere's law: Straight wire, Solenoid, Torroid

UNIT-II : FARADAY'S LAW OF INDUCTION**15 Hrs.**

Faraday's experiments – Faraday's law of induction – Lenz' law-signs in Faraday's law – motional emf – generators and motors – induced electric fields – induced emf and potential difference – The Betatron

UNIT-III : MAGNETIC PROPERTIES OF MATTER AND INDUCTANCE**15 Hrs.**

The magnetic dipole – the force on a dipole in a non uniform field – atomic and nuclear magnetism – magnetization – magnetic materials – the magnetism of the planets – Gauss' law for magnetism – inductance – calculating the inductance - LR circuits – energy storage in a magnetic field – electromagnetic oscillations: qualitative & quantitative – damped and forced oscillations

UNIT-IV : ALTERNATING CURRENT CIRCUITS**15 Hrs.**

Alternating currents – three separate elements: Resistive, inductive and capacitive elements – the single loop RLC circuit : trigonometric, graphical and differential analysis– power in AC circuits: power in the series RLC circuit – the transformer

UNIT-V : MAXWELL'S EQUATIONS**15 Hrs.**

The basic equations of electromagnetism – induced magnetic fields and the displacement current – Maxwell's equations – cavity oscillations – generating an electromagnetic wave – traveling waves and Maxwell's equations – energy transport and the Poynting vector – Poynting theorem

TEXT BOOK(S)

David Halliday, Robert Resnick and Kenneth S.Krane, *Physics*, 5th Edition, 2, Singapore: John Wiley & Sons, 2002, Chapters: 33.1-33.5, 34.1-34.6, 35, 36, 37.1-37.5, 38.1-38.6.

REFERENCE BOOK(S)

Arthur Kip, *Fundamentals of Electricity and Magnetism*, Second Edition, USA: McGraw Hill Inc, 1969. Print.

David J.Griffths, *Introduction to Electrodynamics*, Second edition, New Delhi: Prentice Hall of India Private Limited, 1997. Print.

Paul Lorrain and Dale Corson, *Electromagnetic Field and Waves*, Second Edition, Delhi: CBS Publishers and Distributors, 1986. Print.

PHY6503CM SOLID STATE PHYSICS**(Theory)**

LEARNING OUTCOME :**5 Hrs./Wk.**

On successful completion of the course, the student will be able to

- acquire a clear understanding of crystal structures
- know about magnetic properties of materials and defects
- understand the occurrence of superconductivity
- develop problem solving skills

COURSE OUTLINE :**UNIT-I : CRYSTAL STRUCTURES AND INTERATOMIC FORCES****15 Hrs.**

The crystalline state-basic definitions - the fourteen Bravais lattices - elements of symmetry-nomenclature of crystal directions and crystal planes; Miller indices-examples of simple crystal structures-amorphous solids and liquids - interatomic forces -types of bonding

UNIT-II : X-RAY, NEUTRON, AND ELECTRON DIFFRACTION IN CRYSTALS**15 Hrs.**

Generation and absorption of X-rays - Bragg's law-scattering from an atom - scattering from a crystal-the reciprocal lattice and X-ray diffraction - the diffraction condition and Bragg's law - scattering from liquids-experimental techniques-other X-ray applications in solid-state physics-neutron diffraction - electron diffraction.

UNIT-III : SEMICONDUCTORS AND DEFECTS IN SOLIDS**15 Hrs.**

Crystal structure and bonding-band structure -electrical conductivity, mobility -types of imperfection-vacancies-diffusion- dislocation and the mechanical strength of metals

UNIT-IV : MAGNETISM**15 Hrs.**

Basic formulas :magnetic dipole moment, torque on the dipole- gyromagnetic ratio- Larmor frequency- magnetic susceptibility - classification of materials - Langevin diamagnetism - paramagnetism - antiferromagnetism and ferrimagnetism – soft and hard materials - Curie-Weiss law - ferromagnetic domains

UNIT-V : SUPERCONDUCTIVITY**15 Hrs.**

zero resistance-perfect diamagnetism, the Meissner effect-the critical field-theory of superconductivity: BCS theory – Type I and Type II superconductors- tunneling and the Josephson effect

TEXT BOOK(S)

Ali Omar .M, *Elementary Solid State Physics*, Singapore: Pearson Education, 2002, Chapters: 1.1-1.10, 2.1-2.12, 6.1– 6.3, 6.7, 9.1–9.6, 9.8, 9.9, 9.11, 10.1-10.4, 10.7, 10.8, 10.9, 11.1–11.4, 11.6.

REFERENCE BOOK(S)

Ashcroft N.W. and Mermin N.D, *Solid State Physics*, International Edition, Philadelphia, Holt, Rinehart and Winiton, 1976. Print.

Blakemore J.S, *Solid State Physics*, 2 edition, New York: Cambridge University Press, 1974. Print.

Dekkar A.J., *Solid State Physics*, London: Macmillan, 1971. Print.

Pillai S.O, *Problems in Solid State Physics*, New Delhi: Wiley Eastern Limited. Print.

Pillai S.O., *Solid State Physics*, New Delhi: Wiley Eastern Limited, 1994. Print.

PHY6402CM STATISTICAL MECHANICS AND RELATIVITY

(THEORY)

LEARNING OUTCOME:

4 hrs./wk.

On successful completion of the course, the student will be able to

- explain the distribution of particles using classical and quantum statistics
- identify the connection between distribution function of a system and its thermodynamic variables
- apply the thermodynamic properties to mono and diatomic gases
- deduce the consequences of Einstein's postulates on kinematical variables
- infer the effect of special theory of relativity on energy and momentum

COURSE CONTENT

UNIT I: INTRODUCTION TO STATISTICAL PHYSICS

12 hrs.

Energy states and energy levels – macro states and microstates: distinguishable and indistinguishable particles – thermodynamic probability – Bose-Einstein statistics – Fermi-Dirac statistics – Maxwell-Boltzmann statistics.

