BMT306 : Python Programming Lab
Credits: 2
LTP 004

Course Description: The course aims to equip the students with a comprehensive study of Python Programming.

The course includes Object-Oriented paradigm in Python programs, Python functions, Python exception handling mechanism.

Course Outcomes (CLO):

Upon successful completion of the course, the students should be able to:

CO1: Solve simple to advanced problems using Python language.

CO2: Develop logic of various programming problems using numerous data types and control structures of Python.

CO3: Implement different data structures using Python.

CO4: Implement modules and functions using Python.

CO5: Design and implement the concept of object-oriented programming structures.

CO6: Implement files handling.

List of Practical:

1. Write a program to add two numbers.
2. Write a program that declares 3 integers, determines and prints the largest and smallest in the group.
3. Write a program for factorial of a number.
4. Write a program to calculate simple interest.
5. Write a program to find that given year is leap year or not.
6. Write a program to implement linear search and binary search.
7. Write a program to find that given number is Armstrong or not.
8. Write a program to print Fibonacci Series.
9. Write a program to convert decimal number into binary numbers.
10. Python Program to find sum of array.
11. Write a program to find largest number of elements in array.
12. Write a program to check if a string is palindrome or not.
13. Maintain book record as per their serial numbers in library using dictionary.
14. Write a program to concatenate two dictionaries into one.

15. Perform following operations on dictionary 1) Insert 2) delete 3) change 4) update.
16. Write a program to calculate addition of two number using methods.
17. Program to calculate average of numbers using function.
18. Fibonacci series using recursion.
19. Write a program to create a module of factorial in Python.
20. Write A Program to Find the Area of a Rectangle Using Classes
21. Write A Program to Append, Delete and Display Elements of a List Using Classes
22. Write A Program to Create a Class and Compute the Area and the Perimeter of the Circle
23. Write A Program to Create a Class which Performs Basic Calculator Operations
24. Write A Program to Create a Class in which One Method Accepts a String from the User and Another Prints it.
25. Write A Program that Reads a Text File and Counts the Number of Times a Certain Letter Appears in the Text File.
26. Write A Program to Read a Text File and Print all the Numbers Present in the Text File.
27. Write a program for generation of pyramid.

Pyramid 1 * * * * * * * * * *	Pyramid 2 * * * * * * * * * *	Pyramid 3 * * * * * * * * * *	Pyramid 4 * * * * * * * * * * * * *	Pyramid 5 1 1 2 1 2 3 1 2 3 4

BMT307 : MATLAB Programming Lab
Credits: 2
LTP 004

The course aims to equip the students able to carry out simple numerical computations and analyses using MATLAB.

The course includes simple calculations using MATLAB

Course Outcomes (CLO):

Upon successful completion of the course, the students should be able to:

CO1: Understand the main features of the MATLAB development environment.

CO2: Write simple programs in MATLAB to solve scientific and mathematical problems.

CO3: Understand how to draw a basic graph application.

List of Practical:

1. Introduction to MATLAB.
2. Explain the main windows in MATLAB desktop.
3. Programming in MATLAB: Introduction, Branching statements, loops, functions, additional data types, arrays, inputs/outputs etc.
4. Program to display a Matrix
5. Program to Addition of matrix.
6. Basic graphic applications: Draw Curve, Refine the plot: Line pattern, color, and thickness, Draw multiple curves.

Recommended Books / Suggested Readings:

1. MATLAB: An Introduction with Applications, by Amos Gilat, 2nd edition, Wiley, 2004.
2. C.B. Moler, Numerical Computing with MATLAB, SIAM, 2004.

BPH304: APPLIED OPTICS
Credits: 02
LTP 004

Pre-Requisites: N.A

Course Description:
Theory includes only qualitative explanation therefore students will be able to understand the optics practically and effectively. Minimum five experiments should be performed covering minimum three sections.

Course Learning Outcomes:
This course will help students to:
CO1: Understand basic lasing mechanism qualitatively, types of Lasers, characteristics of Laser Light, types of Lasers, and its applications in developing LED, Holography.
CO2: Learn concept of Fourier optics and Fourier transform spectroscopy.
CO3: Understanding of basic principle and theory of Holography.
CO4: Concept of total internal reflection.
CO5: Characteristics of optical fibre.

Course Contents:

(i) Sources and Detectors: Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers.

