आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

SCHOOL OF SCIENCES

Bachelor of Science (PCM)

THREE YEAR PROGRAMME

[W. E. F. ACADEMIC SESSION: 2020 - 21]

IFTM UNIVERSITY
N.H.-24, Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh-244001
www.iftmuniversity.ac.in

आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश

IFTM University, Moradabad, Uttar Pradesh

NAAC ACCREDITED

Website: www.iftmuniversity.ac.in

SCHOOL OF SCIENCES

Study & Evaluation Scheme of
Bachelor of Science (PCM)
[Session 2020-21]

Programme	**:**	**Bachelor of Science (PCM)**
Course Level	**:**	**UG Course**
Duration	**:**	**Three Year (Six Semester) Full Time**
Medium of Instruction	**:**	**English**
Minimum Required Attendance	**:**	**75%**
Maximum Credits	**:**	**168**

Programme Outcomes (POs):
Students completing this course will be able to:

- Understand the basic laws and explore the fundamental concepts of physics
- Understand the concepts and significance of the various physical phenomena.
- Carry out experiments to understand the laws and concepts of Physics.
- Apply the theories learnt and the skills acquired to solve real time problems.
- Introduces students to the methods of experimental physics. Emphasis will be given on laboratory techniques specially the importance of accuracy of measurements.
- Provide a hands-on learning experience such as in measuring the basic concepts in properties of matter, heat, optics, electricity and electronics.
- Explain fundamental/systematic understanding of the academic field of Physics, its different learning areas like Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics and its linkages with related disciplinary areas/subjects like Chemistry, Mathematics, Environmental sciences.

Study & Evaluation Scheme
of
Bachelor of Science (Physics/Chemistry/Mathematics)
[Session2020-21]

Programme:	**Bachelor of Science (Physics/Chemistry/Mathematics)**
Course Level:	**UG Degree**
Duration:	**Three Year (Six Semester) Full Time**
Medium of Instruction:	**English**
Minimum Required Attendance:	**75%**
Maximum Credits:	**168**

Programme Outcomes (Pos):

Students graduating with the B.Sc. **(Physics/Chemistry/Mathematics)** Degree should be able to acquire:

- Ability to communicate various concepts of B.Sc. programme effectively using examples and their geometrical visualizations.
- Ability to analyze the results and apply them in various problems.
- Ability to employ critical thinking in understanding the concepts in every area of B.Sc. PCM programme.
- Ability to identify unethical behavior and adopting objective, unbiased and truthful actions in all aspects.
- Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.
- Ability to work independently and do in-depth study of various notions of courses.
- Capability of demonstrating comprehensive knowledge of B.Sc. programme.
- Capability to solve problems by using research-based knowledge and research methods.
- Create, select, and apply appropriate techniques, resources, and modern science.
- Develop a sense of research to predict cause-and-effect relationships.

COURSE STRUCTURE
SESSION: 2020-21
B.Sc. - I Year (Physics/Chemistry/Mathematics)
Semester-1

S. No.	Course Code	Course Titles		EVALUATION SCHEME							Course Total (Marks)	Credits
				Internal Exam						External Exam		
			L	T	P	CT	AS+AT	Total			
1.	BPHY-101	Mechanics	3	1	0	20	10	30	70	100	4
2.	BPHY-102	Thermal Physics	3	1	0	20	10	30	70	100	4
3.	BCHE-101	Inorganic Chemistry	3	1	0	20	10	30	70	100	4
4.	BCHE-102	Organic Chemistry	3	1	0	20	10	30	70	100	4
5.	BMAT-101	Matrices and Trigonometry	3	1	0	20	10	30	70	100	4
6.	BMAT-102	Calculus	3	1	0	20	10	30	70	100	4
7.	BPHY-151	Physics Lab-1	-	-	4	-	-	30	70	100	2
8.	BCHE-151	Chemistry Lab -1	-	-	4	-	-	30	70	100	2
	TOTAL		18	6	4	-	-	-	-	800	28

Semester – II

S. No.	Course Code	Course Titles		EVALUATION SCHEME							Course Total (Marks)	Credits
				Internal Exam						External Exam		
			L	T	P	CT	AS+AT	Total			
1.	BPHY-201	Waves & Oscillations	3	1	0	20	10	30	70	100	4
2.	BPHY-202	Optics	3	1	0	20	10	30	70	100	4
3.	BCHE-201	Physical Chemistry	3	1	0	20	10	30	70	100	4
4.	BCHE-202	Basic of Analytical Chemistry	3	1	0	20	10	30	70	100	4
5.	BMAT-201	Vector Calculus and Co-ordinate geometry	3	1	0	20	10	30	70	100	4
6.	BMAT-202	Differential equations and Integral Transforms	3	1	0	20	10	30	70	100	4
7.	BPHY-251	Physics lab-2	-	-	4	--	--	30	70	100	2
8.	BCHE-251	Chemistry lab-2	-	-	4	-	-	30	70	100	2
9.	AECC* Audit course	Environmental Science	3	-	-	20	10	30	70	100	3*
	TOTAL		18	6	4	-	-	-	-	800	28

B.Sc. - II Year (Physics/Chemistry/Mathematics)
Semester-III

S. No.	Course Code	Course Titles	Periods			EVALUATION SCHEME				Course Total (Marks)	Credits
						Internal Exam			External Exam		
			L	T	P	CT	AS+AT	Total			
1.	BPHY-301	Electricity and Magnetism	3	1	0	20	10	30	70	100	4
2.	BPHY-302	Circuit fundamental and Basic Electronics	3	1	0	20	10	30	70	100	4
3.	BCHE-301	Inorganic Chemistry	3	1	0	20	10	30	70	100	4
4.	BCHE-302	Organic chemistry	3	1	0	20	10	30	70	100	4
5.	BMAT-301	Mechanics	3	1	0	20	10	30	70	100	4
6.	BMAT-302	Numerical Methods	3	1	0	20	10	30	70	100	4
7.	BPHY-351	Physics Lab -3	-	-	4	-	-	30	70	100	2
8.	BCHE-351	Chemistry Lab -3	-	-	4	-	-	30	70	100	2
9.	UDM* Audit course	Disaster Management	3	-	-	20	10	30	70	100	03*
	TOTAL		18	6	8	-	-	-	-	800	28

Semester –IV

S. No.	Course Code	Course Titles	Periods			EVALUATION SCHEME				Course Total (Marks)	Credits
						Internal Exam			External Exam		
			L	T	P	CT	AS+AT	Total			
1.	BPHY-401	Atomic and Laser Physics	3	1	0	20	10	30	70	100	4
2.	BPHY-402	Classical and Statistical Mechanics	3	1	0	20	10	30	70	100	4
3.	BCHE-401	Physical Chemistry	3	1	0	20	10	30	70	100	4
4.	BCHE-402	Environmental Chemistry	3	1	0	20	10	30	70	100	4
5.	BMAT-401	Discrete Structures	3	1	0	20	10	30	70	100	4
6.	BMAT-402	Real Analysis	3	1	0	20	10	30	70	100	4
7.	BPHY-451	Physics Lab- 4	-	-	4	-	-	30	70	100	2
8.	BCHE-451	Chemistry Lab-4	-	-	4	-	-	30	70	100	2
	TOTAL		18	6	8	-	-	-	-	800	28

B. Sc. - III Year (Physics/Chemistry/Mathematics), Semester-V

S. No.	Course Code	Course Titles	Periods			EVALUATION SCHEME				Course Total (Marks)	Credits
						Internal Exam			External Exam		
			L	T	P	CT	AS+AT	Total			
1.	BPHY-501	Quantum Mechanics & Atomic Spectra	3	1	0	20	10	30	70	100	4
2.	BPHY-502	Elements of Nuclear Physics	3	1	0	20	10	30	70	100	4
3.	BCHE-501	Inorganic Chemistry	3	1	0	20	10	30	70	100	4
4.	BCHE-502	Organic Chemistry	3	1	0	20	10	30	70	100	4
5.	BMAT-501	Linear Algebra	3	1	0	20	10	30	70	100	4
6.	BMAT-502	Linear Programming	3	1	0	20	10	30	70	100	4
7.	BPHY-551	Physics Lab -5	-	-	4	-	-	30	70	100	2
8.	BCHE-551	Chemistry Lab-5	-	-	4	-	-	30	70	100	2
	TOTAL		18	6	8	-	-	-	-	800	28

Semester – VI

S. No.	Course Code	Course Titles	Periods			EVALUATION SCHEME				Course Total (Marks)	Credits
						Internal Exam			External Exam		
			L	T	P	CT	AS+AT	Total			
1.	BPHY-601	Solid State and Nano Physics	3	1	0	20	10	30	70	100	4
2.	BPHY-602	Electronics and Fiber Optics	3	1	0	20	10	30	70	100	4
3.	BCHE-601	Physical Chemistry	3	1	0	20	10	30	70	100	4
4.	BCHE-602	Polymer Chemistry	3	1	0	20	10	30	70	100	4
5.	BMAT-601	Complex Analysis	3	1	0	20	10	30	70	100	4
6.	BMAT-602	Difference Equations	3	1	0	20	10	30	70	100	4
7.	BPHY-651	Physics Lab -6	-	-	4	-	-	30	70	100	2
8.	BCHE-651	Chemistry Lab-6	-	-	4	-	-	30	70	100	2
	TOTAL		18	6	8	-	-	-	-	800	28

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (PCM) I Year I Semester

BPHY-101: Mechanics

Objective: The course aims at impart knowledge in depth about laws of motion and their application to various dynamical situations, motion of inertial frames and concept of Galilean transformations.

UNIT-I **(10 Sessions)**

Newton's law of motion, Absolute time and absolute space, Fundamental forces of nature, gravitational Electromagnetic, strong nuclear and weak nuclear forces, Frictional force.

UNIT-II **(12 Sessions)**

Angular momentum and Linear momentum, Equation of motion of rigid body Moment of inertia, Product of moment of inertia, Radius of gyration, Theorem of parallel and perpendicular axes, Moments of inertia of a ring and disc, Conservation law of energy, Conservative and non conservative forces.

UNIT-III **(10 Sessions)**

Central forces, Two body centre force Problem, Reduced mass, law of gravitation, Kepler 's law, Motion of Planets and satellites, geostationary satellites, Classification of Kepler's orbits, Relativistic momentum, Mass energy relation Transformation of momentum and Energy.

UNIT-IV **(8 Sessions)**

Frame of References, Galilean transformation, Lorentz transformation, postulates of special theory of relativity, Relativistic mass, Relativistic energy.

Course Outcomes:

Students completing this course will be able to:

- Understand laws of motion and their application to various dynamical situations.
- Explain Fundamental forces in nature.
- Understand conservation laws: conservation of energy, momentum, angular momentum and apply them to basic problems.
- Understand two body central force problem, reduced mass.
- Define Kepler's law, its Classification of Kepler's orbits and to apply Kepler's law to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.
- Understand Frame of References, Galilean transformation, Lorentz transformation, postulates of special theory of relativity.

Suggested Readings:

1. An introduction to Mechanics by Kleppner.
2. Mechanics by Basavaraju & Ghosh.
3. Mechanics by B.S. Agarwal.
4. Mechanics by D.S. Mathur

Website Sources

- https://en.wikipedia.org
- https://courses.lumenlearning.com
- https://physics.info
- https://www.toppr.com
- https://digitalcommons.unl.edu

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (PCM) I Year I Semester

BPHY-102: Thermal Physics

Objective: The goal of this course is to teach fundamental laws of thermodynamics, Maxwell's thermo dynamical relation and their applications.

UNIT- I **(10 Sessions)**

Thermodynamics Systems, Thermal equilibrium and Zeroth law of thermodynamics, First law of thermodynamics, Reversible and irreversible process, Concepts of temperature, Equation of states, Vander wall's equation.

UNIT -II **(10 Sessions)**

Maxwell's thermo dynamical relation and their applications, Entropy, Change of entropy in a reversible and irreversible Processes, Absolute scale of temperature, Carnot's theorem, Enthalpy, Helmholtz function, Gibbs function.

UNIT -III **(8 Sessions)**

Clausius Clapeyron equation, Differential and integral Joule Thomson effects, Temperature Inversion Specific heat Equation.

UNIT -IV **(10 Sessions)**

Thermodynamics and Kinetic temperature, Black body radiation and its application, Kirchoff's law and its applications , Stefan's Boltzmanns law, Rayleigh-Jean's law, Wien's displacement law, Plank's hypothesis and its application to black body radiation.

Course Outcomes:

Students completing this course will be able to:

- Learn the basic concepts of thermodynamics, Zeroth law, first and the second law of thermodynamics
- Describe Maxwell's thermodynamic relations, concept of entropy, Carnot's theorem.
- Derive Clausius Clapeyron equation, Inversion Specific heat Equation.
- Understand the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.
- Have a knowledge of the real gas equations, Vander Waal equation of state, the Joule-Thomson effect.

Suggested Readings:

1. An Introduction to Thermal Physics by Clement John Adkins.
2. Thermal Physics and Statistical Mechanics by Satya Prakash.
3. Thermal Physics by Brijlal and Subrahmanyam.
4. Concepts in Thermal Physics, Stephen Blundell.

Website Sources:

- https://en.wikipedia.org
- https://madeeasy.in
- https://www3.nd.edu
- https://physics.info
- http://www.csc.kth.se

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (PCM) I Year I Semester

BPHY-151: Physics Laboratory – I

Objective: The main goal of this subject is to share the knowledge to the students about the Experiments so that students will get a better understanding of the concepts studied by them in the theory course and correlate with experimental observations.

List of Experiments **(20 Sessions)**

1. To determine the surface tension of a liquid by Jaeger's method.
2. To determine the viscosity of liquid by Poiseuille's method.
3. To determine the value of Stefan's constant.
4. To determine the moment of inertia of flywheel about its axis of rotation.
5. To determine the value of g with help of compound pendulum.
6. To determine the modulus of rigidity of a given material in form of a wire by statistical method.
7. To determine the time period of simple pendulum.
8. To determine the surface tension of the given liquid by capillary rise method.
9. To determine the Elastic Constants of a Wire by Searle's method.
10. Calculate the moment of inertia of an irregular body using a torsion pendulum.

Course outcomes:
Students completing this course will be able to:

- Determine value of Stefan's constant.
- Calculate moment of inertia
- Determine surface tension
- Evaluate elastic constant

Suggested Readings:

1. Practical Physics by S. L. Gupta
2. Practical Physics by Navneet Gupta
3. Practical Physics by S. K. Gupta

Website Sources:

- https://nvlpubs.nist.gov
- https://dkpandey.weebly.com
- http://vlab.amrita.edu
- https://www.niser.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (PCM) I Year II Semester

BPHY-201: Waves and Oscillations

Objective: The objective of this course is to introduce the basic concepts required for a mathematical description of waves and oscillations.

UNIT-I **(10 Sessions)**

Wave motion, Differential equation of motion, Stationary waves, Flow of energy in stationary states, Plane progressive wave's solution, Reflection of waves, Phase change of reflection, Phase and group velocity.

