FYUGP

PHYSICS MINOR PAPERS FROM DISCIPLINE-1

&

VOCATIONAL STUDIES/ DISCIPLINE-2

FOR UNDER GRADUATE COURSES UNDER

BINOD BIHARI MAHTO KOYALANCHAL UNIVERSITY, DHANBAD

Implemented from
Academic Session 2023-2027

30/4/24

30/4/24 30/4/2024 30/04/24

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Members of Board of Studies of FYUGP Syllabus as per Guidelines of the Binod Bihari Mahto Koyalanchal University, Dhanbad

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COURSE STUCTURE FOR FYUGP **'HONOURS/ RESEARCH'**

Table 1: Credit Framework for Four Year Undergraduate Programme (FYUGP) under State Universities of Jharkhand [Total Credits =160]

Level of Courses	Semester	MJ: Discipline specific courses-Core or Major (80)	MN: Minor from discipline (16)	MN: Minor from vocational (16)	MDC: Multidisciplinary Courses [Life Sciences, Physical Sciences, Mathematical and Computer Sciences, Data Analysis, Social Sciences, Humanities, etc.] (9)	AEC: Ability Enhancement Courses (Modern Indian Language and English (8)	SEC: Ability Enhancement Courses (9)	VAC: Value added Courses (6)	IAP: Internship / Dissertation (4)	RC: Research Courses (12)	AMJ: Advanced Courses in lieu of Research (12)	Credits	Double Major (DMJ)
1	2	3	4	5	6	7	8	9	10	11	12	13	14
100-199: Foundation or Introductory courses	I	4	4		3	2	3					20	4+4
	II	4+4		4	3	2	3					20	4+4
Exit Point: Undergraduate Certificate provided with Summer Internship/Project (4 credits)													
200-299: Intermediate level courses	III	4+4	4		3	2	3					20	
	IV	4+4+4		4		2		2				20	4+4
Exit Point: Undergraduate Diploma certificate provided with Summer Internship and Project/ Year Project (4 credits)													
300-399: Higher level courses	V	4+4+4	4						4			20	4+4
	VI	4+4+4+4		4								20	4+4
Exit Point: Bachelor's Degree													
400-499: Advanced courses	VII	4+4+4+4	4									20	4+4
	VIII	4		4						12	4+4+4	20	4+4
Exit Point: Bachelor's Degree with Hons. /Research												160	224

Note: Honours Students not undertaking research will do 3 courses for 12 credits in lieu of a Research project /Dissertation

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Session 2023-2027 onwards

SEMESTER WISE COURSES OF STUDY FOR FOUR YEAR UNDERGRADUATE PROGRAMME **2023 onwards**

Table 2: Semester wise Course Code and Credit Points:

Semester	Common, Introductory, Major, Minor, Vocational & Internship Courses		
	Code	Papers	Credits
I	AEC-1	Language and Communication Skills (Modern Indian language including TRL)	2
	VAC-1	Value Added Course-1	4
	SEC-1	Skill Enhancement Course-1	3
	MDC-1	Multi-disciplinary Course-1	3
	MN-1A	Minor from Discipline-1	4
	MJ-1	Major paper 1 (Disciplinary/Interdisciplinary Major)	4
II	AEC-2	Language and Communication Skills (English)	2
	SEC-2	Skill Enhancement Course-2	3
	MDC-2	Multi-disciplinary Course-2	3
	MN-2A	Minor from Vocational Studies/Discipline-2	4
	MJ-2	Major paper 2 (Disciplinary/Interdisciplinary Major)	4
	MJ-3	Major paper 3 (Disciplinary/Interdisciplinary Major)	4
III	AEC-3	Language and Communication Skills (Modern Indian language including TRL)	2
	SEC-3	Skill Enhancement Course-3	3
	MDC-3	Multi-disciplinary Course-3	3
	MN-1B	Minor from Discipline-1	4
	MJ-4	Major paper 4 (Disciplinary/Interdisciplinary Major)	4
	MJ-5	Major paper 5 (Disciplinary/Interdisciplinary Major)	4
IV	AEC-3	Language and Communication Skills (MIL-2/English-2)	2
	VAC-2	Value Added Course-2	2
	MN-2B	Minor from Vocational Studies/Discipline-2	4
	MJ-6	Major paper 6 (Disciplinary/Interdisciplinary Major)	4
	MJ-7	Major paper 7 (Disciplinary/Interdisciplinary Major)	4
	MJ-8	Major paper 8 (Disciplinary/Interdisciplinary Major)	4
V	MN-1C	Minor from Discipline-1	4
	MJ-9	Major paper 9 (Disciplinary/Interdisciplinary Major)	4
	MJ-10	Major paper 10 (Disciplinary/Interdisciplinary Major)	4
	MJ-11	Major Paper 11 (Disciplinary/Interdisciplinary Minor)	4
	IAP	Internship/Apprenticeship/ Field work / Dissertation/ Project	4
VI	MN-2C	Minor from Vocational Studies/Discipline-2	4
	MJ-12	Major paper 12 (Disciplinary/Interdisciplinary Major)	4
	MJ-13	Major paper 13 (Disciplinary/Interdisciplinary Major)	4
	MJ-14	Major Paper 14 (Disciplinary/Interdisciplinary Minor)	4
	MJ-15	Major Paper 15 (Disciplinary/Interdisciplinary Minor)	4
VII	MN-1D	Minor from Discipline-1	4
	MJ-16	Major paper 16 (Disciplinary/Interdisciplinary Major)	4
	MJ-17	Major paper 17 (Disciplinary/Interdisciplinary Major)	4
	MJ-18	Major Paper 18 (Disciplinary/Interdisciplinary Minor)	4
	MJ-19	Major Paper 19 (Disciplinary/Interdisciplinary Minor)	4
VIII	MN-2D	Minor from Vocational Studies/Discipline-2	4
	MJ-20	Major paper 20 (Disciplinary/Interdisciplinary Major)	4
	RC/I	Research Internship/Field work/Dissertation	12/4
	AMJ-1	Advanced Major Paper-1 (Disciplinary/Interdisciplinary Major)	4
	AMJ-2	Advanced Minor Paper-2 (Disciplinary/Interdisciplinary Major)	4
	AMJ-3	Advanced Minor Paper-3 (Disciplinary/Interdisciplinary Major)	4
		Total Credits	160