UNIT II: STATISTICAL THERMODYNAMICS

12 hrs.

Statistical interpretation of entropy – Bose-Einstein distribution function – Fermi-Dirac distribution function – classical distribution function – comparison of distribution function for indistinguishable particles – Maxwell-Boltzmann distribution function.

UNIT III: APPLICATIONS OF STATISTICS

12 hrs.

Partition function – thermodynamic properties of a system using classical statistics – monatomic ideal gas – distribution of molecular velocities – principle of equipartition of energy – specific heat capacity of a diatomic gas.

UNIT IV: RELATIVISTIC KINEMATICS

12 hrs.

Invariance of physical laws: Einstein's postulates – ultimate speed limit – Galilean transformation – relativity of simultaneity – relativity of time Intervals – relativity of length – Lorentz transformations – Doppler effect for electromagnetic waves.

UNIT V: RELATIVISTIC DYNAMICS

12 hrs.

Relativistic momentum: relativity, Newton's second law and relativistic mass – relativistic kinetic energy – rest energy and Einstein's mass equivalence – Newtonian Mechanics and relativity: general theory of relativity.

TEXTBOOK(S):

Francis W.Sears & Gerhard L. Salinger, (1998). *Thermodynamics, Kinetic theory and Statistical thermodynamics*, (3rd ed.), New Delhi: Narosa Publishing House. Print.

Ch: 11,12,13.1-13.3,13.6.

Hugh D. Young, Roger A. Freedman & Lewis Ford, (2017). *University Physics with Modern Physics*, (14th ed.), Uttar Pradesh: Pearson India Education services Pvt., Ltd. Print.

Ch: 37

REFERENCE BOOK(S):

Arthur Beiser, Shobhit Mahajan & Rai Choudury S., (2009). *Concepts of Modern Physics, (SIE)*, (6th ed.), New Delhi: Tata McGraw Hill Education Private Limited. Print.

Robert Resnick, David Halliday & Kenneth S. Krane, (2002). *Physics*, (5th ed./volume 1), New Jersey: John Wiley & sons. Print.

Raymond A. Serway & Chris Vuille, (2012). *College Physics*, (9th ed./volume 1), Canada: Cengage learning. Print.

PHY6401CM THERMODYNAMICS

(THEORY)

LEARNING OUTCOME:

4 hrs./wk.

On successful completion of the course, the student will be able to

- relate the concept of temperature that underlies the laws of thermodynamics
- classify simple thermodynamic systems
- deduce the macroscopic properties of gas in terms of its molecular properties
- apply first law to study various thermodynamic processes
- estimate the change in entropy of the system

COURSE CONTENT:

UNIT I: TEMPERATURE

12 hrs.

Temperature and thermal equilibrium – temperature scales: Celsius and Fahrenheit scales – measuring temperatures: constant-volume gas thermometer – International temperature scale – thermal expansion – ideal gas.

UNIT II: SIMPLE THERMODYNAMIC SYSTEMS

12 hrs.

Thermodynamic equilibrium – equation of states – hydrostatic systems – mathematical theorems – stretched wire – surfaces – electrochemical cell – intensive and extensive coordinates.

UNIT III: MOLECULAR PROPERTIES OF GASES

12 hrs.

Atomic nature of matter – molecular view of pressure – mean free path – distribution of molecular speeds – equation of state for real gases.

UNIT IV: FIRST LAW OF THERMODYNAMICS

12 hrs.

First law of thermodynamics – heat capacity and specific heat – enthalpy – work done on or by ideal gas – internal energy of an ideal gas – heat capacities of an ideal gas – applications of first law of thermodynamics.

UNIT V: ENTROPY AND SECOND LAW OF THERMODYNAMICS

12 hrs.

One-way processes – entropy change – entropy change for irreversible processes – second law of thermodynamics – entropy and performance of engines – entropy and performance of refrigerators.

TEXTBOOK(S) :

Robert Resnick, David Halliday & Kenneth S. Krane, (2002). *Physics*, (5th ed./ Vol. 1), Singapore: John Wiley & Sons, Print.

Chapters: 21, 22.1 – 22.4, 22.6, 23.3 – 23.8, 24.1 – 24.6.

Richard H Dittman & Mark W Zemansky, (2007). *Heat and Thermodynamics*, (7th ed.), New Delhi: Tata McGraw-Hill Publishing Company Limited. Print.

Chapter: 2.1-2.7, 2.10.

REFERENCE BOOK(S):

Hugh D. Young, Roger A. Freedman, A & Lewis Ford, (2017). *University Physics with Modern Physics*, (14th ed.), Uttar Pradesh: Pearson India Education services Pvt. Ltd. Print.

Feynman, Leighton & Sands, (2012). *The Feynman Lectures on Physics*, (Vol.1), India: Dorling Kindersley Pvt. Ltd, Print.

David R. Gaskell, (2012). *Introduction to the Thermodynamics of Materials*, (5th ed.), New York. London: Taylor & Francis. Print.

PHY6203CP ELECTRONICS LAB III

(LAB)

LEARNING OUTCOMES:

3 hrs. / wk.

On successful completion of the course, the student will be able to

- identify the tools and techniques to formulate the digital experiments
- setup experiments to study the applications of logic gates and flip flops
- develop the skill of observation, troubleshooting and data interpretation
- Analyse the data and their uncertainty levels using numerical and graphical methods
- prepare a lab report with meaningful conclusions

COURSE CONTENT:

45 hrs.

EXPERIMENTS (minimum of 10 experiments)

1. Study of logic gates using discrete components
2. Verification of De Morgan's theorems
3. Universality of NAND / NOR gates
4. Applications of XOR gates – parity checker and generator
5. Study of full adder/ full subtractor circuits with K-map simplification
6. Encoders and decoders
7. Code conversion circuits (BCD / gray code / excess 3 code)
8. Multiplexer / Demultiplexer
9. Study of RS and D latches
10. Study of flip flops (LTspice)
11. Ripple counter & D/A converter
12. Shift registers using ExpEYES

REFERENCE BOOK(S):

Leach, D.P., Malvino, A.P. & Saha, G.K., (2006). *Digital principles and applications*, New Delhi: Tata McGraw Hill book company Ltd., Print.