UNIT-II **(10 Sessions)**

Simple harmonic motion, Differential equation of S.H.M., energy of oscillations, elasticity and simple harmonic vibrations, study of oscillations and its application, superposition of rectangular simple harmonic oscillations.

UNIT-III **(12 Sessions)**

Oscillators, Damped oscillator, Equation of motion and its solution, Damped harmonic oscillator, Effect of damping on frequency, Damping force, Relaxation time, LCR circuit, Moving coil galvanometer.

UNIT-IV **(10 Sessions)**

Forced oscillations, Resonance, amplitude resonance, Parallel resonance, Sharpness of resonance, Quality factor (Q), Energy dissipation, Impedance, Mechanical and electrical impedance.

Course Outcomes:

Students completing this course will be able to:

- Study Wave motion, Differential equation of motion, stationary waves
- Learn Simple harmonic motion, Differential equation of S.H.M and obtaining solution of the oscillator using differential equations.
- Understand Oscillators, Damped oscillator, Equation of motion and its solution.
- Understand the principle of superposition of waves, so thus describe the formation of standing waves.
- Study forced oscillations, resonance and impedance.
- Explain several phenomena we can observe in everyday life that can be explained as wave phenomena.

Suggested Readings:

1. The Physics of waves and Oscillations by N. K. Bajaj.
2. Waves and Oscillations by Brijlal and N. Subrahmanyam.
3. Oscillation & Waves by D. P. Khandelwal
4. Oscillation & Waves by Satya Prakash
5. Physics of Vibration & Waves by H.J. Pain

Website Sources

- https://en.wikipedia.org
- https://en.wikipedia.org

- https://www.toppr.com
- http://egyankosh.ac.in
- http://www.uou.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (PCM) I Year II Semester

BPHY-202: Optics

Objective: The aim of this course is to impart knowledge about the optical phenomena based on the wave description of light. The principles of interference, diffraction and polarization will be fully developed and optical devices that use these properties of light will be described.

UNIT-I **(10 Sessions)**

Coherence and Interference of light, Fresnel's Biprism, Thin films, Newton's Rings, Fabry Perot interferometers, Lummer Plate, Interference filters.

UNIT-II **(10 Sessions)**

Diffraction ,Fresnel's and Fraunhoffer diffraction, Fresnel's half period zones, Zone plate , Fraunhofer diffraction at single, double and n-slits, Absent Spectra.

UNIT-III **(10 Sessions)**

Resolving power, Rayleigh Criterion of limit of resolution, Expressions for resolving powers of telescope and grating.

UNIT-IV **(12 Sessions)**

Polarization, Double refraction, Nicol prism, Polaroids and Retardation plates, Analysis of Polarized light, Optical activity, Specific rotation and optical rotation, Polarimeters, Laurent's Half shade Polarimeter and Bi-quartz Polarimeter.

Course Outcomes:

Students completing this course will be able to:

- Gain knowledge on various theories of light
- Understand the properties of light like coherence, polarization, interference, diffraction.
- Explain Fabry Perot interferometers,
- Learn the applications of diffraction and polarization.
- Understand the applications of interference in design and working of interferometers.
- Understand the resolving power of different optical instruments.

Suggested Readings:

1. Optics by A. K. Ghatak

2. Principle of Optics by B. K. Mathur.

3. Fundamental of Optics by F. A. Jenkins and H. E. White.

4. A Text Book of Optics by N. Subramanyam and Brijlal.

5. Optics by S.L Kakani

Website Sources

- https://www.veerashaivacollege.org
- http://www.hep.manchester.ac.uk
- https://content.kopykitab.com
- http://www.vpscience.org
- https://nanopdf.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) I Year II Semester

BPHY-251: Physics Laboratory – 2

Objective: In this course students would be able to understand basic experiments of optics like: determination of wavelength, radius of curvature, Specific rotation and wavelength of sodium light etc. The students will get a better understanding of the concepts studied by them in the theory course and can correlate with experimental observations.

List of Experiments **(20 Sessions)**

1. To determine the wavelength of sodium light by Newton's ring method.
2. To determine the radius of curvature of Plano convex lens by Newton's ring experiment.
3. To determine the specific rotation of cane sugar solution with the help of polarimeter.
4. To determine the focal length of combination of two lenses separated by distance with the help of Nodal slide and to verify the formula.
5. To determine frequency of tunning fork with help of sonometer.
6. To determine the Resolving Power of a Plane Diffraction Grating.
7. To verify Fresnel's formulae for the reflection of light.
8. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g, and (c) Modulus of Rigidity.
9. To determine the refractive index of the prism and its dispersive power with the help of spectrometer.
10. To determine the wavelength of Sodium light with help of Michelson Interferometer.

Course Outcomes:

Students completing this course will be able to:

- Students completing this course will be able to:
- Evaluate the wavelength of sodium light, radius of curvature.
- Evaluate focal length of combination of two lens
- Evaluate refractive index of the prism
- Evaluate resolving power of plane diffraction grating.

Suggested Readings:

1. Practical Physics by S. L. Gupta
2. Practical Physics by Navneet Gupta
3. Practical Physics by S. K. Gupta

Website Sources:

- http://www.iiserpune.ac.in
- http://vlab.amrita.edu
- https://www.niser.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) I Year II Semester

AECC* (Audit Course)
Environmental Studies

Objective: The aim of this course is to impart basic knowledge about the environment and its allied problems and also to develop an attitude of concern for the environment.

UNIT- I: **(5 Sessions)**

Introduction to environmental studies Multidisciplinary nature of environmental studies; components of environment – atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development.

UNIT –II: Ecosystems **(5 Sessions)**

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems:
a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT -III: **(5 Sessions)**

Natural Resources: Renewable and Non-renewable Resources
Land conservation of Resources and land use change; Land degradation, soil erosion and desertification.
Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
Heating of earth and circulation of air; air mass formation and precipitation.
Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT -IV: **(5 Sessions)**

Biodiversity and Conservation
Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots
India as a mega-biodiversity nation; Endangered and endemic species of India
Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT- V: **(5 Sessions)**

Environmental Pollution
Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution
Nuclear hazards and human health risks
Solid waste management: Control measures of urban and industrial waste. Pollution case studies.

UNIT VI: **(5 Sessions)**

Environmental Policies & Practices

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC)

Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context

UNIT VII: **(5 Sessions)**

Human Communities and the Environment

Human population and growth rate: Impacts on environment, human health and welfares.

Carbon foot-print. x Resettlement and rehabilitation of project affected persons; case studies.

Disaster management: floods, earthquakes, cyclones and landslides.

Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan.

Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.

Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

UNIT-VIII: Field work **(5 Sessions)**

Visit to an area to document environmental assets; river/forest/flora/fauna, etc.

Visit to a local polluted site – Urban/Rural/Industrial/Agricultural.

Study of common plants, insects, birds and basic principles of identification.

Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Course Outcomes:

Students completing this course will be able to:

- To learn about the components of environment: atmosphere, hydrosphere, lithosphere and biosphere
- Understand about the Structure and function of ecosystem
- Study Natural Resources and types of resources, Renewable and Non-renewable Resources
- Biodiversity patterns, Energy resources
- Environmental pollution: types, causes, effects and controls
- Demonstrate a general understanding of the breadth and interdisciplinary nature of environmental issues.

Suggested Readings:

1 . Carson, R. 2002. Silent Spring. Houghton Mifflin Harcourt.

2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.

3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.

4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.

5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principles of Conservation Biology. Sunderland: Sinauer Associates, 2006.

6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.

7. McCully, P.1996. Rivers no more: the environmental effects of dams(pp. 29-64). Zed Books.

8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

9. Odum, E.P., Odum, h.T. & Andrews, J.1971. Fundamentals of Ecology. Philadelphia: Saunders.

10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatement. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India. Tripathi 1992.
14. Sengupta, R. 2003.Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C.E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E.O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20.World Commission on environment and Development. 1987. Our Common Future. Oxford University Press.

Website Sources

- https://aits-tpt.edu.in
- https://www.overpopulationawareness.org
- https://www.joboneforhumanity.org
- https://www.ugc.ac.in
- https://www.pmfias.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) II Year III Semester

BPHY-301: Electricity and Magnetism

Objective: The goal of the course is to gain an understanding of fundamental concepts in electricity and magnetism, magnetic fields and their relationship to electrical fields.

UNIT-I **(10 Sessions)**

Electrostatics: Coulomb's law, Electric Field Strength , Electric Potentials, Poisson and Laplace Equations, Gauss Law and its application, Electric dipole, Electric field and potential due to an electric dipole, Current density and Equation of Continuity.

UNIT-II **(10 Sessions)**

Magneto statics :Magnetic field , Magnetic forces , Magnetic Induction, Biot – Savart Law, Vector and Scalar Magnetic potentials , Magnetic Dipole , Ampers' Law and Ampere's Circuital Law , Magnetic field due to Solenoid.

UNIT-III **(10 Sessions)**

Electromagnetic Induction: Laws of Induction, Faraday's laws and Lenz's Law, Mutual and Self Induction, Betatron, Induced magnetic field, Displacement Current, Maxwell's equations, Electromagnetic wave equation in free space.

UNIT - IV **(12 Sessions)**

Dielectric constant, Polarization, Electronic polarization, Atomic or ionic Polarization, Polarization charges, Electrostatic equation with dielectric, Field, Force and Energy in Dielectrics, Clausius Mossotti Equation.

Demonstrate Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.

Course Outcomes:

Students completing this course will be able to:

- Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.
- Apply Gauss's law of electrostatics to solve a variety of problems.
- Study Biot – Savart Law, Amperes' Law and Ampere's Circuital Law
- Describe the magnetic field produced by magnetic dipoles and electric currents.
- Explain Faraday's laws and Lenz's Law
- Derive an Electromagnetic wave equation in free space
- Study of Polarization, Clausius Mossotti Equation.

Suggested Readings:

1. Electricity and Magnetism by Reitz and Milford.
2. Electricity and Magnetism by A. S. Mahajan and A. A. Rangawala.
3. Electricity and Magnetism by D. C. Tayal.
4. Electromagnetic Waves and Radiating systems by Jordan Balman
5. Electricity and Magnetism by K. K. Tewari.
6. Electricity and Magnetism by A.S. Mahajan
7. Electricity and Magnetism by Satya Prakash
8. Electricity and Magnetism by Edward M. Purcell

Website Sources

- https://mrcet.com
- https://en.wikipedia.org

- http://sites.science.oregonstate.edu
- https://uomustansiriyah.edu.iq
- https://www.electrical4u.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science in (PCM) Programme
B. Sc. (Physics) II Year III Semester

BPHY-302: Circuit Fundamentals and Basic Electronics

Objective: The aim of this course is to provide comprehensive understanding of electronic devices and circuits.

UNIT -I **(10 Sessions)**
Growth and decay in LR Circuit, Charging and discharging in R.C and R.L.C. circuits, Time constant, A.C. Bridges, Maxwell's and Schering's Bridges, Wien Bridge.

UNIT - II **(10 Sessions)**
Semiconductors, Intrinsic and extrinsic semiconductors, Unbiased diode, Forward bias and Reverse bias diodes, Diode as a rectifier, Diode characteristics, Rectifier, Bridge rectifier, Bipolar transistors.

UNIT –III **(12 Sessions)**
Transistor biasing, base bias, emitter bias and voltage divider bias, DC load line. AC equivalent circuits, Amplifiers, Common emitter amplifier, Common collector amplifiers and common base amplifiers, Current and Voltage gain, R.C. coupled amplifier.

UNIT-IV **(10 Sessions)**
Transistor as an Oscillator, Hartley oscillator. Elements of transmission and reception, Modulation and demodulation, Multimeter, Cathode ray oscillator and its simple applications.

Course Outcomes:
Students completing this course will be able to:
- Understand the concept of basic electronics and their applications.
- Obtain knowledge on R L C circuits, semiconductors, diodes, rectifiers and transistors.
- Compute and characterization of amplifiers.
- Study of Transistor as an Oscillator, Hartley oscillator.
- Explain Modulation and demodulation
- Study Cathode ray oscillator and its simple applications.

Suggested Readings:
1. Circuit Fundamental & basic Electronics by J. P. Agarwal & Amit Agarwal.
2. Electronic Devices and Circuit Theory by R. Boylested and L. Nashelksky.
3. Electronic Principles by A. P. Malvino.
4. Integrated Electronics by J. Millman and C.C. Halkias.
5. Electronics by V.K. Mehta

Website Sources
- http://www.olabs.edu.in
- https://www.electronics-tutorials.ws
- https://learnabout-electronics.org
- https://resources.pcb.cadence.com
- https://www.electronics-tutorials.ws
- https://dreamtopper.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science in (PCM) Programme
B. Sc. (Physics) II Year III Semester

BPHY-351: Physics Laboratory – 3

Objective: The main objective of this course is to impart the knowledge to the students about the experiments so that students will get a better understanding of the concepts studied by them in the theory course and correlate with experimental observations.

List of Experiments **(20 Sessions)**

1. To determine the specific resistance of material of a given wire using Carey Foster Bridge.
2. To compare two resistance by means of potentiometer.
3. To convert Galvanometer into Ammeter with potentiometer.
4. To convert Galvanometer into Voltmeter with potentiometer.
5. To find out internal resistance of Lechlanche cell by Potentiometer.
6. To convert Galvanometer to Ammeter and voltmeter with inbuilt power supply and meters
7. To determine the magnetic moment (M) of a magnet and horizontal component of Earth's magnetic field.
8. To find the resistance of an accumulator using Post office box.
9. To study the ballistic constant K of a moving coil Ballistic galvanometer and to calibrate ballistic galvanometer.
10. To determine the unknown frequency to compare the frequency of two unknown signals using CRO.

Course Outcomes:

Students completing this course will be able to:

- specific resistance of material
- compare two resistance
- convert Galvanometer into Ammeter and voltmeter
- magnetic moment (M) of a magnet
- evaluate the ballistic constant

Suggested Readings:

1. Practical Physics by Navneet Gupta
2. Practical Physics by S. K. Gupta
3. Practical Physics by S. L. Gupta

Website Sources:

- http://www.iiserpune.ac.in
- http://vlab.amrita.edu
- https://www.niser.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science in (PCM) Programme
B. Sc. (Physics) II Year III Semester

AECC* (Audit Course): Disaster Management

Objective: The goal of this course is to provide students an understanding to the concepts and aspects of disaster and its relationship with development and to give them awareness of Disaster Risk Reduction (DRR) approaches.

UNIT I: **(10 Sessions)**

Introduction to Disasters

- Definition: Disaster, Hazard, Vulnerability, Resilience, Risks
- Types of disasters – Earthquake, Landslide, Flood, Drought, Fire, campus shooting, bomb threat, terrorist incidence and financial emergency etc.
- Causes and Impacts including social, economic, political, environmental, health, psychosocial, etc. Differential impacts- in terms of caste, class, gender, age, location, disability.
- Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Do's and Dont's during various types of Disasters.