Experiments on Lasers:

a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid-state laser.
b. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid-state laser.
c. To find the polarization angle of laser light using polarizer and analyzer
d. Thermal expansion of quartz using laser

Experiments on Semiconductor Sources and Detectors:

a. V-I characteristics of LED
b. Study the characteristics of solid state laser
c. Study the characteristics of LDR
d. Photovoltaic Cell
e. Characteristics of IR sensor

(ii) Fourier Optics

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering
4. Construction of an optical 4f system

b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

Experiment: To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

(iii) Holography

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy, interferometry, and character recognition

Experiments on Holography and interferometry:

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perot interferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram

(iv) Photonics: Fibre Optics

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres, Fibre optic sensors: Fibre Bragg Grating

Experiments on Photonics: Fibre Optics

a. To measure the numerical aperture of an optical fibre.
b. To study the variation of the bending loss in a multimode fibre
c. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern
d. To measure the near field intensity profile of a fibre and study its refractive index profile
e. To determine the power loss at a splice between two multimode fibre.

Reference Books:

1. Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
2. LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010, Tata McGraw Hill
3. Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
4. Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.
5. Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
6. Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.

7. Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
8. Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edition, 1996, Cambridge Univ. Press

BPH305: PHYSICS WORKSHOP SKILLS
Credits: 02
LTP 200

Pre-Requisites: NA

Course Description:
The aim of this course is to enable the students to familiar and experience with various mechanical and electrical tools through hands-on mode

Course Learning Outcomes
After completing this course, student will be able to:
CO1: Learning measuring devices like Vernier callipers, Screw gauge, travelling microscope and Sextant for measuring various length scales.
CO2: Acquire skills in the usage of multimeters, soldering iron, oscilloscopes, power supplies and relays.
CO3: Developing mechanical skill such as casting, foundry, machining, forming and welding and will become familiar with common machine tools like lathe, shaper, drilling, milling, surface machines and Cutting tools.
CO4: Getting acquaintance with prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axle. Lever mechanism. Lifting of heavy weight using lever, braking systems, pulleys.

Course Contents:

UNIT I

Introduction: Measuring units, Conversion to SI and CGS. Familiarization with meter scale, Vernier calliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc, Use of Sextant to measure height of buildings, mountains, etc.

UNIT II

Mechanical Skill: Concept of workshop practice. Overview of manufacturing methods: casting, foundry, machining, forming and welding, Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood, Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines, Cutting tools, lubricating oils, Cutting of a metal sheet using blade, Smoothening of cutting edge of sheet using file, Drilling of holes of different diameter in metal sheet and wooden block, Use of bench vice and tools for fitting, Make funnel using metal sheet.

UNIT III

Electrical and Electronic Skill: Use of Multimeter, Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB, Operation of oscilloscope. Making regulated power supply. Timer circuit, Electronic switch using transistor and relay.

UNIT IV

Introduction to prime movers: Mechanism, gear system, wheel, Fixing of gears with motor axel, Lever mechanism, lifting of heavy weight using lever, Braking systems, pulleys, working principle of power generation systems, Demonstration of pulley experiment.

Reference Books:

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.
2. Performance and design of AC machines – M.G. Say, ELBS Edition.
3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edition, Newnes [ISBN: 0750660732]
5. New Engineering Technology, Lawrence Smyth/Liam Hennessy, The Educational Company of Ireland [ISBN: 0861674480]

BPH306: ELECTRICAL CIRCUITS AND NETWORK SKILLS

Credits: 02

LTP 200

Pre-Requisites: N.A.

Course Description:

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode.

Course Learning Outcomes:

At the end of this course, students will be able to achieve the following learning outcomes:

CO1: They would be able to demonstrate good comprehension of basic principles of electricity including ideas about voltage, current and resistance.

CO2: They would also be proficient in identifying different combinations of circuit elements besides having sound knowledge about varying types of voltage & current - alternating and direct.

CO3: Their familiarization with basic tenets of electrical circuits like measurement of resistance, current and voltages in different circuits would be complete.

CO4: They would be able to analyze complicated AC and DC electrical circuits.

CO5: They would have the ability to calculate real, imaginary and complex power components of AC sources.

Contents:

UNIT I

Basic Electricity Principles: Voltage, Current, Resistance, and Power, Ohm's law, Series, parallel, and series-parallel combinations, AC Electricity and DC Electricity, Familiarization with multimeter, voltmeter and ammeter.

Understanding Electrical Circuits: Main electric circuit elements and their combination, Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements, Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits, Real, imaginary and complex power components of AC source, Power factor, Saving energy and money.

UNIT II

Electrical Drawing and Symbols: Drawing symbols, Blueprints, Reading Schematics. Ladder diagrams, Electrical Schematics, Power circuits, Control circuits, reading of circuit schematics, Tracking the connections of elements and identify current flow and voltage drop

Generators and Transformers: DC Power sources, AC/DC generators, Inductance, capacitance, and impedance, Operation of transformers.

