SEMESTER: I	COURSE CODE: 22PPHYO16 -1	CREDITS : 3
PART : Open Elective	TITLE : COMMUNICATION PHYSICS	Hours/Week : 3

COURSE OBJECTIVES

1. Understand the basic elements of communication systems.
2. Realize the importance of the Electromagnetic field theory in signal propagation.
3. Justify the necessity and benefits of modulation and demodulation techniques.
4. Describe the various modulation and demodulation techniques used for signal transmission.
5. Learn the basics of fiber optic communication.

UNIT 1 : Elements of communication

Introduction – Block diagram of communication systems – Electromagnetic spectrum for communication applications – Need of communication systems – Classification of signals – analogue and digital signals – Wave forms in communications – Noise in communication - Signal to Noise ratio.

UNIT 2 :Theory of electro magnetic wave propagation

Introduction - Maxwell's equations of electromagnetism – Boundary conditions on field vectors – Energy of electromagnetic field - Poynting theorem **-** Plane wave equation and solutions – Wave propagation in free space, isotropic dielectric and in a conducting medium – Skin depth.

UNIT 3 : Analogue modulation and demodulation

Necessity of Modulation – Types of modulation - Mathematical treatment of Amplitude and Frequency modulation – AM generation by Ring modulator – FM generation by frequency stabilized reactance modulator – Necessity of Demodulation - AM diode demodulator - FM dual slope demodulator.

UNIT 4 : Digital modulation and demodulation

Digital signal and Sampling – Noise reduction by Quantization – Pulse Amplitude modulation (PAM) – Demodulation of PAM signal – Pulse Time Modulation (PTM) – Generation and Recovery of PWM and PPM signals.

UNIT 5 : Optical communication

Basics configuration of Fiber optic communication systems – Optical fibre as wave guide - Construction and working of Optical fibre - Total internal reflection – Acceptance angle and Numerical aperture – Types of optical fibre based on modes and refractive index profile – Attenuation in optical fibres – Dispersion loss in optical fibres.

COURSE OUTCOMES

At the end of the course, student will be able to

1. Realize the essential elements of Communication and their importance.
2. Apply Electromagnetic field theory in signal propagation.
3. Gain knowledge in analogue modulation and demodulation.
4. Describe basic concepts of Pulse modulation and demodulation.
5. Understand the basics of Fiber optic communication.

Text books

1. Kennedy and George, *Electronic Communication Systems*, Tata McGraw-Hill, 4th edition. (1999).
2. R.J. Schoenbeck, *Electronic Communication-Modulation and Transmission, Prentice*-Hall of India, 2nd edition. (1992).
3. B.P. Lathi, *Modern Digital and Analog Communication Systems*, Oxford University Press, 3rd edition. (1998).
4. J.M. Senior, *Optical FibreCommunication,Principles and Practice*, Pearson Education Ltd., 3nd edition, (2009).

Supplementary reading

1. Simon Haykin, *Communication Systems*, John Wiley & Sons, 3rd edition. (2000).
2. G.M. Miller and J.S. Beasley, *Modern Electronic Communication*, Prentice-
3. Hall of India, 7th edition (2012).
4. Barker, Forrest, *Communication Electronics*, (I Edition) Prentice-Hall. (1986).
5. Dennis Roddy, and John Coolen, *Electronic Communication*, Dorling Kindersley (India) Pvt. Ltd, 4th edition, (2014).

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3
CO2	3	2	2	3	2
CO3	3	2	3	2	2
CO4	3	2	3	2	2
CO5	3	2	2	3	3

SEMESTER : I	COURSE CODE: 22PPHYO16-2	CREDITS : 3
PART : Open Elective	TITLE : SPECTROSCOPY AND LASERS	Hours/Week : 3

COURSE OBJECTIVES

1. To give knowledge about the microwave spectroscopy and its applications.
2. To educate the regarding the important of IR and UV spectroscopy
3. To expose the student to the effective study and applications of Raman spectroscopy.
4. To introduce knowledge on basics of laser.
5. To study the types and applications of lasers.

UNIT 1 : Microwave spectroscopy

Rotational spectra of diatomic molecules -Effect of isotopic substitution - The non – rigid rotator - Rotational spectra of polyatomic molecules – Linear molecules - Experimental techniques.

UNIT 2 : IR and UV Spectroscopy

Vibrating diatomic molecule -Diatomic vibrating rotator-Linear molecules - Analysis by infrared techniques – Characteristic- group frequencies - Ultraviolet spectroscopy – determination of band gap – Uses.

UNIT 3 : Raman spectroscopy

Raman effect - Quantum theory of Raman effect - Rotational and vibrational Raman shifts of diatomic molecules- Raman Spectroscopy instrumentation-applications- group frequencies.

UNIT IV: Lasers-fundamentals and types

Basic Construction and Principle of Lasing-Einstein Relations and Gain Coefficient - Population Inversion - Laser types-He-Ne Laser-CO_2 Laser- Nd:YAG Laser- Semiconductor Laser.

UNIT 5 : Laser – Applications

Industry: Laser cutting - welding - drilling – Laser in Hologram -Medical: Lasers in Surgery - Lasers in ophthalmology - Lasers in cancer treatment-Communication: Laser in Optic fibre communication.