Mano, M.M., (2003). *Digital design*, New Delhi: Prentice Hall of India Pvt. Ltd., Print.

Nagrath I.J., (2001). *Electronics Analog and Digital*, New Delhi, Prentice Hall of India Pvt. Ltd., Print.

WEBLINK(S):

Mercy Mbise, (2018). *Digital Electronics*, Retrieved from <https://www.oercommons.org/courses/digital-electronics>. CC BY 2.5 license.

Naveen burla, (2018). *Introduction to Flip Flop*, Retrieved from <https://www.oercommons.org/search?f.search=flip+flop>. CC BY 4.0 license.

User's Manual Experiments for Young Engineers and Scientists
<http://expeyes.in/Documents/eyes17-a4.pdf>

BSPS6401DM APPLICATIONS OF NANOMATERIALS (Theory)

LEARNING OUTCOME :

4 Hrs./Wk.

On successful completion of the course, the student will be able to

- recognize the importance of nano carriers
- understand the use of nanodiagnostic agents in detection and imaging
- explain the utility of nanocarriers in therapy
- analyse the significant role of nanomaterials in environment and energy

COURSE OUTLINE :

UNIT I : Nanodrugs

12 hrs.

Importance of nanodrugs and nanocarriers – difficulties faced in drug delivery - Drug delivery applications of albumin, collagen (protein based); crystalline cellulose, lectins (Carbohydrate based); Liposomes and vesicle (Lipid based); cages and networks (DNA based).

UNIT II : Nano diagnostics and Nano therapeutics

12 hrs.

DNA and protein based biosensors; diagnostic agents: quantum dots, magnetic nanoparticles for imaging and detection of tumors, genetic defects and other diseases; Targeted drug delivery: Magnetic nanoparticles and gold nanoparticles in active and passive targeting; dendrimers, albumin- ABRAXANE; DNA-vaccine; microbes in vaccine delivery.

UNIT III : Nanomaterial based electronic devices

12 hrs.

Principle of Conventional junction and Field Effect Transistors – Conductivity of SWCNT and MWCNT - CNT based junctions –SET and FET with CNT- Nanostructure materials based PV devices –NW-NPL-NT- DSSC-Operation principle – Optimization of efficiency, stability and scalability –Iodine based Electrolytes Hole conducting Materials– Solid state DSSCs – Recent Developments- Principle of *quantum dot infrared detectors* (QDIPs) - Dimensionality and

Laser Performance – Advantages of QD Laser – Challenges Faced- quantum optoelectronic logic operations of AND,OR,NOT and EX-OR.

UNIT IV : Environmental applications

12 hrs.

Nanomaterials and environmental applications – TiO₂ based nanoparticles (water purification)- Iron based nanoparticles (treatment of contaminated solid wastes and water purification)- Bimetallic nanoparticles (remediation for halogenated organic compounds)- Nanoclays and Carbon nanotubes(removal of heavy metals) – Dendrimers and nanosponges (soil treatment)- Magnetic nanoparticles (water treatment) - Nanoproducts in market and their commercial applications.

UNIT V : Nanomaterial based Energy devices

12 hrs.

Principle, Construction and working of energy devices- batteries and fuel cells ; Nanomaterials in Energy storage and conversion devices – secondary batteries, electrodes -anodes and cathodes- Nanomaterials as electrocatalysts for fuel cell applications – carbon based materials in solar energy conversion.

TEXT BOOK(S)

Hornyak, L.G., Tibbals, H.F., Dutta, J., and Moore, J.J., **Introduction to Nanoscience& Nanotechnology**, New York: CRC press, 2009.

Poole, C.P., and Owens, F.J., **Introduction to Nanotechnology**, New Delhi: Wiley India (P) Ltd., 2010.

Rotello, V.M., (Editor), **Nanoparticles Building blocks for nanotechnology**: Rakmo Press Pvt., Ltd., 2010.

Sharon M., Sharon M., Pandey S., Oza G., **Bionanomaterials: Concepts and applications**, New Delhi: Ane Books Pvt. Limited, 2012.

Viswanathan, B., **Nanomaterials**, New Delhi: Narosa Publishing House Pvt. Ltd., 2011.

REFERENCE BOOK (S)

Donglu Shi, **Nanomaterials and Devices**, Elsevier, 1st edition, 2014.

Todd Steiner, **Semiconductor Nanostructures for Optoelectronic Applications**, Boston: Artech House, 2013.

JOURNAL (S)

Rui Yu, Qingfeng Lin, Siu-Fung Leung, Zhiyong Fann, **Nanomaterials and nanostructures for efficient light absorption and photovoltaics**, *Nano Energy* (2012) 1, 57 – 72

Brian E. Hardin¹, Henry J. Snaith² and Michael D., **The renaissance of dyesensitized solar cell**, *McGehee Nature Photonics* (2012) 6, (162-169)

Tae-Hee Lee and Robert M. Dickson, **Discrete two-terminal single nanocluster quantum optoelectronic logic operations at room temperature**, *Proceedings of the National Academy of Sciences PNAS* (2003), 100 (6), 3043-3046.

WEBSITE(S)

http://www.diss.fuberlin.de/diss/servlets/MCRFileNodeServlet/FUDISS_derivate_000000002568/02_2.pdf?hosts

PHE1401AT PROGRAMMING IN C

(Lab cum Theory)

LEARNING OUTCOME:

3T + 2L

hrs./wk.

On successful completion of the course, the student will be able to

- develop logical thinking
- recognize the use of different data structures
- appraise and apply the programming concepts in Physics

COURSE CONTENT:

UNIT I: INTRODUCTION TO C & DATA TYPES

9T + 6L hrs.