UNIT III

Electric Motors: Single-phase, three-phase & DC motors, Basic design, Interfacing DC or AC sources to control heaters & motors, Speed & power of ac motor.

Solid-State Devices: Resistors, inductors and capacitors, Diode and rectifiers, Components in Series or in shunt, Response of inductors and capacitors with DC or AC sources.

UNIT IV

Electrical Protection: Relays. Fuses and disconnect switches, Circuit breakers, Overload devices, Ground-fault protection, Grounding and isolating, Phase reversal, Surge protection. Interfacing DC or AC sources to control elements (relay protection device).

Electrical Wiring: Different types of conductors and cables, Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors, Instruments to measure current, voltage, power in DC and AC circuits, Insulation. Solid and stranded cable, Conduit, Cable trays, Splices: wirenuts, crimps, terminal blocks, split bolts, and solder, Preparation of extension board.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edition.

BPH307: BASIC INSTRUMENTATION SKILLS
Credits: 02
LTP 200

Pre-Requisites: N.A

Course Description:
This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

Course Learning Outcomes:
At the end of this course, students will be able to develop following learning outcomes:
CO1: The student is expected to have the necessary working knowledge on accuracy, precision, resolution, range and errors/uncertainty in measurements.
CO2: Course learning begins with the basic understanding of the measurement and errors in measurement. It then familiarizes about each and every specification of a multimeter, multimeters, multivibrators, rectifiers, amplifiers, oscillators and high voltage probes and their significance with hands on mode.
CO3: Explanation of the Specifications of CRO and their significance. Complete explanation of CRT.
CO4: Students learn the use of CRO for the measurement of voltage (dc and ac), frequency and time period. Covers the Digital storage Oscilloscope and its principle of working

Contents:

UNIT I

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc., Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance, Specifications of a multimeter and their significance.
Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity, Principles of voltage, measurement (block diagram only), Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance.

UNIT II

Cathode Ray Oscilloscope: Block diagram of basic CRO, Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence &chemical composition, Time base operation, synchronization, Front panel controls, Specifications of a CRO and their significance.
Use of CRO for the measurement of voltage (dc and ac frequency, time period, Special features of dual trace, introduction to digital oscilloscope, probes, Digital storage Oscilloscope: Block diagram and principle of working.

UNIT III

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators, Pulse generator, and function generator, Brief idea for testing, specifications, Distortion factor meter, wave analysis.
Impedance Bridges & Q-Meters: Block diagram of bridge. Working principles of basic (balancing type) RLC bridge, Specifications of RLC Bridge. Block diagram & working principles of a Q- Meter, Digital LCR bridges.

UNIT IV

Digital Instruments: Principle and working of digital meters, Comparison of analog & digital instruments, characteristics of a digital meter, working principles of digital voltmeter.

Digital Multimeter: Block diagram and working of a digital multimeter, working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution.

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages
5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges
10.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edition.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012,Tata McGraw Hill
7. Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
8. Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

BPH308: RENEWABLE ENERGY AND ENERGY HARVESTING
Credits: 02
LTP 200

Pre-Requisites: N.A

Course Description:
The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible

Course Learning Outcomes:
Students will be able to
CO1: Significance of renewable energy and details concerning various sources of energy will be imparted to the students. The students are expected to learn not only the theories of the renewable sources of energy, but also to have hands-on experiences on them wherever possible.
CO2: Some of the renewable sources of energy which should be studied here are: (i) offshore wind energy, (ii) tidal energy, (iii) solar energy, (iv) Biogas energy and (v) hydroelectricity.
CO3: Knowledge of various sources of energy for harvesting will be given
CO4: Understand the need of energy conversion and the various methods of energy storage
CO5: Students will have a good understanding of various renewable energy systems, and its components

Course Contents:

UNIT I

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

UNIT II

Solar energy: Solar energy, its importance, 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.
Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.

UNIT III

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.
Geothermal Energy: Geothermal Resources, Geothermal Technologies.
Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

UNIT IV

Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity ,Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power.
Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications Carbon captured technologies, cell, batteries, power consumption. Environmental issues and Renewable sources of energy, sustainability.

Demonstrations and Experiments

1. Demonstration of Training modules on solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Reference Books:

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, (2004), “Renewable Energy, Power for a sustainable future”, Oxford University Press, in association with The Open University.
5. Dr. P Jayakumar, (2009) Solar Energy: Resource Assesment Handbook,
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

BPH309: RADIATION SAFETY
Credits: 02
LTP 200

Pre-Requisites: N.A

Course Description:
The aim of this course is for awareness and understanding regarding radiation hazards and safety.