UNIT II: **(8 Sessions)**

Approaches to Disaster Risk Reduction

- Disaster life cycle – its analysis, phases, culture of safety, prevention, mitigation and preparedness
- Community based DRR (Disaster Risk Reduction), Structural-nonstructural measures,
- Roles and responsibilities of community: Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders

UNIT III: **(8 Sessions)**

Inter-Relationship between Disasters and Development

- Factors affecting Vulnerabilities, impact of Development projects such as dams, embankments, changes in Land-use etc.
- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.
- Role of international co-operations in Disaster Management

UNIT IV: **(8 Sessions)**

Disaster Risk Management in India

- Hazard and Vulnerability profile of India. Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management
- Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation
- Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V: **(10 Sessions)**

Disaster Management: Applications, Case Studies and Field Works

The project /fieldwork is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the institution is located. A few ideas or suggestions are discussed below.

Several governmental initiatives require Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) to be pro active in preparing DM plans and community based disaster preparedness plans. Information on these would be available with the district collector or Municipal corporations.

Teachers could ask students to explore and map disaster prone areas, vulnerable sites, vulnerability of people (specific groups) and resources. The students along with teacher could work on ways of addressing these vulnerabilities, preparing plans and consultation with local administration or NGOs.

Students could conduct mock drills in schools, colleges or hospitals. They could also work on school safety, safety of college buildings, training in first aid.

Other examples could be- identifying how a large dam, road/ highway or an embankment or the location of an industry affects local environment and resources or how displacement of large sections of people creates severe vulnerabilities may be mapped by student project work.

The suggested topics for Project work for student could be as follows:

- Monitoring and evaluation plan for disaster response
- Low cost Home based water purification methods
- Planning Nutrition intervention programmes
- Safety tips before during and after earthquake, cyclone, floods and fire accidents.
- Mock Drills
- Major disasters in India
- Disaster Management in India
- Flood affected areas and damages in India
- Heat waves in India
- Earth quakes in India
- Historical Tsunamis in India
- Nuclear emergence
- Traffic accidents in India
- Train Accidents
- Major disease outbreak
- Disaster management structure in India
- Precaution, mitigation of disaster in India
- Warning system in India to prevent disaster
- Bhopal gas tragedy
- Kutch earth quake
- Tsunami (2004)
- Kosi Calamity 2008
- Mayapuri radiation exposure Delhi (2010)
- Mock exercises

Course Outcomes:

Students completing this course will be able to:

- Disaster, types of Disasters, Causes Global trends in disasters.
- Disaster life cycle, Global trends in disasters.
- Factors affecting Vulnerabilities, impact of Development projects
- Disaster Risk Management in India

Suggested Readings:

- Satish Modh, Introduction to Disaster Management, Macmillan Publisher India Ltd
- Alexander David, Introduction in 'Confronting Catastrophe', Oxford University Press
- Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.
- Damon P. Coppola, Introduction to International Disaster Management, Butterworth-Heinemann,
- Singhal J.P. "Disaster Management", Laxmi Publications. ISBN-10: 9380386427 ISBN-13: 978-9380386423
- Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., ISBN-10: 1259007367, ISBN-13: 978-1259007361]
- Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi
- Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi.
- Carter, Nick. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
- Cuny, F. Development and Disasters, Oxford University Press. Document on World Summit on Sustainable Development.
- Govt. of India: Disaster Management Act 2005, Government of India, New Delhi. Government of India, 2009.
- Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi Indian Journal of Social Work.

- Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April.

Websites Source:

- http://nidm.gov.in/
- http://nidmssp.in
- http://www.drishtiias.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) II Year IV Semester

BPHY-401: Atomic & Laser Physics

Objective: This course impart knowledge of atomic spectra of one and two valance electron atoms and to teach about Laser construction, working, principles and their applications.

UNIT- I **(10 Sessions)**

Atomic Spectroscopy :-Hydrogen spectrum, Pauli's exclusion principle, Spectra of alkali elements, spin orbit interaction and fine structure in alkali and alkaline spectra, LS and JJ coupling, Selection rules, Zeeman effect, Paschen back effect, Stark effect.

UNIT-II **(10 Sessions)**

X-Rays:- X-Rays and generation of X-rays, X-ray spectrum, origin of Continuous X-ray spectrum, Characteristics X-rays, Bragg's Law, Moseley's law, Auger effect.

UNIT-III **(10 Sessions)**

Laser Physics :-Spontaneous and stimulated emission, Einstein coefficients, Population inversion, Pumping schemes, type of Lasers (three and four level), Optical resonators, quality factor, transverse and longitudinal mode, Coherence, Threshold conditions.

UNIT: IV **(12 Sessions)**

Laser and its Applications :Ruby Laser, He-Ne Laser, CO_2 Laser, Semiconductor Laser, Four level solid state Laser, Dye Laser, Argon Laser, Excimer Laser, Application of Lasers (Radar, Holography, medical and material processing).

Course Outcomes:

Students completing this course will be able to:

- Hydrogen spectrum, Pauli's exclusion principle
- Spectra of alkali elements and alkaline spectra
- Identify atomic effect such as Zeeman Effect, Paschen back effect and Stark effect.
- Explain the observed dependence of atomic spectral lines on externally applied electric and magnetic fields.
- X-rays their generation and types of X-ray spectra
- Study about different laser systems and its applications

Suggested Readings:

1. Molecular Spectroscopy by Jeanne L.Mc Hale.
2. Laser Theory & Applications by G.M Barrow.
3. Laser Physics by Satya Prakash.
4. Introduction to Atomic Physics by H.E.White.
5. Introduction to LASER by M N Avadhanlu
6. Laser system and Application by Rajesh Mishra
7. Laser system and Application by S K Srivastav
8. Laser , Principle types and application by K R Nadian

Website Sources:

- http://epgp.inflibnet.ac.in
- http://www.tcm.phy.cam.ac.uk
- http://www.iiserpune.ac.in
- https://en.wikipedia.org
- http://www.iiserpune.ac.in
- http://www.laserfest.org
- https://www.physics-and-radio-electronics.com
- https://onlinelibrary.wiley.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) II Year IV Semester

BPHY-402: Classical and Statistical Mechanics

Objective: This course provides knowledge in a solid foundation in classical mechanics and provides information about general methods of studying the dynamics of particle systems and calculating probability for various statistical systems of particles.

UNIT-I **(10 Sessions)**

Mechanics of a system of particles, generalized co ordinates, D' Alembert's principle, The Lagrangian formulation and Lagrange's equations of motion, The Hamiltonian formulation and Hamilton's equation of motion.

UNIT-II **(10 Sessions)**

The rigid body motion, force free motion of symmetrical rigid body, two body central force problem, reduction to equivalent one body problem, the equation of motion and first integrals, classification of orbits, orbit for integrable power law potentials, inverse square law – kepler problem.

UNIT-III **(10 Sessions)**

Probability and thermodynamic probability, Principle of equal priori probability, probability distribution and its narrowing with increase in number of particles, accessible and inaccessible states.

UNIT-IV **(12 Sessions)**

Liouville's theorem, Ensembles, the micro canonical, the canonical and grand canonical ensembles, Maxwell-Boltzmann Statistics, Partition function, Maxwell Velocity distribution and mean values, Equipartition theorem, Statistics of identical particles, Fermi – Dirac and Bose Einstein Statistics.

Course Outcomes:

Students completing this course will be able to:

- Mechanics of a system of a particle, D' Alembert's principle
- Lagrange's equations of motion, The Hamiltonian formulation and Hamilton's equation of motion.
- reduction to equivalent one body problem, the equation of motion and first integrals, classification of orbits
- They are able to interpret different types of events.
- Students have understood the concept of phase space and its volume.
- They can easily distinguish between different types of particles and statistics and can easily distribute bosons, fermions and classical particles among energy levels.
- Probability and Principle of equal priori probability
- Understand the basic idea about statistical distributions.
- Impart the knowledge about the phase transitions and potentials.
- Liouville's theorem, Ensembles, Maxwell-Boltzmann Statistics, Fermi – Dirac and Bose Einstein Statistics.
- Understand the applications of statistical laws.

Suggested Readings:

1. Classical Mechanics by Gupta Kumar.
2. Classical Mechanics by J. C. Upadhayay.
3. Classical Electrodynamics by J. D. Jackson.
4. Statistical Mechanics by K. M. Khanna.
5. Classical Mechanics by Herbourt Goldstein
6. Classical Mechanics by N. C. Rana

Website Sources

- http://www.iitg.ac.in
- https://en.wikipedia.org
- http://kestrel.nmt.edu
- http://people.duke.edu
- http://www.physics.usu.edu
- https://sites.astro.caltech.edu
- http://lehman.edu

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) II Year IV Semester
BPHY-451: Physics Laboratory – 4

Objective: In this Course students would gain the practical knowledge by performing various experiments like measuring thickness of wire, wavelength, and verification of truth table etc.

List of Experiments **(20 Sessions)**

1. Measurement of wavelength of laser by diffraction grating.
2. To study the diffraction pattern of laser light and determine its wavelength.
3. Measurement of thickness of wire by Laser.
4. Measurement of the wavelength of the Laser by Double slit.
5. To measure the divergence of a Laser beam.
6. To Plot frequency response curve of a single stage RC coupled amplifier.
7. To verify the truth table of various Logic Gates Circuits.
8. To verify the truth table of Half Adder and Full Adder.
9. To study the rectification by half wave rectifier.
10. To verify the basic laws of Boolean expression using logic gates.

Course Outcomes:
Students completing this course will be able to:

- Evaluate wavelength of laser
- Determine Thickness of wire
- divergence of a Laser beam
- verify the truth table of logic gates, half adder, full adder

Suggested Readings:

1. Practical Physics by Navneet Gupta
2. Practical Physics by S. K. Gupta
3. Hand book of Electronics by Gupta Kumar
4. Practical Physics by S. L. Gupta

Website Sources:

- https://nvlpubs.nist.gov
- https://dkpandey.weebly.com
- http://vlab.amrita.edu
- https://www.niser.ac.in

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) III Year V Semester

BPHY-501: Quantum Mechanics & Atomic Spectra

Objectives: The objective of this course is to explain the basic principles and formulations of quantum mechanics.

UNIT-I **(10 Sessions)**

Failure of classical physics to explain black body spectra, Planck's radiation law, Compton Effect, Wave particle duality, de Broglie's hypothesis, Concept of wave and group velocity, Experimental demonstration of matter waves, Davisson and Germer experiment, Heisenberg's uncertainty principle .

UNIT-II **(10 Sessions)**

Schrodinger's equation (Time dependent and time independent equations), Physical significance of wave function Ψ, Expectation values of a dynamical quantities, Ehrenfest's theorem, Eigen value and Eigen functions, Particle in a box, Harmonic Oscillator , One dimensional motion in step potential, Rectangular barrier.

UNIT-III **(10 Sessions)**

Operators, Hermitian operator, Parity operator, orbital angular momentum operator, Effect of operators, Commutation relations, Eigen values and eigen functions, orthonormality, normalization, Dirac Delta function.

UNIT-IV **(12 Sessions)**

Bohr's atomic model, Somerfield elliptic orbits , Effect of finite nuclear mass in relation to Rydberg constant, Vector atom model, Spinning of electron, Space quantization, Selection rules, Pauli's exclusion principle, Larmor precession.

Course Outcomes:

Students completing this course will be able to:

- Understand the Failure of classical physics to explain black body spectra
- Study of Compton Effect, Wave particle duality, de Broglie's hypothesis
- Derive Schrodinger's equation, Physical significance of wave function Ψ
- Study Ehrenfest's theorem, Eigen value and Eigen functions
- Understand Operators, orthonormality, normalization, Dirac Delta function.
- Study Bohr's atomic model, Somerfield elliptic orbits
- Understand Pauli's exclusion principle, Larmor precession

Suggested Readings:

1. Quantum Mechanics by L.I. Schiff.
2. Concept of modern Physics by A. Beiser.
3. Quantum mechanics` By Ghatak and Loknathan,
4. Fundamentals of Modern Physics by R.M. Eisberg.
5. Introduction to Atomic Spectra by H.E. White.
6. Quantum Mechanics by Eugen Merzbacher
7. Quantum Mechanics by S P Singh
8. Quantum Mechanics by V K Thankappam
9. Quantum Mechanics by L.D. Landau

Website Source

- https://en.wikipedia.org
- https://ocw.mit.edu
- http://physics.mq.edu.au
- https://faculty.washington.edu
- http://www.nat.vu.nl

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) III Year V Semester
BPHY-502: Elements of Nuclear Physics

Objective: The aim of the course is to provide knowledge in depth in the content areas of nuclear physics and properties of elementary particles.

UNIT- I **(12 Sessions)**

Basic Properties of the nucleus, Mass/ size (radius), Nuclear spin, Magnetic dipole moment, Electric Quadrapole moment, Parity, packing friction, Binding energy, Saturation of nuclear forces, Main Characteristics of Nuclear forces, Meson theory of nuclear Forces.

UNIT-II **(10 Sessions)**

Alpha decay, Range of α particle, Geiger Nuttal law, Magnetic spectrometer for energy of α particle, Tunneling, Gamow's theory of α decay, β- decay, Measurement of energy of β particle and end point energy, Neutrino theory of β- decay, γ- decay, Energy of γ photon.

UNIT-III **(10 Sessions)**

Gas filled counter, Ionization chamber, Proportional counter, Linear accelerators, Cyclotron, Synchrotrons, Geiger Muller detector, Semiconductor Detector, Scintillation detector.

UNIT- IV **(10 Sessions)**

Classification of elementary particles (Quarks, Strange, Mesons), Quantum Numbers, Yukawa's Theory, Gell Mann-okubo mass formula.

Course Outcomes:

Students completing this course will be able to:

- acquire Basic knowledge about nuclear Properties, Binding energy, Characteristics of Nuclear forces
- Alpha decay, Range of α particle, Geiger Nuttal law, Gamow's theory of α decay, β- decay, γ- decay
- Understand the features of nuclear forces, exchange force and meson theory.
- Describe various counters : Gas filled counter, Ionization chamber, Proportional counter, Linear accelerators
- elementary particles and their classification

Suggested Readings:

1. Nuclear Physics, by- S. N. Ghoshal.
2. Fundamentals of nuclear Physics by- B. B. Srivastava
3. Nuclear Physics by- I. Kaplan
4. Concept of Nuclear Physics by B.L. Cohen
5. Nuclear Physics by –S.B. Patel
6. Nuclear Physics theory and experiment by – R.R. Roy and B.P Nigam
7. Nuclear Physics by D. C. Tayal

Website Sources:

- https://www.hep.phy.cam.ac.uk
- http://oms.bdu.ac.in
- http://oregonstate.edu
- https://en.wikipedia.org
- http://www.pas.rochester.edu
- https://science.mcmaster.carad

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) III Year V Semester

BPHY-551: Physics Laboratory – 5

Objective: The main goal of this course is to provide knowledge to the students about the Experiments. The students will get a better understanding by performing various experiments like hybrid parameters of transistors, LDR, Zener diode and UJT etc.