Character Set – Constants, Variables and Keywords – Instructions – type declaration instruction – control instructions – Data types: integer long and short, signed and unsigned – char – float and double – storage classes: automatic, register, static and external

UNIT II: CONTROL STRUCTURE

9T + 6L hrs.

Decision control structure – if statement – if-else statement – use of logical operators – conditional operators – loop control structure: loops – while loop – for loop: nesting of loops, multiple initializations in the for loop – break statement – continue statement – do – while loop – case control structure: decisions using switch – go to statement

UNIT III: FUNCTIONS

9T + 6L hrs.

Introduction to function – passing values between functions – scope rule of functions – advanced features of functions: function declaration and prototypes – call by value and call by reference – Pointers – pointer notation – recursion

UNIT IV: ARRAYS AND POINTERS

9T + 6L hrs.

Array initialization – pointers and arrays – Two dimensional array: initialization – memory map – pointers – three dimensional array – array of pointers

UNIT V: STRINGS & STRUCTURES

9T + 6L hrs.

String concepts – standard library string functions – two dimensional array of characters – array of pointers to strings – Structures: declaring a structure – accessing structure elements – array of structures – additional features and uses of structures

PROGRAM EXERCISES ON THE FOLLOWING CONCEPTS IN PHYSICS:

Force and Newton's law
Applications of Newton's law
Collisions, Impulse and Momentum
Systems of Particles
Rotational Kinematics
Projectile motion
Optics
Thermodynamics
Series–Parallel circuit analysis
Network analysis of dc circuits

TEXT BOOK(S):

Yashavant P. Kanetkar (2012), *Let us C*, (12th ed.), New Delhi, BPB Publications, Chapters: 1–6,8,9,10. Print.

REFERENCE BOOK(S):

Ananthi Sheshasaayee & G. Sheshasaayee (2002), *Programming language C with practicals*, (1st ed.), Chennai, Margham Publications, Print.

Balagurusamy E (2011), *PROGRAMMING IN ANSI C*, (5th ed.), New Delhi, Tata McGraw Hill Education Pvt. Ltd, Print.

Byron S. Gottfried (1991), *Schaum's Outline of Theory and Problems of Programming with C*, New Delhi, Tata McGraw Hill Education Pvt. Ltd, Print.

Herbert Schildt (2000), *C: The Complete Reference*, (4th ed.), New Delhi, Tata McGraw Hill Publication, Print.

PHE3401AA CIRCUIT THEORY

(THEORY)

LEARNING OUTCOME:

5 hrs./wk.

On successful completion of the course, the student will be able to

- analyze series and parallel circuits
- apply network theorems for circuit simplifications
- interpret the working of circuits with resistive and reactive components

UNIT I: SERIES & PARALLEL CIRCUITS

15 hrs.

Current in a series circuit – series resistance – series voltage drops – Kirchhoff's voltage law – polarity of voltage drops – total power in a series circuit – voltage in a parallel circuit – branch current – Kirchhoff's current law – resistances in parallel – total power in parallel circuits.

UNIT II: KIRCHHOFF'S LAWS & NETWORK THEOREMS

15 hrs.

Kirchhoff's current law – Kirchhoff's voltage law – method of branch currents – node-voltage analysis – method of mesh currents – superposition theorem – Thevenin's theorem – Norton's theorem – Thevenin-Norton conversions – conversion of voltage and current sources – Millman's theorem.

UNIT III: CAPACITIVE REACTANCE & CAPACITIVE CIRCUITS

15 hrs.

Alternating current in a capacitive circuit – capacitive reactance – series and parallel capacitive reactances – capacitive current and voltage – capacitor and resistor in series – impedance triangle – RC phase-shifter circuit – capacitor and resistor in parallel.

UNIT IV: INDUCTIVE REACTANCE & INDUCTIVE CIRCUITS

15 hrs.

Induction by alternating current – self-inductance – self-induced voltage – how self-induced voltage opposes a change in current – mutual inductance – transformers – inductive reactance – series and parallel inductive reactances – alternating current in an inductive circuit – inductive reactance and resistor in series – impedance triangle – inductive reactance and resistor in parallel.

UNIT V: RC AND L/R TIME CONSTANTS & ALTERNATING CURRENT CIRCUITS

15 hrs.

L/R time constant – high voltage produced by opening an RL circuit – RC time constant – RC charge and discharge curves – high current produced by short-circuiting an RC circuit – AC circuits with resistance – circuits with inductive reactance – circuits with capacitive reactance – opposite reactances cancel – series reactance and resistance – parallel reactance and resistance – series-parallel reactance and resistance.

TEXTBOOK(S):

Mitchel E Schultz, (2011). *Grob's Basic Electronics*, (11th ed.), New York: McGraw – Hill International Publications. Print.

Chapters: UNIT I: 4.1 – 4.6, 5.1 – 5.6, UNIT II: 9.1 – 9.5, 10.1,1.0.2, 10.5 – 10.8 , UNIT III: 17.1 – 17.3 , 18.1 – 18.5, 18.7, UNIT IV: 19.1 – 19.6, 20.1 – 20.3 , 21.1 – 21.4, UNIT V: 22.1 – 22.6, 23.1 – 23.7

REFERENCE BOOK(S):

Albert P. Malvino, & David J. Bates, (2009). *Electronic Principles*, (7th ed.), New Delhi: Tata McGraw- Hill Publishing Company Ltd., Print.

Edward Hughes, (2008), *Electrical and Electronic Technology*, (10th ed.), England, Pearson Education Limited. Print.

PHE4501CT INTRODUCTION TO WEB PROGRAMMING

(LAB CUM THEORY)

LEARNING OUTCOME

4T+2L hrs./wk.

On successful completion of the course, the student will be able to

- interpret PHP programming structure and develop a simple PHP web page
- create, backup and restore a MySQL database
- employ server-side scripting

COURSE CONTENT:

UNIT I: BASIC ELEMENTS OF PHP

12T + 6L hrs.