Course Learning Outcomes:
This course will help students in the following ways:
CO1: Awareness and understanding the hazards of radiation and the safety measures to guard against these hazards.
CO2: Learning the basic aspects of the atomic and nuclear Physics, specially the radiations that originate from the atom and the nucleus.
CO3: Having a comprehensive knowledge about the nature of interaction of matter with radiations like gamma, beta, alpha rays, neutrons etc. and radiation shielding by appropriate materials.
CO4: Knowing about the units of radiations and their safety limits, the devises to detect and measure radiation, such as the Geiger-Mueller counter and scintillation counter.

Course Contents:

UNIT I

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron, The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half-life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

UNIT II

Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons – Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation, Beta Particles- Collision and Radiation loss (Bremsstrahlung), Interaction of Neutrons- Collision, slowing down and Moderation.

UNIT III

Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC). Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), Scintillation Detectors (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetry.

UNIT IV

Radiation safety management: *Biological effects of ionizing radiation*, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection

(ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation, Nuclear waste and disposal management, Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

Application of nuclear techniques: Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil. *Industrial Uses:* Tracing, Gauging, Material Modification, Sterization, Food preservation.

Reference Books:

1. W.E. Burcham and M. Jobes – Nuclear and Particle Physics – Longman (1995)
2. G.F.Knoll, Radiation detection and measurements
3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J. Meredith and J.B. Massey, "Fundamental Physics of Radiology". John Wright and Sons, UK, 1989.
5. J.R. Greening, "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations, G.C. Lowental and P.L. Airey, Cambridge University Press, U.K., 2001
7. Martin and S.A. Harbisor, An Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. W.R. Hendee, "Medical Radiation Physics", Year Book – Medical Publishers Inc. London, 1981

BPH310: WEATHER FORECASTING

Credits: 02

LTP 200

Pre-Requisites: N.A

Course Description:

The aim of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Course Learning Outcomes:

After completion of this course, students will be able to:

CO1: Acquire basic knowledge of the elements of the atmosphere, its composition at various heights, variation of pressure and temperature with height.

CO2: To learn basic techniques to measure temperature and its relation with cyclones and anti-cyclones.

CO3: Knowledge of simple techniques to measure wind speed and its directions, humidity and rainfall.

CO4: Absorption, emission and scattering of radiations in atmosphere. Radiation laws.

CO5: Knowledge of global wind systems, jet streams, local thunderstorms, tropical cyclones, tornadoes and hurricanes.

CO6: Knowledge of climate and its classification. Understanding various causes of climate change like global warming, air pollution, aerosols, ozone depletion, acid rain.

CO7: Develop skills needed for weather forecasting, mathematical simulations, weather forecasting methods, types of weather forecasting, role of satellite observations in weather forecasting, weather maps etc. Uncertainties in predicting weather based on statistical analysis.

CO8: Develop ability to do weather forecasts using input data

Contents:

UNIT I

Introduction to atmosphere: Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature with height; air temperature; requirements to measure air temperature; temperature sensors: types; atmospheric pressure: its measurement; cyclones and anticyclones: its characteristics.

UNIT II

Measuring the weather: Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere; radiation laws.

UNIT III

Weather systems: Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes.
Climate and Climate Change: Climate: its classification; causes of climate change; global warming and its outcomes; air pollution; aerosols, ozone depletion, acid rain, environmental issues related to climate.

UNIT IV

Basics of weather forecasting: Weather forecasting: analysis and its historical background; need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather station; basics of choosing site and exposure; satellites observations in weather forecasting; weather maps; uncertainty and predictability; probability forecasts.

Demonstrations and Experiments:

1. Study of synoptic charts & weather reports, working principle of weather station.
2. Processing and analysis of weather data:
   (a) To calculate the sunniest time of the year.
   (b) To study the variation of rainfall amount and intensity by wind direction.
   (c) To observe the sunniest/driest day of the week.
   (d) To examine the maximum and minimum temperature throughout the year.
   (e) To evaluate the relative humidity of the day.
   (f) To examine the rainfall amount month wise.
3. Exercises in chart reading: Plotting of constant pressure charts, surfaces charts, upper wind charts and its analysis.
4. Formats and elements in different types of weather forecasts/ warning (bothaviation and non-aviation)

Reference books:

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
2. The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
3. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
4. Text Book of Agrometeorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur.
5. Why the weather, Charls Franklin Brooks, 1924, Chpraman & Hall, London.
6. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.