List of Experiments **(20 Sessions)**

1. Measurement of Hybrid parameter of a transistor.
2. To study the resonance in series LCR circuit with source of given frequency (A.C. mains).
3. To study and Plot the characteristic of L.D.R.
4. To study the FET amplifier in CS configuration.
5. To study the integrator circuit and observe the effect of RC upon fixed time form.
6. To draw the characteristic of Zener diode in reverse and forward bias voltage.
7. To measure certain UJT parameters and study the operation of UJT relaxation oscillator.
8. To Study the ripple factor in a d.c. power supply.
9. To study the characteristics of a Tunnel diode.
10. To study emitter follower/ Darlington pair amplifier.

Course Outcomes:
Students completing this course will be able to
- Evaluate hybrid parameters of transistors
- Plot characteristics of L.D.R., FET, Tunnel diode and Zener diode.
- Evaluate ripple factor
- Evaluate UJT parameters.

Suggested Readings:

1. Practical Physics by Navneet Gupta
2. Practical Physics by S. K. Gupta
3. Hand book of Electronics by Gupta Kumar
4. Practical Physics by S. L. Gupta

Website Sources

- https://www.learncbse.in
- https://www.electronicshub.org

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) III Year VI Semester

BPHY-601: Solid State and Nano Physics

Objective: The objective of this paper is to familiarize students of basic theory of solid state structure and nano physics.

UNIT-I **(10 Sessions)**

Crystalline and glassy forms, liquid crystal, Crystal structure, periodicity, lattice and basis, Crystal translational vector, Unit cell and primitive cell, Wigner Seitz cell, Bravais lattices in two or three Dimensional, packing fraction.

UNIT-II **(10 Sessions)**

Crystal Planes and Miller indices, Interplanner Spacing, Crystal structures-NaCl, Diamond, CsCl and ZnS.

X-ray diffraction, Bragg's law and Bragg's diffraction conditions in direct and reciprocal lattice, K-Space.

UNIT-III **(10 Sessions)**

Reciprocal lattice, Reciprocal Lattice Vectors, Reciprocal Lattice to the simple cubic lattice, b.c.c and f.c.c., Specific heat of solids, Einstein's theory of specific heat, Debye model of specific heat of solids.

UNIT-IV **(12 Sessions)**

Introduction to Nanoscience and Nanotechnology, Difference between nanomaterial and bulk materials, Reduction of dimensions 3D, 2D, 1D, 0D materials, various morphologies of nanomaterial, Bottom up and top down approaches, size dependent physical properties, Nano cluster.

Course Outcomes:

Students completing this course will be able to:

- Understand Crystal structure, Unit cell, primitive cell and Wigner Seitz cell
- Study Bravais lattices in two or three Dimensional, packing fraction.
- Understand Crystal Planes and Miller indices
- Learn X-ray diffraction, Bragg's law
- Understand Reciprocal lattice, Reciprocal Lattice Vectors
- Explain Debye model of specific heat of solids.
- Understand the influence of lattice vibrations on thermal behavior
- Understand nanoscience and Nanotechnology, various morphologies of nanomaterials.

Suggested Readings:

1. Introduction to solid state Physics by Kittel .John Wiley & Sons Inc. Publication
2. Solid State Physics- A. J. Dekkar, Mc Millan students Ed.
3. Solid State Physics - S.L. Gupta & V. Kumar

4. Fundamentals of Solid State Physics-B. S. Saxena, R.C.Gupta & P. N. Saxena

5. Introduction to Nanotechnology, by Charles P. Poole, Jr. Frank J. Owens, John Wiley & Sons Inc. Publication.

6.Solid State Physics by R K Puri

Website Sources

- http://www.uou.ac.in
- http://solid.fizica.unibuc.ro
- https://www.chem.uci.edu
- http://shodhganga.inflibnet.ac.in
- https://www.nanowerk.com

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) III Year VI Semester

BPHY-602: Electronics and Fiber Optics

Objective: The aim of this course is to impart knowledge of various network theorems, transistors, diodes, optical fiber and their importance.

UNIT – I **(10 Sessions)**

Concept of Network (Active and Passive Network, T & □ Network, Symmetric and Asymmetric Network), Characteristic Resistance, Thevenin's theorem, Norton's theorem, Superposition theorem, Maximum power transfer theorem, Milliman's theorem.

UNIT- II **(10 Sessions)**

Transistors parameters, base width modulation transit time and life-time of minority carriers , Emitter resistance, Collector conductance, Base spreading resistance, Diffusion capacitance, Reverse Feedback ratio, Equivalent circuit for transistors, hybrid model, Input and output impedances, Field effect transistors and their characteristics, Biasing of FET.

Unit – III **(10 Sessions)**

Tunnel Diodes, Zener and Avalanche diodes, Point contact diode, LED Photo diode, Thermistor, Effect of Temperature on junction diode thermistor, Phototransistors, Silicon Controlled rectifiers, Uni-junction transistor and their simple uses.

Unit- IV **(12 Sessions)**

Structure optical fiber, Importance of optical fiber, Propagation of light waves in optical fiber, Types of fiber, Acceptance angle and acceptance cone, Numerical aperture, Fiber losses and their units (basic concept), Band width, Bandwidth length product, Dispersion in optical fiber.

Course Outcomes:

Students completing this course will be able to:

- Learn various network theorems
- Understand transistor, FET, their characteristics.
- Various diodes, thermistor
- Verify the rectifier circuits using diodes.
- Optical fiber, types of optical fibers and their importance.
- Fiber losses, Dispersion in optical fiber.

Suggested Readings:

1. Networks, Lines and Fields- John D Ryder (Prentice-Hall)
2. Electronic Principles – Malvino.
3. Principles of Electronics - V.K. Mehta

4. Optical Fiber and Optical Fiber Communication Systems - S. K. Sarkar
5. Optical Fiber Communication- G. Keiser (Mc Graw Hill)

6. Electronic Devices & Circuit Theory - Bodystead / Nashels

Website Sources:

- https://circuitglobe.com
- https://ecee.colorado.edu
- https://ecee.colorado.edu
- https://en.wikipedia.org
- http://www.sasurieengg

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B. Sc. (Physics) III Year VI Semester
BPHY-651: Physics Laboratory – 6

Objective: The main goal of this subject is to share the knowledge to the students about the various network theorems. The students will get a better understanding of the concepts studied by them in the theory course and correlate them with experimental observations.

List of Experiments **(20 Sessions)**

1. To verify superposition theorem and determine the current flowing through the load resistance.
2. To verify Thevenin theorem and determine the current flowing through the load resistance.
3. To verify Norton theorem and determine the current flowing through the load resistance.
4. To Plot the V-I characteristics of P-N junction diode.
5. To plot the input and output characteristics of transistor in Common Emitter Configuration.
6. To plot the input and output characteristics of transistor in Common Base Configuration.
7. To study a push Pull amplifier using transistor.
8. To verify the condition of oscillation in Phase shift oscillator.
9. To measure the self-inductance of a given coil by Anderson's bridge method.
10. To study the differentiator circuit and obtain differentiated pulse from it at different frequencies.

Course Outcomes:

- Students completing this course will be able to:
- Verify various network theorem.
- Plot V-I characteristics of diode.
- Evaluate Characteristics of transistor
- Evaluate differentiator circuit.

Suggested Readings:

1. Practical Physics by Navneet Gupta
2. Practical Physics by S. K. Gupta
3. Hand book of Electronics by Gupta Kumar
4. Practical Physics by S. L. Gupta
5. Networks, Lines and Fields- John D Ryder (Prentice-Hall)
6. Electronic Principles – Malvino.

Website Courses:

- https://www.electronics-tutorials.ws
- http://itmgoi.in
- https://www.electronics-tutorials.ws
- https://www.electronicshub.org

Note: Latest editions of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) I Year (I Semester)
BCHE-101: INORGANIC CHEMISTRY

Objectives: This course will equip students with the necessary knowledge to understand chemistry at the most fundamental level to understand the periodic properties of different elements, different principles for filling electrons in different energy levels and to draw energy diagrams, and how to calculate bond order.

Unit-I

(08 Sessions)

Periodic Properties:

Atomic and ionic radii, ionization energy, electron affinity and electro negativity - definition, methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

Unit – II

(08 Sessions)

Chemical Bonding:

Covalent Bond – Valence bond theory and its limitations, directional characteristics of covalent bond, MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules , multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro – negativity difference .

Unit-III

(10 Sessions)

s-Block Elements:

Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems , an introduction to alkyls and aryls .

Unit -IV

(10 Sessions)

p – Block Elements:

Comparative study of group 13 – 17 elements , compounds like hydrides, oxides, oxyacids and halides of group 13–16, hydrides of boron– diborane and higher boranes, fullerenes, carbides, silicates, interhalogens.

Chemistry of Noble Gasses: Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Course Outcomes:

Students completing this course will able to:

- Gain an understanding of the bonding fundamentals for both ionic and covalent compounds, including electronegativities, bond distances and bond energies using MO diagrams and thermodynamic data
- Predicting geometries of simple molecules
- The fundamentals of the chemistry of the main group elements, and important real world applications of many of these species

Suggested Readings:

1. Inorganic Chemistry by J.E.Huheey

2. Basic Inorganic Chemistry by Cotton and Wilkinson
3.Organic Chemistry by Morrisson and Boyd
4. Concise Inorganic Chemistry by J.D.Lee

Website Sources:

- https://www.internetchemistry.com/
- http://www.chemguide.co.uk/
- https://freebookcentre.net/
- Chemical Elements.com

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) I Year (I Semester)
BCHE-102: ORGANIC CHEMISTRY

Objectives: The main objective of this course is to make the students knowledgeable about the fundamentals of carbon chemistry, to understand the consequences (reactivity, properties) of the three-dimensionality of molecules, so that they may be able to interpret patterns of reactivity on the basis of mechanistic reasoning,

Unit – I

(08 Sessions)

Mechanism of Organic Reactions:
Homolytic and heterolytic bond fission, Types of reagents – electrophiles and nucleophiles, Types of organic reactions.
Reactive intermediates – Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples), charge transfer complexes, resonances, hyperconjugation, inductive and electromeric effects.

Unit – II

(10 Sessions)

Stereochemistry of Organic Compounds:
Concept of isomerism, types of isomerism: Optical isomerism – elements of symmetry, molecular chirality, enantiomers, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers , diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantionmer and recemization. Relative and absolute configuration, sequence rules, R & S systems of nomenclature.
Geometric isomerism – determination of configuration of geometric isomers, E & Z system of nomenclature.

Unit – III

(08 Sessions)

Cycloalkanes: Nomenclature, Baeyer's strain theory and its limitations, Ring strain in small rings (cyclopropane and cyclobutane) , theory of strain less rings. Preparation and properties of cyclo alkane.

Unit – IV

(08 Sessions)

Arenes and Aromaticity: Huckel's rule, aromatic ions. , Nomenclature of benzene derivatives, the aryl group, aromatic nucleus and side chain, Aromatic electrophilic substitution –Mechanism of nitration, halogenation, sulphonation and Friedel – Crafts reaction. Orientation and ortho/para ratio, side chain reactions of benzene derivatives, Birch reduction: Methods of preparation and chemical reactions of alkyl benzenes and naphthalene and anthracene.

Course Outcomes:
Students completing this course will able to:

- Interpret the concept of aromaticity and the main properties of aromatic compounds.
- Associate polarization of a bond with electronegativity.

- Understand nucleophile and electrophile groups and their properties.
- Associate different bond types of carbon and its hybrit orbitals.
- Express the differences between valence bond and molecular orbital approaches.
- Derive mechanism of a reaction.
- Interpret the reactions and properties of cyclo alkanes, arenes, halogen compounds.

Suggested readings:

1. A Textbook of Qualitative Inorganic Analysis By A.I. Vogel
2. A Text Book Of Organic Chemistry By I L Finar Vol I
3. M.S Singh, Advanced Organic Chemistry/Reactions And Mechanism: Pearson Education Pvt.Ltd.
4. S.M. Mukerjee And S.P., Singh Reaction Mechanism In Organic Chemistry Macmillan India Ltd.

Web sources:

- https://www.masterorganicchemistry.com/
- https://www.organic-chemistry.org/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) I Year (I Semester)
BCHE-151: CHEMISTRY PRACTICAL

Objectives: The objective of this course is to give knowledge to the students about the chemical experiments, properly carry out the experiments, and appropriately record and analyze the results. Students will be able to use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments. Students will know and follow the proper procedures and regulations for safe handling and use of chemicals. Students will be able to successfully pursue their career objectives in advanced education in professional and/or graduate schools, in a scientific career in government or industry, in a teaching career in the school systems, or in a related career following graduation.

INORGANIC CHEMISTRY PRACTICALS

(10 Sessions)

1. Qualitative inorganic analysis: Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:
   Anions: Carbonate, sulphate, chloride, bromide, acetate, nitrate, borate, phosphate.
   Cations: Lead, copper, iron, aluminum, zinc, manganese, calcium, strontium, barium, potassium and ammonium.
2. Semi micro Analysis – cation analysis, separation and identification of ions from Group I , II , III ,IV , V and VI .
3. Find the strength in grams per litre of the given solution of sodium hydroxide with the help of standard oxalic acid solution.
4. Determine the total alkalinity in ppm in the given sample of water using standard sulphuric acid solution.
5. Determination of Fe (II) using $KMnO_4$with oxalic acid as primary standard.

ORGANIC CHEMISTRY PRACTICALS

(10 Sessions)

1) Determination of melting point:
   Naphthalene 80 – 82^0 , Benzoic acid 121.5 - 122^0 m - Dinitrobenzene 90^0
   Urea 132.5 - 133^0 , Succinic acid 184.5 - 185^0 P – Dichlorobenzene 52^0
2) Crystallization:
   i- Phthalic acid from hot water (using fluted filter paper and steam less funnel)
   ii- Naphthalene from ethanol
   iii- Benzoic acid from water
3) Decolorisation and crystallization using charcoal:
   i- Decolorisation of brown sugar (Sucrose) with animal charcoal using gravity filtration.
   ii- Crystallization and decolorisation of impure naphthalene (100g of naphthalene mixes with 0.3 gm of Congo Red using 1 g decolorizing carbon)from ethanol.
4) Detection of extra element (n and halogens) and functional groups in the given organic compound
5) Qualitative analysis of phenols , carboxylic acids , carbonyl compounds(aliphatic and aromatic) , carbohydrates ,amines ,Acetamide amides) organic compounds.

Course outcomes:

Students completing this course will able to:

- Demonstrate mastery of basic organic chemistry laboratory techniques, including Distillation , recrystallization, melting point determination, liquid-liquid extraction, gravity and liquid filtration, and chromatography.
- Students will demonstrate the ability to safely and effectively perform synthetic organic reactions, using proper glassware set-up, handling of hazardous chemicals, and following the prescribed experimental procedures.
- Students will demonstrate safe laboratory practices through the use of appropriate personal protective equipment and appropriate handling of all chemicals, including proper disposal of waste.
- Students will critically assess the progress and success of their experiments, and be able to adjust experimental procedures when necessary.

Suggested Readings:

1. Practical Chemistry - Giri, Bajpai And Pandey, S. Chand & Co. Ltd., New Delhi.
2. Laboratory Manual In Organic Chemistry, R.K. Bansal, Willey Eastern.
3. Experimental Organic Chemistry, Vol. I And Ii, P.R. Singh, D.S. Gupta And K.S. Bajpai,Tata Mc- graw Hill.
4. Instrumental Methods of Chemical Analysis G.W. Ewing Mc Graw Hill.
5. Experiments In General Chemistry, N.R. Rado And U.C. Agarwal, Eastern Press.