Accessing PHP – creating a sample application – embedding PHP in HTML – identifiers, variables, operators – control structures and iteration – alternative control structures syntax – using declare –using arrays – numerically indexed arrays – array indices and operators – multidimensional arrays.

UNIT II: STRINGS AND FUNCTIONS

12T + 6 L hrs.

Formatting strings – manipulating strings using string functions – using require and include functions – defining own functions – passing reference and values – return keyword – recursion.

UNIT III: INTRODUCTION TO MySQL

12T + 6 L hrs.

Relational database concepts – web database architecture – Logging into MySQL – setting up users privileges – Creating Tables in MySQL – Data Manipulation Commands – Dropping Table.

UNIT IV: INTEGRATING MySQL AND PHP

12T + 6 L hrs.

Accessing MySQL database with PHP – querying a database – uploading files – using directory functions – sending and reading email – managing date and time – session control – setting and reading cookies – implementing simple session – configuring a session.

UNIT V: BUILDING APPLICATIONS WITH AJAX

12T + 6 L hrs.

Introduction to Ajax – HTTP request and Response – server side programming – adding ajax elements – creating additional files – adding bookmarks.

LAB Programs:

1. Write a PHP script to get the PHP version and configuration information.
2. Create a simple HTML form and accept the user name and display the name through PHP echo statement.
3. Write a PHP program using loops to convert word to digit.
4. Write a PHP program using functions to compute the sum of the digits of a number
5. Create a database named student using MySQL. Insert 10 records using PHP with necessary fields and find the average and grade of 10 students.
6. Write PHP script to read, write and delete a cookie.
7. Creating a static web page using PHP.
8. Create an application form using PHP form elements and write a module to upload your resume.

TEXT BOOK(S):

Luke Welling and Laura Thomson, (2009). *PHP and MySQL web development*, (4th ed.), New Delhi: Pearson Education Inc., Print.

Chapters:1,3,5,8,9,10,11,19,21,23,27,28,29,34.

REFERENCE BOOK(S):

Jon A. Phillips and Michele E. Davis, (2006). *Learning PHP and MySQL*, (1st ed.), California: O'reilly Media Inc., Print.

Mario Lurig, (2008). *PHP Reference: Beginner to Intermediate PHP5*, (1st ed.).

Steve Suehring, Tim Converse, and Joyce Park, (2009). *PHP6 and MySQL Bible*, Wiley Publishing, Inc., Print.

WEBSITE(S):

https://spoken-tutorial.org/tutorial-search/?search_foss=PHP+and+MySQL&search_language=English

<https://coursesweb.net/php-MySQL>

https://www.w3schools.com/php/php_MySQL_intro.asp

<https://www.tutorialspoint.com/php/>

<https://www.tutorialspoint.com/MySQL/>

http://www.nptelvideos.com/php/php_video_tutorials.php

PHE5501CM DATA COMMUNICATION & NETWORKING (Theory)

LEARNING OUTCOME :

5

Hrs./Wk.

On successful completion of the course, the student will be able to

- understand the importance of networking & basic model
- have a basic knowledge in wireless technology & network security
- familiarize with the DNS & IP addressing

COURSE OUTLINE :**UNIT-I : INTRODUCTION TO DATA COMMUNICATION & NETWORK MODELS****15 Hrs.**

Data communications-Networks-Network types-Internet Standards -Network models-Protocol layering-TCP/IP protocol suite-The OSI model-OSI versus TCP/IP-Transmission media-Guided Media-Unguided Media: Wireless

UNIT-II : DATA-LINK LAYER**15 Hrs.**

Introduction-Link layer addressing-Error detection & correction-Block coding-Cyclic codes-Checksum-Forward error correction-Wired LANs: Ethernet Protocol-Standard Ethernet-Fast Ethernet-Gigabit Ethernet-10 Gigabit Ethernet-Telephone Networks-Dial-Up service-Digital Subscriber Line(DSL)-Cable networks

UNIT-III : NETWORK LAYER**18 Hrs.**

Introduction-IEEE 802.11 Project-Bluetooth-WiMAX -Cellular Telephony-Satellite networks -Connecting Devices & Virtual LANs-Network-Layer Services-Packet Switching-IPV4 Addresses-Forwarding of IP Packets-IPV6 Addressing-Transition from IPV4 to IPV6-Internet Protocol (IP)-ICMPv4-Mobile IP-Unicast Routing-Routing Algorithms-Unicast Routing Protocols-Multicasting Basics-Intradomain & Interdomain Multicast Protocols-IGMP-ICMPv6 Protocol

UNIT-IV : TRANSPORT LAYER**12 Hrs.**

Introduction-Transport-Layer Protocols-User Datagram Protocol-Transmission Control Protocol-World wide web and HTTP-FTP-Electronic Mail

UNIT-V : APPLICATION LAYER**15 Hrs.**

SNMP-Quality of Service-Flow Control to Improve QoS-Cryptography and Network Security-Symmetric-Key ciphers-Asymmetric-key ciphers

TEXT BOOK(S)

Behrouz A Forouzan, Data Communications and Networking, 5th Edition: Tata McGraw Hill, New Delhi, 2013, Chapters: 1, 2, 7, 9, 10.1-10.4, 10.5, 13, 13.4, 14.1, 14.2, 15.1-15.3, 16, 17, 18, 19, 20, 21, 22, 23, 24.1-24.3, 26.1-26.3, 27.1, 27.2, 30.2, 30.3, 31.1, 31.2. Print.

REFERENCE BOOK(S)

Andrew S.Tanenbaum, Computer Networks, 4th edition, New Delhi: Prentice Hall of India Pvt. Ltd., 2005. Print

William, Data communication & Networks, First Edition, New Delhi: East-west Press Private Ltd., 2004. Print.

PHE5401CT LINUX ADMINISTRATION

(LAB CUM THEORY)

LEARNING OUTCOME:

3T + 2L hrs./wk.