Abbreviations:

AEC Ability Enhancement Courses

SEC Skill Enhancement Courses

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IAP Internship/Apprenticeship/ Project
MDC Multidisciplinary Courses
MJ Major Disciplinary/Interdisciplinary Courses
DMJ Double Major Disciplinary/Interdisciplinary Courses
AMJ Advance Major Disciplinary/Interdisciplinary Courses
MN Minor Disciplinary/Interdisciplinary Courses
RC Research Courses

AEC (Ability enhancements courses)- 2 Credits

- *Full marks – 50, Pass Marks – 20*
- *In AEC the students of all faculties will have to select either Hindi or English in Semester -1 and those students who have opted Hindi will have to select English as AEC in Semester -2 and vice versa. For 3rd and 4th semester student can opt Sanskrit, Urdu, Bengali, English, Hindi or TRL.*
- *In 4th semester there will be AEC-3 will include Language and Communication Skill in Hindi and English.*
- *No internal examination will be conducted.*

VAC (Value added Courses)- 2 Credits

- *Full marks – 50, Pass Marks – 20*
- *For 1st semester – "Understanding India"*
- *For 4th Semester – "Environmental Studies"*
- *No internal examination will be conducted.*

SEC (Skill Enhancement Courses) – 3 Credits

- *Full Marks – 75, Pass Marks – 30*
- *Digital Education or Mathematical & Computational Thinking Analysis is selected as SEC. Student will have to select or opt either of the two subjects for semester – I, II and III in no case both subject will be allowed to opt.*
- *No internal examination will be conducted.*

MDC (Multidisciplinary Courses) – 3 credits

- *Full Marks – 75, Pass Marks – 30*
- *A student will study three different subjects in the multidisciplinary courses during first three semesters.*
- *No internal examination will be conducted.*

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Table3: Semester wise Course Code and Credit Points and Marks distribution of Minor Papers from Discipline-1:

S.N.	Semester	Papers	Credit	Full Marks		Pass Marks	
				Theory (Internal+ End Sem)	Practical End Sem	Theory (Internal+ End Sem	Practical
1.	I	MN-1A	3+1	15+60	25	30	10
2.	III	MN-1B	3+1	15+60	25	30	10
3.	V	MN-1C	3+1	15+60	25	30	10
4.	VII	MN-1D	3+1	15+60	25	30	10

- *No internal or mid semester examination will be conducted for practical papers.*

Table 4: Semester wise Course Code and Credit Points and Marks distribution of Minor Papers from Vocational Studies/Discipline-2:

S.N.	Semester	Paper	Credits	Full Marks		Pass Marks	
				Theory (Written test)	Practical/ Demonstration/ Skill test & Viva voce	Theory	Practical/ Demonstration/ Skill test & Viva voce
1.	II	MN-2A	4	75	25	30	10
2.	IV	MN-2B	4	75	25	30	10
3.	VI	MN-2C	4	75	25	30	10
4.	VIII	MN-2D	4	75	25	30	10

- *No internal or mid semester examination will be conducted.*

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SEMESTER WISE COURSES IN PHYSICS FOR FYUGP **2023 onwards**

Table 5: Semester wise Papers and Examination Structure for Physics Minor from Discipline-1:

Semester	Code	Minor Papers	Credits	Full Marks		Pass Marks	
				Theory (Internal+ End Sem)	Practical/ End Sem	Theory (Internal+ End Sem	Practical End Sem
I	MN-1A	Mechanics	3+1	15+60	25	30	10
III	MN-1B	Electricity & Magnetism	3+1	15+60	25	30	10
V	MN-1C	Thermal Physics and Statistical Mechanics	3+1	15+60	25	30	10
VII	MN-1D	Waves & Optics	3+1	15+60	25	30	10