Web Sources:

- https://www.acs.org/content/acs/en/education/students/highschool/chemistryclubs/activities/simulations.html
- http://www.chem.ox.ac.uk/vrchemistry/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) I Year (II Semester)
BCHE-201-PHYSICAL CHEMISTRY

Objectives: The main objectives of this course are to learn errors and data analysis methods. To understand the fundamental theory and laboratory techniques in physical chemistry. Also to calculate gaseous state numerical problem analysis. And to know about colloids and their practical application.

Unit – I

(10 Sessions)

Mathematical Concepts and Computers:

Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like Kx, X^n, Sin x, log x maxima and minima, differentiation and reciprocity relations. Integration of some useful/relevant functions

Computers: General introduction to computers, different components of a computer , hardware and software, input – output devices, binary numbers and arithmetic.

Unit – II

(10 Sessions)

Gaseous State:

Postulates of kinetic theory of gases, deviation from ideal behavior, Vander Waals equation, relationship between critical constants and Vander Waals constants, law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities, collision number, mean free path and collision diameter, Liquefaction of gases.

Liquid State:

Intermolecular forces, structure of liquids (a qualitative description).

Liquid crystals: classification& application of liquid crystals

Solid State: space lattice, unit cell. Laws of crystallography , X – Ray diffraction by crystals, Derivation of Bragg's equation.

Unit – III

(08 Sessions)

Colloids: Definition and classification

Sols: kinetic, optical and electrical properties, coagulation, stability of colloids, Hardy – Schulze law, gold number.

Emulsions: types of emulsions, preparation, Emulsifiers.

Gels: preparation and properties.

Applications of colloids.

Unit – IV

(08 Sessions)

Chemical kinetics:

Rate of a reaction , factors influencing the rate of a reaction.

Reactions: Zero order, first order, second order, half life and mean life. Determination of the order of reaction - integration method, Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Collision theory and transition state theory.

Course outcomes:

Students completing this course will able to:

- Describe the ideal and real gases.
- By interpreting the real gases, the student will be able to solve the problems.
- Uses the Van Der Waals gas equation.
- Uses the real gas and Van Der Waals isoterms.
- Describes the critical state, adapts critical state equation to the problems.

Suggested readings:

1. Spectroscopy by William Kemp
2. Spectroscopy by Pavia
3. Organic Spectroscopy by J. R. Dyer
4. Modern Electrochemistry by J.O. M. Bockris and A.K.N.Reddy
5. Advanced Physical Chemistry by Atkins
6. Introduction to Electrochemistry by S. Glasstone
7. Elementary organic spectroscopy by Y.R. Sharma8. Spectroscopy by P.S.Kalsi

Web Sources:

- https://www.edx.org/learn/physical-chemistry
- https://www.learnchem.net/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) I Year (II Semester)
BCHE-202: BASICS OF ANALYTICAL CHEMISTRY

Objectives: The main objectives of this course are to learn Intermediate theory and laboratory techniques in analytical and physical chemistry.To know about the advanced data analysis methods and goodness-of-fit criteria. Fourier transforms spectroscopic methods and instrumentation.students will know the applications of Electrochemistry and Liquid chromatography.

Unit -I

(10 Sessions)

Data Analysis –
Concept of significant figures—its importance, accuracy, methods of expressing accuracy, error analysis, types of errors, minimizing errors, precision-mean, median, mean deviation, standard deviation and confidence limit.
Chemical and single pan balance , precautions in using balance, sources of error in weighing, correction for buoyancy, temperature effects, calibration of weights.

Unit -II

(10 Sessions)

Calibration of glassware and volumetric analysis
Calibration of pipette, volumetric flask , Burette. Measurements in analytical chemistry, S.I units-Fundamental units (Mass, amount of substances, distance, time, temperature, current) and Derived. Units(Area, Volume ,density, velocity, force, pressure, energy, heat, work, power, charge, potential, resistance, frequency) (S.I Units and Symbol only)
Preparation of standard solution, indicators, acid base titration, complex metric titration

Unit -III

(08 Sessions)

Chromatographic Techniques-
Types of chromatography, principle , column chromatography-principle, types of adsorbents, preparation of the column, elution, recovery of substances and applications.
TLC-principles, choice of adsorbent and solvent, preparation of chromatoplates. Rf values. Factors affecting the Rf values .Significance of Rf values.
Paper Chromatography-principle, solvent used development of chromatogram, ascending, descending and radial paper chromatography.

Unit -IV

(08 Sessions)

Gravimetric Analysis –
Principle-theories of precipitation-solubility product and precipitation-factors affecting solubility. Conditions of precipitation, co- precipitation and post precipitation. Reduction of errors. Precipitation from homogeneous solution-washing and drying of precipitate.
Choice of the precipitant-Specific and Selective precipitants-Anthranilic acid , Cupferon, Dimethyl glyoxime, Ethylenediamine .

Course Outcomes:
Students completing this course will able to:

- Explain the theoretical principles and important applications of classical analytical methods within titration (acid/base titration, complexometric titration, redox titration.
- Various techniques within gravimetric and coulometric methods.
- Theoretical principles of selected instrumental methods within electro analytical and spectrometric/spectrophotometric methods
- Main components in such analytical instruments. Like various separation techniques in chromatography, and typical applications of chromatographic techniques.
- Assess and suggest a suitable analytical method for a specific purpose, and evaluate sensitivity, important sources of interferences and errors, and also suggest alternative analytical methods for quality assurance.

Suggested readings:

1. Analytical Chemistry by Skoog and Miller
2. A textbook of qualitative inorganic analysis by A.I. Vogel
3. Nanochemistry by Geoffrey Ozin and Andre Arsenault
4. Stereochemistry by D. Nasipuri5. Organic Chemistry by Clayden.
5. J.H. Keneedy, Analytical Chemistry:

Web Sources:

- https://edu.rsc.org/teacher-pd/in-person/analytical-chemistry/classroom-resources.

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) I Year (II Semester)
BCHE-251: CHEMISTRY PRACTICAL

Objectives: Students will understand the scientific reasoning, quantitative analysis laboratory practice and safety. They will know the basic analytical and technical skills to work effectively in the various fields of chemistry. The ability to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions**.**

PHYSICAL CHEMISTRY

(10 Sessions)

1. Determination of relative surface tension of the given organic compound.
2. Determination of relative viscosity of the given organic compound.
3. Determination of order of reaction.
4. Determination of number of molecules of water of crystallisation (n) in the given sample of Mohr's salt.
5. Determination of percentage purity of an impure sample of $kmno_4$.

ANALYTICAL CHEMISTRY

(10 Sessions)

1. Determination of r_f value by using paper chromatography.
2. Determination of common food adulteration in various food sample (desi ghee, mustard oil, turmeric powder, chili powder).
3. Determination of oxalate ion content in the guava fruit.
4. Determination of quantity of casein present in different samples of milk.
5. Determination of dosage of bleaching powder required for disinfection of different samples of water taken from different sources.

Course Outcomes:

Students completing this course will able to:

- ❖ To understand the principles defining analytical chemistry from the point of view of the "problem solving" approach.
- ❖ Furthermore, he will acquire knowledge about the chemical equilibria in solution ,carrying out simple qualitative tests and of defining the optimal conditions for a reaction to proceed.
- ❖ volumetric and gravimetric quantitative determinations; standard analysis procedures, understanding and development of a SOP
- ❖ Statistical treatment of the data and significance tests for the final evaluation of analytical data; potentiometry and its applications.

Suggested Readings:

1. D.A. Skoog, Principles of Instrumental Analysis: Sundars College Publicing.
2. Modern Methods of Chemical Analysis: R.L. Pecsok: John Willey New York
3. Experiments in Physical Chemistry - J.C. Ghose, Bharti Bhawan.

Web Sources

- https://www.labster.com/chemistry-virtual-labs/
- https://digitallearning.ucf.edu/ilab/remote-labs/college-of-sciences-remote-lab-resources/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) II Year(III Semester)
BCHE-301: INORGANIC CHEMISTRY

Objectives: This course will equip students with the necessary knowledge to understand chemistry at the most fundamental level. Understand the Characteristic properties of d-block elements. To understand Coordination Compounds, Werner's coordination theory and its experimental verification. Learning of Lanthanides and Actinides their properties and applications

Unit – I

(09 Sessions)

Elements of First Transition Series
Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and study of their complexes with respect to relative stability of their oxidation states, coordination number and geometry.

Unit – II

(09 Sessions)

Coordination Compounds
Werner's coordination theory and its experimental verification, effective atomic number (E.A.N.) concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit – III

(09 Sessions)

Lanthanides and Actinides
Electronic configuration, oxidation states, ionic radii and magnetic properties, lanthanide and actinide contraction, complex formation .

Unit – IV

(09 Sessions)

Oxidation and Reduction:
Oxidation Number, Oxidising agents, Reducing agents, Electrode potential, electrochemical series and its applications,
Acids and Bases:
Arrhenius , Bronsted-Lowry, Lewis , Lux-Flood concept , Usanovitch and solvent system concepts of acids and bases.
Non-aqueous Solvents:
Physical properties of a solvent, types of solvents and their general characteristics, Reactions in non-aqueous solvents with reference to liquid NH_3 and Liquid SO_2.

Course outcomes:
Students completing this course will able to:

- Gain an understanding of Elements of First Transition Series elements.
- Coordination compounds and their applications.
- Predicting stereo chemistry and geometries of coordination compounds.
- Electrode potential, electrochemical series and its applications.

Suggested readings:
1. Inorganic Chemistry by J.E.Huheey

2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. Organic Chemistry by Morrisson and Boyd
4. Concise Inorganic Chemistry by J.D.Lee

Website Sources:

- https://www.internetchemistry.com/
- http://www.chemguide.co.uk/
- https://freebookcentre.net/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) II Year (III Semester)
BCHE-302: ORGANIC CHEMISTRY

Objectives: This course will give an introduction to modern spectroscopic techniques including time-resolved laser methods. Students will learn theory and application to, ultraviolet and visible spectroscopy, infrared spectroscopy, Raman, fluorescence, nuclear magnetic resonance spectroscopy,time-resolved spectra including lifetime measurements, etc. Comprehension and industrial applications of alcohols, phenols and ethers and synthesis of many carboxylic acids and their industrial production will be learned by students.

Unit – I

(09 Sessions)

Electromagnetic Spectrum: Absorption Spectra-
Brief idea about Ultraviolet (UV) absorption spectroscopy –Beer-Lambert's law ; molar absroptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.

Infrared (I.R.) absorption spectroscopy – molecular vibrations, Hooke's law, selection rules, intensity and position of I.R. bands, fingerprint region, characteristic absorptions of various functional groups and interpretation of I.R. spectra of simple organic compounds.

Unit – II

(09 Sessions)

Phenols:
Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character, Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols: electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Friedel Craft reaction, Fries rearrangement, Kolbe Schmitt reaction, oxidation and reduction of phenol, brief idea about dihydric phenols**.**

Unit – III

(09 Sessions)

Aldehydes and Ketones:
Nomenclature and structure of the carbonyl group , synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of ketones from nitrile and from carboxylic acids, Mechanism of nucleophillic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knoevenagel Condensations.

Unit – IV

(09 Sessions)

Carboxylic Acids:
Nomenclature, structure and bonding, acidity of carboxylic acids, effects of substituent on acid strength, Preparation of carboxylic acids, Reactions of carboxylic acids , Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids , Hydroxy acids: lactic , Tartaric and Citric Acids.
Carboxylic Acid Derivatives: Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms Of Esterificaton And Hydrolysis(Acidic And Basic).

Course Outcomes:
Students completing this course will able to:

- understand how to use their understanding of organic mechanisms to predict the outcome of reactions
- How to design syntheses of organic molecules.
- How to determine the structure of organic molecules using IR and NMR spectroscopic techniques
- Students will demonstrate an advanced level of knowledge in organic spectroscopy**.**

Suggested readings:

1. Inorganic Chemistry by J.E.Huheey
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. Organic Chemistry by Morrisson and Boyd
4. Concise Inorganic Chemistry by J.D.Lee

Web Sources:

- https://www.masterorganicchemistry.com/
- https://www.organic-chemistry.org/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) II Year (III Semester)
BCHE-351: CHEMISTRY PRACTICAL

Objectives: Students will be able to understand the objective of their chemical experiments, properly carry out the experiments, and appropriately record and analyze the results. Students will be able to use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments. Students will know and follow the proper procedures and regulations for safe handling and use of chemicals. Students will be able to communicate the concepts and results of their laboratory experiments through effective writing and oral communication skills.

A) Inorganic Chemistry:

(10 Sessions)

1) Determination of alkali content – an acid tablet using HCl.
2) Estimation of hardness of water by EDTA.
3) Estimation of ferrous and ferric ions by dichromate method.
4) Estimation of copper using sodium thiosulphate solution.
5) Inorganic preparations:

a) Preparation of chrome alum.
b) Preparation of potash alum.
c) Preparation of chrome red.

B) Organic Chemistry:

(10 Sessions)

1) Determination of R*f* values and identification of organic compounds using paper chromatography.
2) Separation of green leaf pigments (spinach leaves may be used).
3) Separation of a mixture of phenylalanine and glycine , Alanine and aspartic acid , Leucine and glutamic acid, using Spray reagent –ninhydrin.
4) Separation of monosaccharide – a mixture of D- galactose and D-fructose using n-butanol: acetone: water (4:5:1), spray reagent – aniline hydrogen phthalate.
5) Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives**.**

Course outcomes:

Students completing this course will able to:

- Demonstrate mastery of basic organic chemistry laboratory techniques, including identification of organic compounds using paper chromatography.
- Students will demonstrate the ability Separation of a mixture of amino acids by paper chromatography.
- Students will understand the estimation of hardness of water.
- Students will critically assess the progress and success of their experiments, and be able to adjust experimental procedures when necessary.

Suggested Readings:

1. Practical Chemistry - Giri, Bajpai and Pandey, S. Chand & Co. Ltd., New Delhi.
2. Laboratory Manual In Organic Chemistry, R.K. Bansal, Willey Eastern.

3. Experimental Organic Chemistry, Vol. I and II, P.R. Singh, D.S. Gupta And K.S. Bajpai, Tata Mc Graw Hill.
4. Method of Chemical Analysis G.W. Ewing Mc Graw Hill.
5. Experiments In General Chemistry, N.R. Rado And U.C. Agarwal, Eastern Press.

Web Sources:

- https://www.acs.org/content/acs/en/education/students/highschool/chemistryclubs/activities/simulations.html
- http://www.chem.ox.ac.uk/vrchemistry/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) II Year(IV Semester)
BCHE-401: PHYSICAL CHEMISTRY

Objectives: To learn electrochemistry and Conductance in electrolyte. Fundamental theory of thermodynamics and variables used to calculate gaseous state numerical problem related to thermodynamics and electrochemistry.To know the Statement and meaning of the terms- phase equilibrium system of two component system-(Pb-Ag system).