On successful completion of the course, the student will be able to

- use key command line concepts & utilities to administer a Linux machine
- discover the tools used by system administrators in enterprise Linux environments
- analyse Network Servers and configure new services

COURSE CONTENT:

UNIT I: INTRODUCTION TO LINUX

9T + 6L hrs.

History of Linux – open source Linux origins – Red hat distributions – Linux principles – logging in to a Linux system switching between virtual consoles and the graphical environment – starting the X Server – changing password – root user – changing identities – editing text files – using basic Linux commands – running commands – man command – what is info commands – vim advanced editor – vim basics – opening a file in vim – modifying a file – saving a file and exiting vim – configuring vi and vim – scheduling tasks – run levels.

Lab: Basic commands in Linux, scheduling task and run control scripts.

UNIT II: USERS & GROUP ADMINISTRATION

9T + 6L hrs.

Users – groups – Linux file security – file permissions – permission types – examining permissions – interpreting permissions – changing file ownership – changing permissions – symbolic method – changing permissions – numeric method – determining file permissions – switching user accounts – user and group id numbers – the sticky bit – /etc/passwd, /etc/shadow, and /etc/group files – user management tools – system users and groups – monitoring logins – default permissions – special permissions for executables & directories – setting a umask.

Lab: Managing users and Group creation–file permissions.

UNIT III: FILE SYSTEM MANAGEMENT

9T + 6L hrs.

Partitions and file systems – inodes and directories – cp,mv,rm and inodes – hard & soft links – removable media – adding new file systems to the filesystem tree – device recognition – disk partitioning – managing partitions – masking file systems filesystem labels – tune2fs –mount points and /etc/fsta – mounting filesystems with mount – unmounting filesystems – mount by example – handling swap files and partitions – mounting NFS filesystems – automounter.

Lab: Installation of Linux – installation of software – mounting of devices – creating file system.

UNIT IV: NETWORK ADMINISTRATION

9T + 6L hrs.

First stage – starting the installation – first stage – boot media – accessing the installer – first stage – installation method – second stage – installation overview – configuring file systems – alternative partitioning – package selection – first boot – post-install configuration – starting a kickstart installation – software installation.

Lab: Basic networking commands

UNIT V: NETWORK SECURITY

9T + 6L hrs.

Ipv4 and Ipv6 – TCP/IP network addresses – class-based IP addressing – netmask – classless interdomain routing(CIDR) – obtaining an IP address – broadcast addresses – gateway addresses – name server addresses –TCP/IP configuration files-domain name service(DNS) – Ifconfig – routing – monitoring your network – ping and netstat – IP aliasing – network file services – NFS server – service profile – DHCP – SAMBA services – configuring SAMBA printing to the SAMBA server – Samba client tools – smbclient – smbmount.

Lab: Installation and configuration of NFS & SAMBA, configuring DNS, DHCP & DNS.

TEXTBOOK(S):

Red Hat Enterprise Linux System Administration (RH133). Print.

UNIT: I Chapters: 5,6,10

Red Hat Linux Essentials (RH033). Print.

UNIT II and III. Chapters: 1,2,3,5,9,15,16.

Red Hat Linux Network Services and Security Administration (RH253). Print.

UNIT IV and V. Chapters: 1,2,3,5,9,15,16.

REFERENCE BOOK(S):

Richard L. Peterson, (2008). *Linux - The Complete Reference*, (6th ed.), New Delhi: Tata McGrawHill.
Print.

PHE6402CT FUNDAMENTALS OF IOT

(LAB CUM THEORY)

LEARNING OUTCOME:

3T+ 2L

hrs./wk.

On successful completion of the course, the student will be able to

- explain the concepts of Internet of Things
- analyse basic protocols in wireless sensor network
- identify sensor technologies for sensing real world entities
- classify IoT hardware and software
- develop basic IoT applications on an embedded platform

COURSE CONTENT:

UNIT I: OVERVIEW OF IOT TECHNOLOGY

9T + 6L hrs.

Introduction – definition and characteristics of IoT – physical design of IoT – logical design of IoT – IoT enabling technologies – IoT levels and deployment templates.

UNIT II: IOT DESIGN METHODOLOGY

9T + 6L hrs.

IoT and M2M – difference between IoT and M2M – SDN and NFV for IoT – needs for IoT system management.

UNIT III: IOT COMPONENTS

9T + 6L hrs.

Sensor technology – actuator – sensor data communication protocols – radio frequency identification technology – wireless sensor networks technology.

UNIT IV: BUILDING IOT WITH HARDWARE PLATFORMS

9T + 6L hrs.

Embedded computing basics – platforms: CC3200 – Arduino – Raspberry Pi – connecting to cloud.

UNIT V: CASE STUDY

9T + 6L hrs.

Various real time applications of IoT: home automation – automatic lighting – home intrusion detection – smart cities – smart parking – environment – agriculture – smart irrigation.

Lab Programs:

1. Interfacing LED, push button, and traffic light
2. Displaying the output in the serial monitor at a specified baud rate
3. Interfacing IR sensors, buzzer, intrusion detection and temperature sensor
4. Viewing the weather monitoring report using thingspeak tool with the help of HTTP protocol

5. Controlling hardware from a web page (HTTP webserver)
6. Smart home monitoring (humidity, gas, temperature) using MQTT broker and to establish bidirectional communication using Publish / Subscribe model
7. Creating dashboard on cloud server and pulling data from local server
8. Health Monitoring (checking temperature and blood pressure) using IoT

TEXTBOOK(S):

Arshdeep Bahga & Vijay Madisetti, (2015). *Internet of Things - A hands-on approach*, (1st ed.), Hyderabad: Universities Press Ltd. Print.

Chapters: 1, 3, 4.1

Raj Kamal, (2017). *Internet of Things – Architecture and Design Principles* (1st ed.), UK: McGraw Hill Education Pvt. Ltd. Print.

Chapters: 7, 8

REFERENCES BOOK(S):

Adrian McEwen & Hakim Cassimally, (2012). *Designing the Internet of Things*, UK: Wiley Publications. Print.