COURSE OUTCOMES

At the end of the course, student will be able to

1. Study briefly about the microwave spectroscopy.
2. Improve knowledge about IR and UV spectroscopy with its applications.
3. Understand the Raman spectroscopy and applications.
4. Understand the basics of laser action
5. Study various types Laser and its applications

Text books

1. Colin N. Banwell and Elaine M. Mc Cash, *Fundamentals of Molecular Spectroscopy,*Mc Grow – Hill Education (India) Pvt.Ltd.,New Delhi. (5thedition), (2013).
2. G.R. Chatwal and S.K.Anand, *Spectroscopy -Atomic and Molecular*, Himalaya Publishing House (5th edition). (2016).
3. Arthur Beiser, *Concepts of Modern Physics,McGraw Hill,* New York, (1995).
4. D.N. Sathyanarayana, *Vibrational Spectroscopy*, New Age International, New Delhi. (2015).
5. G. Aruldhas, *Molecular Structure and Spectroscopy*, Prentice Hall, New Delhi. (2006).
6. Gupta, Kumar and Sharrna, *Spectroscopy*.PragathiPrakashan - 23rd edition (2011).
7. N. Avadhanulu, S. Chand & Company *An introduction to LASERS* (2001).
8. William T. Silfvast, *laser fundamentals,*Cambridge University Press - 2nd edition (2008).
9. K. Thyagarajan and AX Ghatak, *LASER Theory and Application* - Laxmi Publications (2019).
10. M. Streen, J. Mazumder*, LASERmaterial processing springer* (2010).
11. B.K. Sharma, *Spectroscopy*, Goel Publication house - 22nd edition (2011).
12. H.Kaur, *Spectroscopy*, PragathiPrakashan – 8th edition (2013).

Supplementary Reading

1. R.P Straughen and S. Walker, *Spectroscopy (Vol. I, II, III),* Chapman & Hall, London. (1976).
2. G. Aruldhas, *Molecular Structure and Spectroscopy,* PHI Learning Private Limited – Hall of India, 2nd edition. (2007).
3. Michael Hollas, *Modern Spectroscopy,* John Wiley, New York-4th edition – (2004).
4. Walter S. Struve, *Fundamentals of Molecular Spectroscopy,* John Wiley and Sons, Ames, Iowa. (1989).
5. Harvey Ellott White, *Introduction to Atomic Spectra – white*, McGraw Hill (1934).
6. William T. SilfVast, *Laser fundamentals* - Cambridge University Press - Published in South Asia by foundation books, 23, Ansari Road, New Delhi (2004)

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	2	2	2	2	2
CO4	2	3	3	3	3
CO5	3	3	3	3	3

SEMESTER : I PART : Open Elective	COURSE CODE : 22PPHYO16-3 TITLE : RENEWABLE ENERGY AND ENERGY HARVESTING	CREDITS : 3 Hours/Week : 3

COURSE OBJECTIVES

1. To learn various types of alternative sources of energy.
2. To understand the basics and applications of solar energy.
3. To understand harvesting methods of wind, ocean, geothermal and hydro energies.
4. To learn the basics of piezo-electric effect and its applications in energy harvesting.
5. To understand the various forms of electromagnetic energy harvesting techniques.

UNIT 1 : Fossil fuels and alternative sources of energy

Fossil fuels and nuclear energy, need of renewable energy, non – conventional energy sources, Wind energy, Tidal energy, Wave energy systems, Ocean Thermal Energy Conversion, Solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, hydroelectricity, basics of Energy Auditing.

UNIT 2 : Solar energy

Solar energy, storage of solar energy, solar pond, non – convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning, need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits and sun tracking systems.

UNIT 3 : Wind energy harvesting:

Fundamentals of wind energy, wind turbines and different electrical machines in wind turbines, power electronics interfaces, grid interconnection topologies.

Ocean energy :Ocean energy potential against wind and solar, wave characteristics and statistics, wave energy devices. Tide characteristics tide energy technologies.

Geothermal and hydro energy : Geothermal resources, geothermal techniques. Hydropower resources, hydro technologies and environmental impacts.

UNIT 4 : Piezoelectric energy harvesting

Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, piezoelectric parameters and modelling piezoelectric generators, piezoelectric harvesting applications and human power.

UNIT 5 : Electromagnetic energy harvesting

Linear generators, physics mathematical models, recent applications. Carbon captured technologies, cell, batteries and power consumption. Environmental issues and Renewable sources of energy, sustainability.

COURSE OUTCOMES

At the end of the course, student will be able to

1. Know various types of alternative sources of energy.
2. Describe the basics and applications of solar energy.
3. Understand the harvesting methods of wind, ocean, geothermal and hydro energies.
4. Study the basics of piezo-electric effect and its applications in energy harvesting.
5. Differentiate the various forms of electromagnetic energy harvesting techniques.

Text book

1. S.C.Bhatia, R.K. Gupta, *Woodhead Text book of renewable energy*. (2018) edition
2. Dr.NiranajanSahu, *Renewable energy and energy harvesting*, KAAV Publications, (2017).
3. K.P. Prasad Rao, T. Vijay Muni, *Applications of renewable energy sources, Notion Press, (2020).*

OUTCOME MAPPING

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	2
CO2	3	2	2	3	3
CO3	3	2	2	3	3
CO4	3	2	3	3	2
CO5	3	3	2	3	3