Unit – I

(10 Sessions)

Thermodynamics – I

First Law of Thermodynamics:

Statement, definition of internal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure and their relationship, Joule's law – Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Kirchhoff's equation.

Unit – II

(10 Sessions)

Thermodynamics – II

Second Law of Thermodynamics:

Need for the law, different statements of the law, Cornot's cycle and its efficiency, Carnot's theorem. Thermodynamic scale of temperature.

Concept of entropy:

Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius Clapeyron equation, entropy as a criteria of spontaneity and equilibrium.

Gibbs and Helmholtz functions:

Gibbs function (G) and *Helmholtz* function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P, V and T.

Unit – III

(08 Sessions)

(Electrochemistry)

Conductance in electrolyte solutions, variation of molar equivalent and specific conductance with dilution. Migration of ions and Kohlrausch's law, weak and strong electrolytes, Ostwald's dilution law, Transport number, and its determination by Hittorf's method.Applications of conductivity measurements. Nernst theory and equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode, standard electrode potential, sign conventions, Electrolytic and Galvanic cells.

Unit – IV

(08 Sessions)

(Phase Equilibrium)

Statement and meaning of the terms-phase, component and degree of freedom, phase equilibrium system of one component system-(water, and Sulphur) phase equilibrium system of two component system-(Pb-Ag system), desilverisation of lead (Pattinson's Process)

Course Outcomes:

Students completing this course will able to:

- Know how to make solutions of various molar concentrations.
- Understand the calculation of internal energy and enthalpy, Heat capacity, heat capacities.

Suggested Readings:

1. Text Book of Physical Chemistry by S Glasstone
2. Advanced Physical Chemistry by Gurudeep Raj
3. Modern Electrochemistry J.O.M. Bockris And A.K .M. Reddy: Plenium Press New York.
4. Physical Chemistry: Atkins, Oxford Universiyt Press, New York.
5. Physical Chemistry, I.N.Livine: Tata Mc Graw Hill Publication New Delhi.

Web sources:

- https://www.acs.org/content/acs/en/education/students/highschool/chemistryclubs/activities/simulations.html
- http://www.chem.ox.ac.uk/vrchemistry/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) II Year (IV Semester)
BCHE-402: ENVIRONMENTAL CHEMISTRY

Objectives: This course provides an overview of the concepts and applications used to predict and explain chemical concentrations found in different parts of indoor and outdoor environments.The course main objectives is to answer the connection between chemical uses and mishaps, and damage to human health or to ecologies .This course introduces concepts that form a basis for rationalizing or predicting environmental behavior of pollutant chemicals.

Unit – I

(09 Sessions)

Components of Environment (a brief introduction), air and water pollutents and their classification, air and water quality standards, soil chemistry: inorganic and organic chemistry of soil, macro and micro nutrients of soil.

Unit – II

(09 Sessions)

Methods of control of air and water pollution:
Adsorption of gaseous pollutants, electrostatic precipitation of air pollutants, cyclonic separation of air pollutants, aeration of water, waste water treatment, softening of water .

Unit – III

(09 Sessions)

Sampling and analysis of air and water pollutants:
Methods of sampling gaseous, liquid and solid pollutants, analysis of NO_2, SO_2, H_2S And CO, analysis of toxic heavy metals(Cd, Cr, As, Pd, Cu, Hg)
Analysis of total cationic and anionic burdens of water.
Analytical techniques for pesticide residue analysis.

Unit – IV

(09 Sessions)

Environmental Toxicology:
Bio-degradability, Bio-Oxidation, Bio-reduction, Bio-hydrolysis, Biochemical effects of arsenic, cadmium, lead, mercury, designing a green synthesis, designing safer chemicals.

Course Outcomes:

Students completing this course will able to:

- Demonstrate knowledge of chemical and biochemical principles of fundamental environmental processes in air, water, and soil.
- Recognize different types of toxic substances & responses and analyze toxicological information.
- Apply basic chemical concepts to analyze chemical processes involved in different environmental problems
- Describe water purification and waste treatment processes and the practical chemistry involved.
- Describe causes and effects of environmental pollution by energy industry and discuss some mitigation strategies. 6. Explain energy crisis and different aspects of sustainability.

Suggestive Readings:

1. Fundamentals of ecology by M.C.Dash

2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k. Banerji

Web Sources:

- https://nptel.ac.in/courses/104/103/104103020/
- https://www.openlearning.com/courses/introduction-to-environmental-chemistry/
- https://environmentalchemistry.com/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) II Year(IV Semester)
BCHE-451: CHEMISTRY PRACTICAL

Objectives: To give ability to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions to the students. They will understand the scientific reasoning and quantitative analysis, laboratory practice and safety. Students will learn the basic analytical and technical skills to work al and technical skills to work effectively in the various fields of chemistry like physical and environmental chemistry.

Physical Chemistry:

(10 Sessions)

1. Determination of the transition temperature of the given substance by thermometric method (e.g. $MnCl_2.4H_2O$ / $CuSO_4.5H_2O$) / $Na_2CO_3.10H_2O$)
2. Determination of the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
3. Determination of the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.
4. Acid-base titration by pH meter.
5. Determination of the equivalent conductance of given electrolyte solution at room temperature using conductivity meter.

Environmental Chemistry:

(10 Sessions)

1. Determination of the percentage of available chlorine in the given sample of bleaching powder.
2. Determination of total dissolved solids in water / effluent sample.
3. Determination of Biological Oxygen Demand (BOD) of the given water sample.
4. Determination of Chemical Oxygen Demand (COD) of the given water sample using $K_2Cr_2O_7$ solution.
5. Determination of the conductivity of the soil sample.

Course outcomes:

Students completing this course will able to:

- Understand the principles defining physical chemistry and environmental chemistry from the point of view of the "problem solving" approach.
- Furthermore, he will acquired knowledge about total dissolved solids in water, Chemical Oxygen Demand (COD) of the given water sample carrying out simple qualitative tests and of defining the optimal conditions for a reaction to proceed.

Suggestive Readings:

1. Experimental physical chemistry by Frederick A. Bettelheim
2. Experimental physical chemistry by G. Peter Matthews
3. Experimental physical chemistry by Farrington Daniels
4. Experimental physical chemistry by Halpern and McBane
5. Experiments in Physical Chemistry by Shoemaker, Garland and Nible

Web Sources

- https://www.labster.com/chemistry-virtual-labs/
- https://digitallearning.ucf.edu/ilab/remote-labs/college-of-sciences-remote-lab-resources/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) III Year (V Semester)
BCHE-501 -INORGANIC CHEMISTRY

Objectives: This course deals with the production, chemistry and properties of the transition metals, lanthanides and actinides. Specifically, the class introduces electron configurations for the elements and oxidation state trends for each group. Including bonding and isomerism in coordination compounds , crystal field theory, and electronic properties of ligands. Also cover metal bonding in clusters, the HSAB concept, chelate effect, and complex stability.

Unit – I

(09 Sessions)

Transition Metal Complexes:
Limitations of valance bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planner complexes, factors affecting the crystal-field parameters.
stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination .

Unit – II

(09 Sessions)

Magnetic Properties of Transition Metal Complexes:
Types of magnetic behavior, methods of determining magnetic susceptibility,spin-only formula, L-S coupling, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Unit – III

(09 Sessions)

Metal carbonyls , Silicones and Phosphazenes
Metal carbonyls: 18 electron rule, preparation, structure and nature of bonding in the mononuclear carbonyls. Silicones and phosphazenes as examples of inorganic polymers.

Unit – IV

(09 Sessions)

Hard and Soft Acids and Bases (HSAB)
Classification of acids and bases as hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness, Symbiosis, theoretical basis of hardness and softness, electro negativity and hardness and softness.

Course Outcomes:
Students completing this course will able to:

- To know the relative stability about coordination complexes.
- A brief knowledge about hardness and softness of lewis acids and bases
- Nature of bonding in carbonyl, silicones and phosphagenes.
- Useful applications about magnetic properties of transition metal complexes.

Suggested Readings:

1. Inorganic Chemistry by J.E.Huheey
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. Concise Inorganic Chemistry by J.D.Lee

4. The Organometallic Chemsitry Of Transition Metals: John Willey

Web Sources:

1. www.chem.tamu.edu
2. www.academia.edu
3. www.amu.ac.in
4. www.chem.tamu

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) III Year (V Semester)
BCHE-502: ORGANIC CHEMISTRY

Objective: To Predict and explain patterns in shape, structure of organic compounds. To give idea about Synthesis and reactivity for carbohydrates **.** To provide explanation of the chemistry of amino acids and proteins To understand the concepts of organic chemical structure and bonding and stability found in fats and oils.

Unit – I

(09 Sessions)

Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy, Proton magnetic resonance (^{1}H- NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals,

interpretation of 1H NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2-tribromoethane, ethyl acetate, toluene and acetophenone, Problems pertaining to the structures elucidation of simple organic compounds using UV, IR and ^{1} H NMR spectroscopic, techniques.

Unit – II

(09 Sessions)

Carbohydrates

Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Conversion of glucose intro mannose, Formation of glcosides, Determination of ring size of monosaccharides, Structures of ribose and deoxyribose,

An introduction to disaccharides (maltose, sucrose and lactose)

Unit – III

(09 Sessions)

Amino Acids, Peptides and Proteins:

Classification, structure and stereochemistry of amino acids, Acid-base behavior isoelectric point and electrophoresis, Preparation and reactions of - amino acids, classification and structure of proteins, selective hydrolysis of peptides, Protein denaturation/renaturation.

Unit – IV

(09 Sessions)

Fats, Oils and Detergents

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, Saponification value, iodine value, acid value, Soaps, synthetic detergents.

Course Outcomes:

Students completing this course will able to:

- Confirm the structure of carbohydrates.
- Student can understand the synthesis and properties of amino acids and proteins
- To predict the synthesis and properties of detergents and soaps.
- Explore the knowledge about effects of fats and oils

Suggested Readings:

- Biochemistry : L. Steyer, Freeman And Co.; New York
- Organic Synthesis: M.B. Smith: Mc Graw Hill, New York
- Advanced Organic Chemistry Reaction, Mechanism And Structure, M.B. Smith And J. March: John Willey And Sons, New York.

Web Sources:

1. www.structbio.ptt.edu>notes>nmr_ref_notes-2011
2. www.academia.edu>CHE_320_organic_spectroscopy
3. www.chtf.stuba.sk>files>Carbohydrates_Boudreaux
4. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod11.pdf

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) III Year (V Semester)
BCHE-551- CHEMISTRY PRACTICAL

Objectives:

- Chemistry lab includes basic laboratory operation, separation and purification of organic compounds.
- To identify simple precipitation and crystallization, sublimation, solid-liquid and liquid-liquid extraction.
- To learn laboratory exercises in simple distillation, fractional distillation, melting point determination, re crystallization, and rudimentary organic synthesis and analysis.

(10 Sessions)

Inorganic Chemistry

1. Estimation of Copper by gravimetric method.
2. Estimation of Nickel by gravimetric method.
3. Estimation of Copper and Zinc in a mixed solution of both by gravimetric method.
4. Preparation of Ni-DMG complex, $[Ni(DMG)_2]$
5. Preparation of copper tetra ammine complex. $[Cu(NH_3)_4]SO_4$.

(10 Sessions)

Organic Chemistry:

1. Determination of saponification value of an oil or fat.
2. Determination of Iodine value of an oil or fat.
3. Isolation of lactose from milk and its quantitative analysis.
4. Estimation of amino acid using ninhydrin by spectrophotometric method.
5. Preparation of methyl orange / methyl red / iodoform / m-dinitrobenezene / fluorescein/ Malachite green/ drug.

Course outcomes:

Students completing this course will able to:

- Understands the gravimetric analysis.
- Understand the synthetic process of organic compounds.
- Learn the synthesis of drugs and dyes.

Suggested readings:

1. A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.
2. A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.
3. A.I. Vogel: Textbook of Practical Organic Chemistry, Prentice Hall, 5th Edn.
4. F. G. Mann & B. C. Saunders: Practical Organic Chemistry, Orient Longman (1960).M university

Web Sources

- http://www.freebookcentre.net/Chemistry/InOrganic-Chemistry-Books.html
- http://www.freebookcentre.net/Chemistry/InOrganic-Chemistry-Books.html
- http://onlinelabs.in/chemistry

Note: Latest edition of all the suggested readings must be used

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) III Year (VI Semester)
BCHE-601: PHYSICAL CHEMISTRY

Objectives: To develop basic and advance concepts regarding the Physical Properties and Molecular Structure. To derive the expressions for Schrödinger wave equation and its importance.To study the concept, Interaction of radiation with matter and Laws of photochemistry.

Unit – I

(09 Sessions)

Physical Properties and Molecular Structure:

Optical activity, polarization – (Clausius – Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties paramagnetism, diamagnetism and ferromagnetism.

Unit – II

(09 Sessions)

Quantum Mechanics:

Schrödinger wave equation and its importance, postulates of quantum mechanics, particle in a one dimensional box., calculation of energy levels from wave functions, Hybrid orbitals – sp, sp3, sp2, calculation of coefficients of A.O's used in sp and sp2 hybrid orbitals and interpretation of geometry.

Unit – III

(09 Sessions)

Spectroscopy:

Introduction: electromagnetic radiation, regions of the spectrum.

Rotational *Spectrum*-

Diatomic Molecules:

energy levels of a rigid rotor (semi-classical principles), selection rules, determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Infrared Spectrum: Energy levels of simple harmonic oscillator, selection rules, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, , idea of vibrational frequencies of different functional groups.

Unit – IV

(09 Sessions)

Photochemistry:

Interaction of radiation with matter, Laws of photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non- radiative processes (internal conversion, intersystem crossing), quantum yield.

Course outcomes:

Students completing this course will able to:

- Derive mathematical expressions for different energy levels from wave functions.
- Explain the electromagnetic radiation, regions of the spectrum.

- Explain the concept of Jablonski diagram depicting various processes occurring in the excited.
- Apply the concepts of dipole moment and structure of molecules.

Suggested Readings:

1. Text Book Of Physical Chemistry By S Glasstone
2. .Advanced Physical Chemistry By Gurudeep Raj
3. Modern Electrochemistry J.O.M. Bockris And A.K .M. Reddy: Plenium Press New York.
4. Physical Chemistry: Atkins, Oxford Universiyt Press, New York.
5. Physical Chemistry, I.N.Livine: Tata Mc Graw Hill Publication New Delhi.