Hwaiyu Geng, (2017). *Internet of Things and Data Analytic*, P.E, UK: Wiley Publications.

Marco Schwartz, (2016). *Internet of Things with Arduino Cookbook*, San Francisco: Packt Publishing Ltd. Print.

Olivier Hersent, David Boswarthick & Omar Elloumi, (2013). *The Internet of Things: Key applications and Protocols*, (2nd ed.), UK: Wiley Publications. Print.

WEBLINK(S):

<https://www.edureka.co/blog/iot-tutorial/>

<https://www.guru99.com/iot-tutorial.html>

https://www.tutorialspoint.com/internet_of_things/internet_of_things_overview.htm

<https://nptel.ac.in/courses/106/105/106105166/>

CSPH6401DT THE 8051 MICROCONTROLLER AND EMBEDDED SYSTEMS

(Lab cum Theory)

LEARNING OUTCOME :

3T + 1L Hrs./Wk.

On successful completion of the course, the student will be able to

- appreciate the need for microcontrollers
- familiarize with the assembly instructions of 8051 microcontroller
- develop skill in using C for programming microcontroller

- understand concepts of interfacing techniques

COURSE OUTLINE :

UNIT-I : THE 8051 MICROCONTROLLERS

9T + 3L Hrs.

Microcontrollers and embedded processors – Overview of the 8051 family -8051 PROGRAMMING IN C: Data types and time delay in 8051 C – I/O programming in 8051 C – Logic operations in 8051 C- Data conversion programs in 8051 C – Accessing code ROM space in 8051 C – Data serialization using 8051 C.

UNIT-II : 8051 TIMER PROGRAMMING IN ASSEMBLY AND C

9T + 3L Hrs.

Programming 8051 timers – Counter programming – Programming timers 0 and 1 in 8051 C

UNIT-III : 8051 SERIAL PORT PROGRAMMING IN ASSEMBLY AND C

9T + 3L Hrs.

Basics of serial communication – 8051 connection to RS232 – 8051 serial port programming in Assembly – Programming the second serial port – Serial port programming in C

UNIT-IV : INTERRUPTS PROGRAMMING IN ASSEMBLY AND C

7T + 3L Hrs.

8051 interrupts – Programming timer interrupts – Programming external hardware interrupts – Programming the serial communication interrupt – Interrupt priority in the 8051 / 52 –Interrupt programming in C

UNIT-V : LCD AND KEYBOARD INTERFACING

11T + 3L Hrs.

LCD interfacing –

keyboard

interfacing ADC

AND DAC

INTERFACING:

Parallel and serial ADC – DAC interfacing

EXPERIMENTS/PROGRAMS(LAB):

1. Generation of pulses and pulse trains using timers
2. Generation of square wave with varying duty cycles
3. Serial transmission of data at different baud rates
4. Generation of Ramp Signal on the DAC Output
5. Binary Pattern on the Port 1 LEDs
6. Echoing the Switches to the LEDs
7. Multiplexing 7-segment Displays
8. Displaying Text in LCD

TEXT BOOK(S)

Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, *The 8051 Microcontroller and Embedded Systems*, 2nd edition, New Delhi: Prentice-Hall of India, 2005, Chapters: 1,7,9,10,11,12,13.1 -13.2.

REFERENCE BOOK(S)

Ajay v Deshmukh, *Microcontrollers Theory & applications*, New Delhi: The Tata McGraw Hill, 2005. Print.

Kenneth J, Ayala *The 8051 Microcontroller*, 2nd edition, Mumbai: Penram International Publishing, 2005. Print.

Myke Predko, *Programming and customizing the 8051 Microcontroller*, New Delhi: McGraw Hill Publishing Company Ltd.,, 1998. Print.

MAPH6402DM INTRODUCTION TO ASTROPHYSICS

(THEORY)

LEARNING OUTCOME

4Hrs./Wk.

On successful completion of the course, the student will be able to

- recognize the principles involved in astrophysical measurements
- identify the basic principles behind the formation, evolution and death of stars
- become familiar with celestial coordinates and successive phases of the moon
- explain the occurrences of solar and lunar eclipse

COURSE OUTLINE:

UNIT I: COSMOLOGY AND MEASUREMENT TOOLS OF ASTRONOMY

12 hrs.

Refracting telescopes – reflecting telescopes – angular resolution – charged coupled devices – radio telescopes – classifying galaxies – the Hubble law – the expanding universe – the big bang

UNIT II: NATURE OF STARS AND STELLAR EVOLUTION

12 hrs.

Stellar distances and parallax – apparent brightness and luminosity – the magnitude scale – star colors and temperature – the Hertzsprung-Russell diagram – protostars and dark nebulae – reaching the main sequence – red giants – planetary nebulae – white dwarfs – core-collapse supernovae.

UNIT III: CELESTIAL SPHERE

12 hrs.

Celestial sphere – diurnal motion – celestial axis and equator – celestial horizon – zenith and nadir – celestial meridian – celestial points – northern and southern hemispheres – eastern and western

hemispheres – visible and invisible hemispheres – declination circles – verticals – parallactic angle – rising and setting – transit or culmination – due east – due west – due north – due south – annual motion of the Sun – ecliptic – obliquity – first point of Aries – first point of Libra – equinoxes and solstices – colures – celestial co-ordinates – to trace the changes in the co-ordinates of the Sun in the course of a year – sidereal time – latitude of a place – to find the hour angle of a body at rising or setting – to find the duration of day time – morning and evening stars – circumpolar stars – the zones of the Earth – to trace the variations in the duration of day and night during the year at different stations

UNIT IV : THE MOON

12 hrs.

Sidereal month – synodic month – elongation – conjunction – opposition – quadratures – daily motion of the moon – successive phases of the moon – moon exhibits the same side to the earth – Metonic cycle – golden number – epact – Sunday letter – Earth shine.

UNIT V: OUR SUN

12 hrs.