Web Sources:

- http://www.freebookcentre.net/Chemistry/Chemistry-Books-Online.html
- https://guides.lib.umich.edu/c.php?g=282900&p=1885122

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) III Year (VI Semester)
BCHE-602: -POLYMER CHEMISTRY

Objectives: To Know about polymeric materials and their classification and to learn about different mechanisms of polymerization along with polymerization techniques To determine chain length of polymers based on their kinetic mechanism To learn about different methods of finding out average molecular weight of polymers and transition temperature (Tg) and crystalline melting point (Tm) Determination of Tg and Tm

Unit – I

(09 Sessions)

Introduction and nomenclature:
Characteristic, Classification, Nomenclature of Polymer, Functionality, Physical Properties of Polymer, Mechanism of Polymerization (Addition Polymerization)

Unit-II

(09 Sessions)

Molecular Weight Determination:
Molecular weight, Determination of molecular weight of polymers by osmotic pressure and viscosity method and its practical significance, Viscometry, Chemical and geometrical structure of Polymers

Unit-III

(09 Sessions)

Characterization:
Glass-transition temperature (T_g) of Polymer, Factors that affect the value of T_g,T_g and molecular weight ,melting point ,Importance of T_g,Brief idea of crystallinity.

Unit-IV

(09 Sessions)

Processing of Polymers:
Processing of Polymers (Calendaring, Die casting, Film casting, Moulding), High Performance Polymers (PPS, PES, PEEK, Polyamides), Classification and application of composites.

Course Outcomes:

Students completing this course will able to:

- Understand the importance of macromolecules/polymers in day to day life and apply their knowledge in sustainable development of mankind.
- Apply the learned fundamental instrumental techniques in the polymer characterization.
- Explain (1) step-growth and chain-growth polymerization, with respect to synthesis mechanisms and kinetics, (2) crystalline melting temperature and glass transition temperature, including the influence of kinetics, and (3) the flow properties of polymer melts and polymer solutions, with respect to both temperature and molecular weight.
- Demonstrate an ability to quickly acquire knowledge in new polymer related applications and to acquire new knowledge for the innovation and development of polymer materials and related processes.

Suggested Readings:

1.Text Book Of Polymer Science, F.W. Billmeyer, Willey Science New York.

2 .Principles Of Polymeriszation, J. Odien, John Willey, Singapore
3.Principles Of Polymer Science, P. Bahadur And N. V. Shashtri , Narosa Publishing House New Delhi.
4. Polymer Sciences, V.R. Gowarikar And J. Sridhar, Willey Eastern New Delhi.

Web Sources

- https://guides.lib.umich.edu/c.php?g=282900&p=1885122
- http://www.freebookcentre.net/Chemistry/Chemistry-Books-Online.html

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc (PCM) III Year (VI Semester)
BCHE-651-CHEMISTRY PRACTICAL

Objectives: To impart the knowledge of scientific reasoning and quantitative analysis laboratory practice and safety. The basic analytical and technical skills to work effectively in the various fields of physical and polymer chemistry. The ability to perform accurate quantitative measurements with an understanding of the theory and use of contemporary chemical instrumentation, interpret experimental results, perform calculations on these results and draw reasonable, accurate conclusions.

Physical Chemistry:

(10 Sessions)

1) Determination of rate constant of acid catalyzed hydrolysis of an ester.
2) Determination of order of hydrolysis of an ester by sodium hydroxide.
3) Studies on the kinetics of iodination of acetone.
4) Determine the partition coefficient of iodine between water and carbon tetrachloride.
5) Verify Beer – Lambert Law for $KMnO_4$ / $K_2Cr_2O_7$ and determining the concentration of the given solution of the substance from absorption measurement.

Polymer Chemistry:

(10 Sessions)

1. Preparation of a Thiokol Rubber.
2. Preparation of a Rubber Ball from Rubber Latex.
3. Preparation of casein glue from milk and testing of its activity.
4. Determine the viscosity of polymer solution of different concentrations.
5. Determine the number average/molecular weight average / viscosity average molecular weight of a polymer.

Course outcomes:

Students completing this course will able to:

- Understand the principles defining physical chemistry from the point of view of the "problem solving" approach.
- Furthermore, he will acquired knowledge about rate constant, Heat of reactions , partition coefficient and spectroscopic analysis of the given sample and carrying out simple qualitative tests and can defining the optimal conditions for a reaction to proceed.

Suggested Readings:

1. Experimental physical chemistry by Frederick A. Bettelheim
2. Experimental physical chemistry by G. Peter Matthews
3. Experimental physical chemistry by Farrington Daniels
4. Experimental physical chemistry by Halpern and McBane
5. Experiments in Physical Chemistry by Shoemaker, Garland and Nible

Web Sources

- https://www.labster.com/chemistry-virtual-labs/
- https://digitallearning.ucf.edu/ilab/remote-labs/college-of-sciences-remote-lab-resources/

Note: Latest edition of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – I Year (I Semester)

BMAT-101: MATRICES AND TRIGONOMETRY

Objective: -The main aims of this course is to introduce the basic tools of matrices to solve the systems of linear equations, eigenvalues and corresponding eigenvectors for a square matrix and to compute the values of the six trigonometric functions and their transformations, use the basic trigonometric identities to solve trigonometric equations.

MATRICES

UNIT-1 **(08 Sessions)**
Special types of matrices, Elementary transformations, Inverse of a matrix by elementary transformations.

UNIT-2 **(10 Sessions)**
Rank of matrix, Echelon form andNormal forms, Solution of simultaneous linear equations.

UNIT-3 **(12 Sessions)**
Characteristic Equation, Eigen values and Eigen vector of a matrix, Cayley-Hamilton Theorem with proof, Eigen values and Eigen vectors of symmetric, Skew symmetric, Hermition,Skew-Hermition, Unitary and Orthogonal matrices, Diagonalisation of matrix.

TRIGONOMETRY

UNIT-4 **(12 Sessions)**
Complex number, Function of complex variable, Trigonometric, Exponential ,Logarithmic functions, Inverse trigonometric, Hyperbolic functions and Separations into real and imaginary parts.

UNIT-5 **(08 Sessions)**
Expansions and Summation of series.

Course Outcomes:
Students completing this course will be able to:

- Solve a system of linear equations by row-reducing its augmented form.
- Perform the matrix operations of addition, multiplication and transposition and express a system of simultaneous linear equations in matrix form
- Determine whether or not a given matrix is invertible and if it is, find its inverse.
- Solve the problems ofComplex number, Function of complex variable, Trigonometric, Exponential, Logarithmic functions.

Suggested Readings:

1. S. C. GUPTA: Introduction to matrices, Sultan Chand & Sons Publication Delhi.
2. N. Saran & J.K. Goyal: Introduction to matrices, PragatiPrakashan, Meerut.
3. P. Duraipandian: Trigonometry, Sultan Chand & Sons Publication
4. R. S. Chandel, S.K. Singh &GauriSankar: A Text book of Algebra &Trigonometry, Ram Prasad & Sons.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – I Year (I Semester)

BMAT-102: CALCULUS

Objective: -The main aim of this course is to equip the student with necessary analytic and technical skills to handle problems of mathematical nature as well as practical problems. More precisely, main target of this course is to explore the different tools for higher order derivatives, to plot the various curves and to solve the problems associated with differentiation and integration of vector functions. This course is primarily concerned with developing the students' understanding of the concepts of calculus and providing experience with its methods and applications to create mathematical models in order to arrive into an optimal solution.

DIFFERENTIAL CALCULUS

UNIT-1 **(12 Sessions)**
Successive Differentiation, n^{th} differential coefficient of algebraic, Exponential, Trigonometric function, Inverse function, Logarithmic function, Leibnitz's theorem (with proof), Finding $(y_n)_0$.

UNIT-2 **(10 Sessions)**
Partial differentiation, Euler's theorem, Change of variables, Jacobians, Maxima and minima of two variables.

UNIT-3 **(10 Sessions)**
Expansions of functions by Maclaurin and Taylor's theorems, Curvature, Asymptotes, Curve tracing.

INTEGRAL CALCULUS

UNIT-4 **(08 Sessions)**
Reduction Formulae, Beta and Gamma functions, Dirichelet's theorem, Definite integrals.

UNIT-5 **(10 Sessions)**
Multiple integrals, Length of the curves, Area of the curves, Volume and surface of solids by revolution of the curves.

Course Outcomes:
Students completing this course will be able to:

- Understand continuity and differentiability in terms of limits.
- Describe asymptotic behavior in terms of limits involving infinity.
- Use derivatives to explore the behavior of a given function, locating and classifying its extrema, and graphing the function.

Suggested Readings:

1. Gorakh Prasad : Integral calculus, Pothisala Publication.
2. Shanti Narayan : Integral calculus, S. Chand Publication.
3. Gorakh Prasad : Differential calculus, PothisalaPublication.
4. Shanti Narayan : Differential calculus, S. Chand Publication.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – I Year (II Semester)

BMAT-201: VECTOR CALCULUS AND CO-ORDINATE GEOMETRY

Objective: -The main aims ofthis course are to introduce and develop the methods of vector analysis and to familiarize the students with concept and applications co-ordinate geometry of three dimensions. These methods provide a natural aid to the understanding of geometry and some physical concepts. They are also a fundamental tool in many theories of Applied Mathematics.

VECTOR CALCULUS

UNIT-1 **(12 Sessions)**
Vector Differentiation and Integration, Gradient, Divergence and Curl and their properties.

UNIT-2 **(10 Sessions)**
Line integrals, Surface integral, Volume integral, Theorems of Gauss, Green and Stoke'sandtheirproblems.

GEOMETRY

UNIT-3 **(10 Sessions)**
General equation of second degree, Tracing of conics, System of conics, confocal conics, Polar equation of conic and its properties.

UNIT-4 **(10 Sessions)**
3-Dimensional system of co-ordinates, Direction cosines and direction ratios, Projection, Plane, Straight line,

UNIT-5 **(08 Sessions)**
Sphere, Cone and Cylinder and central conicoid.

Course Outcomes:
Students completing this course will be able to:

- Calculate and interpret derivatives in up to three dimensions
- Integrate functions of several variables over curves and surfaces
- Use Green's theorem and the Divergence theorem to compute integrals Identify and sketch curves
- Use three dimensional geometry using vectors
- Understand mathematical models to relate mathematics with daily life problems.

Suggested Readings:

1. B. S .Grewal: Engineering Mathematics, Khanna Publishers.
2. S. S. Gangwar, Hari Krishan&K.M.Agarwal: Vector Analysis & Analytical Geometry Published by Ram Prashad& Sons, Agra,
3. Pundir& Gupta M. C: Geometry &Vectors,Published by PragtiPrakashan, Meerut.
4. M.A. Pathan: Vector Analysis, Published by PragtiPrakashan, Meerut.
5. Mittal & Mittal: Three dimension Co-ordinate geometry Published by PragtiPrakashan, Meerut.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – I Year (II Semester)

BMAT-202: DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS

Objective: -The main aims of this course are to recognize differential equations that can be solved by each of the three methods – direct integration, separation of variables and integrating factor method – and use the appropriate method to solve them. To describe Laplace Transforms, the ideas of Fourier and indicate their applications in the fields such as application of PDE, theory of wave equations, differential equations and many others.

DFFERENTIAL EQUATIONS

UNIT-1 **(10 Sessions)**
Formation of First order and first degree,Solutions of homogeneous differential equations, linear differential equations and exact differential equations, Linear differential equations with constant coefficients, Homogeneous linear differential equations.

UNIT-2 **(12 Sessions)**
Differential equations of the first order but not of the first degree, Clairaut's equations and singular solutions, Simultaneous linear differential equations with constant coefficients, Linear differential equations of the second order (including the method of variation of parameters) with variable coefficient.

UNIT-3 **(10 Sessions)**
Formation of partial differential equations, Partial differential equations of the first order, Lagrange's equations, Linear partial differential equations with constant coefficients.

INTEGRAL TRANSFORMS

UNIT-4 **(10 Sessions)**
The concept of transform, Laplace transforms(L.T.), Linearity property of transforms, Shifting theorem, Laplace transform of derivatives & integrals, Dirac's Deltafunction, Unit step function, Laplace transform of periodic function.

UNIT-5 **(08 Sessions)**
Inverse Laplace transform, Convolution theorem, Solution of differential equations by Laplace transform.

Course Outcomes:
Students completing this course will be able to:

- Think logically and mathematically in any field of engineering.
- Gain an experience in the implementation of Mathematical concepts which are applied in various field of sciences and Engineering.
- Recognize the different methods of finding Laplace transforms and Fourier transforms of different functions.
- Apply the knowledge of L.T, F.T, and Finite Fourier transforms in finding the solutions of differential equations
- Solve the initial value problems and boundary value problems.

Suggested Readings:

1. I. E. Kreyszig : Advanced Engineering Mathematics(9^{th} Edition), John Wiley and sons
2. A. R. Vasishtha: Differential equations, Krishna publication, Meerut.
3. K. P. Gupta & J. K. Goyal: Integral transforms.
4. R. Kumar and N. Kumar: Differential Equations & Integral Transform C.B.S.Publication, Delhi.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – II Year (III Semester)

BMAT-301: MECHANICS

Objective: -The main aims of this course are helps the students to develop skills and knowledge of standard concepts in mechanics to become aware of their applications. Both the components of mechanics, namely, statics and dynamics are dealt with in this course. Study of various forces and components.

UNIT-1 **(12 Sessions)**
Velocity, Acceleration along radial and transverse directions, along tangential and normal directions.

UNIT-2 **(10 Sessions)**
Simple harmonic motion, Motion under laws of forces, Earth attraction, Elastic strings.

UNIT-3 **(08 Sessions)**
Motion in resisting medium, Constrained motion (circular and cycloidal only).

UNIT-4 **(10 Sessions)**
Motion on smooth and rough plane curves, Rocket motion, Central orbits and Kepler's law.

UNIT-5 **(10 Sessions)**
An introduction to central conicoid, Common Catenary, Centre of gravity, Virtual work.

Course Outcomes:
Students completing this course will be able to:

- Solve for the resultants & moments of any force systems and determine equivalent force systems
- Determine the internal forces in plane trusses and beams
- Solve the mechanics problems associated with friction forces
- Obtain the centroid, first moment and second moment of an area
- Describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference and analyze the forces causing the motion of a particle
- Apply work, energy, impulse and momentum relationships for a particle in motion

Suggested Readings:

1. K. P. Gupta & J. K. Goyal: Statics. Krishna publication ,Meerut
2. A. R. Vasishtha& D. C. Agarwal: Dynamics of a particle. Krishna publication.
3. S. D. Sharma & P. P. Mittal : Dynamics of a particle. Krishna publication , Meerut

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – II Year (III Semester)

BMAT-302: NUMERICAL METHODS

Objective: -The main aims of this course are to introduce a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering. The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods, along with a rudimentary understanding of finite precision arithmetic and the conditioning with stability of the various problems and methods. This will help to choose, develop and apply the appropriate numerical techniques for your problem, interpret the results, and assess accuracy

UNIT-1 **(12 Sessions)**
Approximation and errors in computations, Inherent errors, Rounding error, Truncation errors, absolute errors, Relative errors and percentage errors, Error in the approximation of a function and series, Propagation of error.

UNIT – 2 **(10 Sessions)**
Calculus of Finite Differences: Finite difference, Forward differences, Backward differences, Shift operator, Central difference operator, Averaging operator, Differential operator, Relationship between operators, Factorial notation, Missing terms technique and Separation of symbols.

UNIT - 3 **(08 Sessions)**
Interpolation with Equal Intervals: Introduction, Gregory- Newton's forward and Gregory- Newton's backward interpolation formulae
Central Differences: Central differences, Gauss's forward and Gauss's backward interpolation formulae.