The photosphere – the chromosphere – the corona – thermonuclear energy – lunar – solar eclipses – penumbral regions – maximum and minimum number of eclipses in a year

TEXT BOOK(S)

Kumaravelu S. and Kumaravelu, Susheela. (2004). *Astronomy*. Nagercoil: SKV Publications. Print.

Chapters: Chap–II Articles 39 – 63, 67, 69, 77, 80 – 82, Chap–III Articles 87 – 88 and 91

Chap – XII Articles 229 – 242, 250 – 251 and 254 Chap–XIII Articles 256 – 259, 272 – 274.

William J. Kaufman III, Roger A. Freedman and Robert M. Geller. (2014). *Universe* (10th ed.). USA: W.H. Freeman Company. Print.

Chapters: 6.1–6.4, 6.6, 16.1, 16.5–16.7, 17.1–17.4, 17.7, 18.3, 18.4, 19.2, 20.3 (Pg No. 567–568), 20.4 (Pg No. 569 – 570), 20.6 (Pg No. 575 – 577), 23.3, 23.5, 25.2, 25.3.

REFERENCE BOOK(S)

Abhayankar K.D. (2001). *Astrophysics: Stars and Galaxies*. India: Universities Press. Print.

Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas. (2011). *An introduction to Astrophysics* (2nd ed.). New Delhi: PHI learning private Ltd. Print.

Bhattacharya, A.B. Joardar, S. Bhattacharya, R. (2010). *Astronomy and Astrophysics*. India: Overseas Press (India) Pvt. Ltd. Print.

Krishnaswamy, K.S. (2007). *Astrophysics: A Modern Perspective*. New Delhi: New Age International (P) Limited. Print.

Michael A. Seeds. (2001). *Foundations of Astronomy*. USA: Brooks/ Cole Thomson learning. Print.

Sasidharan, G.K. (2008). *The Great Universe*. New Delhi: S. Chand & Company Ltd. Print.

Srinivasan G. (2011). *Can stars find peace?*. New Delhi: Universities Press. Print.

BTPH6402DM BIOMEDICAL INSTRUMENTATION

(THEORY)

LEARNING OUTCOME:

4 hrs./wk.

On successful completion of course, student will be able to

- know the physiology of human system
- inquire the basic principle and mechanism of biomedical instruments
- relate the use of biomedical devices in monitoring the diseases

COURSE CONTENT:

UNIT I: CELLULAR MEASUREMENTS AND SURFACE CHARACTERIZATION

12 hrs.

Cell structure and components – microscopy – light, resolution & magnification – light and dark field microscopy electron microscopy – cellular markers – confocal laser scanning microscopy – two photon excitation microscopy –image processing – single cell measurement – oculometer and fluorescence activated cell sorting (FACS).

UNIT II: MEDICAL IMAGING OF NEURO-MUSCULAR SYSTEM

12 hrs.

Anatomy and function of brain and neuron – resting and action potential – impulse conduction – brain waves – electroencephalography (EEG) – evoked potential – brain imaging – X ray, CT (Computed Tomography), magnetic resonance imaging (MRI) – nuclear imaging – muscular system – types of muscles – mechanism of muscle contraction and its types (isotonic and isometric) – neuromuscular junction – electromyography (EMG).

UNIT III: SENSORY AND BEHAVIORAL MEASUREMENTS

12 hrs.

Structure and function of eye (rods and cones, mechanism of photoreception & rhodopsin cycle) – visual field – eye pressure – ophthalmoscope – potential acuity meter (PAM) – vision enhancers (lens): anatomy of ear – mechanism of hearing and equilibrium – audiometry – otoscopy.

UNIT IV: ASSISTING AND THERAPEUTIC EQUIPMENTS IN CIRCULATORY SYSTEM

12 hrs.

Structure of heart – mechanism and conduction of heart beat – stethoscope – electrocardiogram (ECG) – ECG monitoring – electrograms – Blood vessels – types – circulation – blood pressure: direct and indirect measurement – vessel distension.

UNIT V: PULMONARY FUNCTION ANALYSER IN RESPIRATORY SYSTEM**12 hrs.**

Structure of respiratory organ–lungs –principle of gas exchange – artificial respiration – heart – lung machine (HLM) – cardiac – pulmonary volume – measurement of pulmonary volume – spirometry – body plethysmograph – impedance plethysmography – inductance plethysmography.

TEXT BOOK(S):

Ahuja V.M., (2011). *Textbook of Medical Physiology*, (2nd ed.) New Delhi: Ane Books Pvt. Ltd. Print.

Guyton A.C., Hall J.E., (2001). *Textbook of Medical Physiology*, (10th ed.), New Delhi: W.B. Saunders company. Print.

Webster J.G., (2004). *Bioinstrumentation*, Singapore: John Wiley & Sons. Print.

Chapters: 6.2, 7.2 - 7.6, 7.10.4, 7.10.5, 7.11, 7.12.2, 8.2.2, 8.2.3, 8.5.1, 8.9, 8.10, 9.2.

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Arumugam M., (2001). *Biomedical Instrumentation*, Anuradha Agencies Publishers. Print.

Carr J.J., Brown J.M, (2011). *Introduction to Biomedical equipment technology*, (4th ed.), New Delhi: Pearson Education, Inc. Print.

Cromwell L., Weibell F.J., and Pfeiffer E.A., (1992). *Biomedical Instrumentation and Measurements*, (2nd ed.), New Delhi: Prentice- Hall of India. Print.

Pattabhi V. Gautham N., (2010). *Biophysics*, New Delhi: Narosa Publishing House. Print.

Pandey O.N., Rakesh Kumar., (2008). *Biomedical Electronics and Instrumentation*, S.K Kataria & Sons. Print.

Sherwood L., (2004). *Human Physiology from cells to systems*, (5th ed.), USA: Thomson- Brooks/Cole. Print.

Waugh A., Grant A., (2001). *Anatomy and Physiology in Health and Illness*, (9th ed.), UK: Churchill Livingstone. Print.