UNIT - 4 **(10 Sessions)**
Interpolation with Unequal Intervals: Introduction, Divided differences, divided difference table, Newton's divided difference formula, Lagrange's interpolation formula.

UNIT - 5 **(10 Sessions)**
Numerical Differentiation: Introduction, Derivatives of Newton's forward and Newton's backward interpolation formulae.
Numerical Integration: Introduction, General quadrature formula, Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule.

Course Outcomes:
Students completing this course will be able to:
- Apply various interpolation methods and finite difference concepts
- Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations
- Work out numerical differentiation and integration whenever and wherever routine methods are not applicable

Suggested Readings:

1. V. Rajaraman: Computer Oriented Numerical Methods, PHI.
2. Gupta&Malik: Numerical Analysis",
3. B. S.Grewal: Numerical methods in Engineering and Science, Khanna Publishers, Delhi.
4. Pradeep Niyogi: Numerical Analysis and Algorithms, TMH.

Website Sources:
- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – II Year (IV Semester)

BMAT-401: DISCRETE STRUCTURES

Objective: -The main aims of this course are to prepare students to develop mathematical foundations to understand and create mathematical arguments require in learning many mathematics and computer sciences courses. To motivate students how to solve practical problems using discrete mathematics. Also, in this course basic concepts of Graph theory such as Trees, Eulerian Graphs, Vertex colorings.

UNIT – 1 **(12 Sessions)**
Relations and Functions : Sets, Product sets, Relations, Composition of relations, Types of relations, Equivalence Relation, Function, Types of functions, Injective, Surjective, Bijective, Inverse function, Composition of functions, Recursively defined functions.

UNIT – 2 **(10 Sessions)**
Propositional Calculus: Propositions, Compound propositions, Basic logical operations, Tautologies and Contradictions, Logical equivalence, Algebra of propositions, Conditional and Biconditional statements, Normal forms, Arguments and Mathematical induction.

UNIT – 3 **(08 Sessions)**
Boolean Algebra: Definition, Laws of Boolean algebra, Duality, Logic gates, Boolean Expressions, Normal forms, *K*-maps for two, three and four variables.

UNIT – 4 **(10 Sessions)**
Combinatorics: Basic counting principles, Permutation, Combinations, Binomial coefficients, Inclusion-Exclusion principle, and discrete numeric function, Generating function, Recurrence relations.

UNIT – 5 **(10 Sessions)**
Graph Theory: Graph, Finite and Infinite graphs, Trivial graph, Degree of a vertex, Null graph, Subgraph, Connected and Disconnected graphs, Directed graph, Paths, Cycles, Regular graph, Planar graph, Euler's formula, Eulerian and Hamiltonian graphs.
Trees: Tree, Forest, Rooted tree, Properties of trees, Level, Height, Path length of tree.

Course Outcomes:
Students completing this course will be able to:

- Write an argument using logical notation and determine if the argument is or is not valid.
- Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
- Understand the basic principles of sets and operations in sets.
- Apply counting principles to determine probabilities.
- Demonstrate an understanding of relations and functions and be able to determine their properties.
- Demonstrate different traversal methods for trees and graphs.

Suggested Readings:

1.J.P. Tremblay and R.P. Manohar: Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill Publishing company Limited, New Delhi , 1989.

2.SeymourLipschutz and Marc Lars Lipson: Discrete Mathematics, Tata McGraw-Hill Publishing company Limited, New Delhi.

3. N. Deo, "Graph Theory with application to Engineering and Computer Science," PHI.

4. Swapan Kumar Sarkar: A text book of discrete mathematics, S. Chand & Company Pvt. Ltd. New Delhi.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – II Year (IV Semester)

BMAT-402: REAL ANALYSIS

Objective: - The main aims of this course real analysisare to provide students with the special knowledge which necessary for basic concepts in real analysis, it strives to enable students to learn basic concepts about functions of bounded variation grasp basic concepts about the uniform convergence of sequences and series of functions, total variation and learn about Riemann integrals.

UNIT-1 **(12 Sessions)**
Countability of Z and Q, Order properties of Q and its order incompleteness, Construction of R from Q using Dedekind cuts, Order completeness of R, The least upper bound property and equivalent conditions including the nested interval property, Unaccountability of R Bounds, Bounded sets and their properties, Sup and inf of sets, Bolzano-Weierstrass theorem.

UNIT-2 **(10 Sessions)**
Sequences, Bounded sequences, Monotone sequences and their convergence, Limsup and liminf and convergence criterion using them, Subsequences, Cauchy sequences and their convergence criterion.

UNIT-3 **(08 Sessions)**
Interior points and limit points, Open, Closed, and Perfect sets.

UNIT-4 **(10 Sessions)**
Limits and continuity, Basic properties of continuous functions, Operations on sequences, Uniform continuity, Bounded functions, Intermediate Value Theorem, Discontinuities, Monotonic functions.

UNIT-5 **(10 Sessions)**
Infinite series and their convergence, Geometric series, The comparison test, Series of non-negative terms, The condensation test, Integral test, Ratio and root tests, Absolute and conditional convergence, Alternating series and Leibnitz's theorem.

Course Outcomes:
Students completing this course will be able to:

- Describe the basic differences between the rational and the real numbers.
- Understand and perform simple proofs
- Answer question concerning uniform convergence of concrete numerical sequences and series
- Give the definition of concepts related to metric spaces, such as continuity, compactness, completeness and connectedness
- Give the essence of the proof of Stone-Weierstrasstheorem, the contraction theorem as well as the existence of convergent subsequences using equicontinuity.

Suggested Readings:

1. Malik & Arora: Mathematical Analysis, New Age Publication ,New Delhi
2. N.R. Gupta: Real Analysis, Pearson Education Ltd
3. Tom M. Apostol: Mathematical Analysis, Addison-Wesley Publishing Company
4. Walter Rudin: Principles of Mathematical Analysis, McGraw-Hill.
5. Richard R. Goldberg : Methods of Real Analysis, Oxford and IBH

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – III Year (V Semester)

BMAT-501: LINEAR ALGEBRA

Objective: - The main aims of this courseare to enables the students to understand the basic ideas of vector algebra, linear dependent and independent set, basis, the fundamental properties of eigenvalue, eigenvectors of a linear transformation various types of real quadratic forms and their applications to be familiar with the notion of inner product space and orthogonal vectors.

UNIT-1 **(10 Sessions)**
Theory of sets, Relations and functions, Binary composition, Vector spaces and their elementary properties.

UNIT-2 **(10 Sessions)**
Subspaces, Linear dependence and independence, Spanning set, Basis and dimension, direct sum, Quotient space.

UNIT-3 **(12 Sessions)**
Linear transformations and their algebra, Range and null space, Rank and nullity, Rank-nullity theorem, Matrix representation of linear transformations, Change of basis.

UNIT-4 **(08 Sessions)**
Linear functions, Dual space, Bi-dual space, Natural isomorphism, Annihilators, Bilinear and quadratic forms.

UNIT-5 **(10 Sessions)**
Inner product spaces, Cauchy-Schwarz's inequality, Bessel's inequality and orthogonality, Hermitian, Unitary, Normal transformations and their diagonalizations.

Course Outcomes:
Students completing this course will be able to:

- Define basic terms and concepts of matrices, vectors and complex numbers
- Use of various forms of complex numbers to solve numerical problems
- Apply the matrix calculus in solving a system of linear algebraic equations
- Calculate the area of planar shapes (triangle, parallelogram) and the volume of parallelepiped using vector algebra

Suggested Readings:

1. A. R. Vashistha: Linear Algebra, , Krishna Publication, Meerut.
2. N. P. Balli: Linear Algebra, , Golden Book.
3. Hoffmann Kunze: Linear Algebra, PHI Learning Pvt.
4. David C. Lay: Linear Algebra and its applications,, Pearson India.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – III Year (V Semester)

BMAT-502: LINEAR PROGRAMMING

Objective: -The main aims of this courseare to help in solving problems in different environments that needs decisions to formulate linear programming. This module aims to introduce students to use quantitative methods and techniques effective for assignment and transportation problems, game theory, model formulation and applications that are used in solving business decision problems as well as various fields of science.

UNIT – 1 **(10 Sessions)**
Linear Programming Problems: Definition of Linear Programming(LP), Terminology and requirements of LP, Advantages of LP, Limitations of LP, Application areas of LP, General mathematical formulation of LPP, Graphical method for solving LPP, Simplex method, and Big-M method.

UNIT – 2 **(10 Sessions)**
Duality in Linear Programming: Definition, Formulation of dual problems, Advantages of duality, Characteristics of dual problem, Construction of the dual problem, Solution of the prime and dual problems and Dual simplex method.

UNIT – 3 **(12 Sessions)**
Transportation Problem: Definition, Transportation models, Linear programming formulation of transportation problem, Method for finding the initial solution by North -West corner method, least cost entry method, Row minima method, Column minima Method, Vogel's approximation method, unbalanced problem, Degeneracy problem, Test for optimality.

UNIT – 4 **(10 Sessions)**
Assignment Problems: Definition, Assignment models, Hungarian method of assignment problem (minimization case), Maximization case in assignment problem, unbalanced assignment problem and Restrictions on assignments.
Job Sequencing Problem: Definition, Notations, Terminology, Assumptions, Processing *n* jobs through two machines, processing*n* jobs through three machines, processing*n* jobs through *m* machines.

UNIT – 5 **(08 Sessions)**
Game Theory:Definition, Pay-off, Types of games, The maximine - minimax principle, Principles of dominance, Games without saddle points (Mixed strategies), Solution of games by Graphical method and Linear programming method.

Course Outcomes:
Students completing this course will be able to:

- Formulate real-world problems as a linear programming model and describe the theoretical workings of the graphical and simplex method todemonstrate the solution process .
- Explain the relationship between a linear program and its dual, including strong duality
- Formulate specialized linear programming problems, namely transportation and assignment problems
- Demonstrate solution methods including graphs and linear programming to analyze and solve the Two-person, zero-sum games

Suggested Readings:

1. H. A. Taha: Operations Research An introduction, Macmillan.
2. J. K. Sharma: Operations Research Theory and Applications, Macmillan India Ltd.
3. V. K. Kapoor: Operations Research, Sultan Chand and Sons, New Delhi.
4. S. D. Sharma: Operations Research ,Kedarnath&Ramnath and Company.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – III Year (VI Semester)

BMAT -601: COMPLEX ANALYSIS

Objective: The main aims of this course are to introduce the fundamental ideas of the functions of complex variables and developing a clear understanding of the fundamental concepts of Complex Analysis such as analytic functions, complex integrals and a range of skills which will allow students to work effectively with the concepts of analysis and evaluation.

UNIT-1 **(12 Sessions)**

Functions of a complex variable, Analytic function, Necessary and sufficient conditions of analytic function, C-R equations (Cartesian and polar forms), Harmonic functions, Milne's Thomson method, Orthogonal system.

UNIT-2 **(10 Sessions)**

Mapping by elementary function, Linear and bilinear transformation, fixed point, Cross ratio, Critical point.

UNIT-3 **(10 Sessions)**

Complex integration, Line integral, Cauchy fundamental theorem, Cauchy's integral formula, Cauchy's integral formula for higher derivatives, Liouville theorem, Taylor and Laurent series.

UNIT-4 **(08 Sessions)**

Singularities and zeros of an analytic function, Rouche's theorem, Fundamental theorem of algebra.

UNIT-5 **(10 Sessions)**

Cauchy residue theorem, Jordan lemma, Calculus of residues-integration round the unit circle, Evaluation of improper integrals, Poles lie on the real axis.

Course Outcomes:

Students completing this course will be able to:

- Becoming familiar with the concepts Complex numbers and their properties and operations with Complex number.
- Finding domain and range of complex functions and sketching their graphs.
- Evaluating limits and checking the continuity of complex function.
- Checking differentiability and Analyticity of functions.
- Evaluate Complex integrals and applying Cauchy integral.

Suggested Readings:

1. Rule V. Churchill: Complex Variables and Applications, TMH Publication.
2. T.Path: Function of Complex Variable, PothisalaPvt.Ltd, Allahabad.
3. A. R. Vasistha: Complex Analysis, Krishna Prakashan Media (P) Ltd, Meerut.
4. Conway: Complex of one variable,Nrosa Publication.
5. Kasana: Complex variable, Theory and Application, PHI Publication.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (PCM) Programme
B.Sc. (PCM) – III Year (VI Semester)

BMAT -602:DIFFERENCE EQUATIONS

Objective: -The main aims of this course are to understand application of sequences and series of numbers and functions, partial difference equations, Discrete boundary value problem, Application with different engineering problem, Discrete mathematical models.

UNIT-1 **(10 Sessions)**
Introduction, Difference Calculus – The Difference Operator Summation, Generating functions a approximate summation.
Linear Difference Equations – First order equations, General results for linear equation. Equations with constant coefficients Applications, Equations with variable coefficients,nonlinear equations that can be linearized and the z-transform.

UNIT-2 **(10 Sessions)**
Stabilty Theory- Initial value problems for linear systems, Stability of linear systems, Stability of nonlinear systems, Chaotic behavior.
Asymptotic methods – Introduction, Asymptotic analysis of sums, Linear equations, Nonlinear equations.

UNIT-3 **(10 Sessions)**
The self-adjoint second order linear equation – Introduction Sturmian Theory, Greens functions, Disconjugacy, The Riccati Equations and Oscillation.
The Sturm-Liouville problem- Introduction, Finite Fourier Analysis, A non-homogeneous problem.

UNIT-4 **(08 Sessions)**
Discrete Calculus of variations- Introduction, Necessary conditions, Sufficient conditions and Disconjugacy.

UNIT-5 **(10 Sessions)**
Boundary Value Problems for Nonlinear equations- Introduction, The Lipschitz case, Existence of solutions, Boundary value Problems for differential Equations, Partial differential Equations, Discretization of Partial Differential Equations, Solution of partial differential equations.

Course Outcomes:
Students completing this course will be able to:

- Apply the theory to study the qualitative theory of solutions of difference equations and partial difference equations of higher order.
- Apply the theory to study the quantitative and qualitative study of solutions of different discrete models in Engineering.
- Difference between the qualitative and quantitative behavior of solutions of the difference equations and the corresponding differential equations.
- Apply the theory to study the solution in discrete boundary value problems.

Suggested Readings:

1. M. D. Rai Singhaniya : Differential equations, S. chand Publications.
2. Difference equations :Schaum'sOutlines, TMH.
3. Fulford Glenn R. : Modelling with Differential and Difference Equations, Cambridge University Press.
4. Youssef N.Raffoul : Qualitative Theory of Volterra Difference Equations, Springer International Publishing AG.
5. Hyun-Ku Rhee, Rutherford Aris, Neal R. Amundson:First-Order Partial Differential Equations, Vol. 1 (Dover Books on Mathematics) Kindle Edition.

Website Sources:

- www.pdfdrive.com
- www.dmi.gov.in
- www.yourarticlelibrary.com
- onlinecourses.nptel.ac.in
- en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.