Table 6: Semester wise Papers and Examination Structure for Physics Minor from Vocational Studies/Discipline-2:

Semester	Code	Minor Papers	Credits	Full Marks		Pass Marks	
				Theory (Written test)	Practical/ Demonstration / Skill test & Viva voce	Theory	Practical/ Demonstration / Skill test & Viva voce
II	MN-2A	Energy Sources	4	75	25	30	10
IV	MN-2B	Basic Instrumentation Skills	4	75	25	30	10
VI	MN-2C	Optical Instruments	4	75	25	30	10
VIII	MN-2D	Digital Systems	4	75	25	30	10

MINOR PAPERS FROM DISCIPLINE-1

SEMESTER I

PHYSICS-MN-1A : MECHANICS

(Credits: Theory-03, Practicals-01)

MN-1A: Theory

Credits: 03 Lectures: 45

Marks: 75 [End Semester Examination (ESE) =60 + Internal Examination =10 + Class Performance & Attendance =05] Pass Marks (Internal + End Semester) = 40

Instruction to Question Setter for
Semester Internal Examination (SIE 10 marks):
*There will be two group of questions. Question No.1 will be **very short answer type in Group A** consisting of five questions of 1 mark each. **Group B will contain descriptive type** two questions of five marks each, out of which any one to answer.*

End Semester Examination (ESE 60 marks):
*There will be **two** group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 & 3 will be short answer type** of 5 marks. **Group B will contain descriptive type** three questions of fifteen marks each, out of which any three are to answer.*
***Note:** There may be subdivisions in each question asked in Theory Examinations.*

COURSE OBJECTIVE

- This course begins with the review of Vectors and Differential equations and ends with the Special Theory of Relativity. Students will also appreciate the Gravitation, Elasticity, Surface tension, Viscosity and Oscillations.
- The emphasis of this course is to enhance the basics of mechanics. By the end of this course, students should be able to solve the seen or unseen problems/numericals in vectors, differential equations and mechanics and some properties of matter.

COURSE LEARNING OUTCOMES

Upon completion of this course, students are expected to understand the following concepts which would help them to appreciate the application of the fundamental concepts to the analysis of simple, practical situations related to the real world:

- Understand the role of vectors and coordinate systems in Physics.
- Learn to solve Ordinary Differential Equations: First order, Second order Differential Equations with constant coefficients.
- Understand laws of motion and their application to various dynamical situations.
- Apply Kepler's law to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.
- Explain the phenomenon of simple harmonic motion.

- Understand special theory of relativity - special relativistic effects and their effects on the mass and energy of a moving object.
- In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, vernier callipers, Travelling microscope) student shall embark on verifying various principles learnt in theory. Measuring 'g' using Bar Pendulum, Kater's pendulum and measuring elastic constants of materials, viscous properties of liquids etc.

SKILLS TO BE LEARNED

- Learn the concepts of vector calculus.
- Learn the concepts of elasticity of solids and viscosity of fluids.
- Develop skills to understand and solve the equations of Newtonian gravity and central force problem.
- Acquire basic knowledge of oscillation.
- Have an understanding of basic concepts of Special Theory of Relativity.

COURSE CONTENT

Vector Analysis: Triple Scalar product, Triple Vector product, gradient, divergence, Curl and their physical significance, scalar and vector fields, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem. **(10 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients. **(4 Lectures)**

Central force field: Motion of a particle in a central force field –two body problem. Kepler's Laws and their deduction. **(4 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. **(4 Lectures)**

Elasticity: Elastic constants and their interrelations, Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion, Torsional pendulum. **(8 Lectures)**

Fluids: Surface Tension: Excess of pressure - Application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature. Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of liquid with temperature. **(8 Lectures)**

Special Theory of Relativity: Galilean transformations. Postulates of Special Theory of Relativity. Lorentz transformation, Length contraction. Time dilation. Relativistic addition of velocities. **(7 Lectures)**

Reference Books:

1. Mathematical Physics, H K Das and Dr. Rama Verma, S. Chand and Company Limited.
2. Mathematical Physics, B D Gupta, Vikash Publishing House, 4th edition.
3. Mathematical Physics, B.S. Rajput, Pragati Prakashan, 21st Edition, 2009.

4. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed., 2012, Jonesand Bartlett Learning.
5. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
6. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley.
7. Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
8. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley.
9. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
10. Elements of Properties of Matter, D. S. Mathur, S. Chand Publication.
11. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
12. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
13. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
14. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning
15. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
16. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
17. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
18. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
19. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
20. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

Additional Books for Reference

1. Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
2. University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
3. Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010,
a. Cengage Learning
4. Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

MN-1A: Practical

Credit: 01 Lectures: 30 (15X2)

Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination will be as per the following guidelines:

Experiment	60 marks
Practical record notebook	10 marks
Viva-voce	30 marks

1. To measure the diameter of a thick wire using vernier caliper.
2. To measure the diameter of a thick wire using screw gauge.
3. To measure the diameter of a thick wire using travelling microscope.
4. To study the random error in observations.
5. To study the Motion of Spring and calculate (a) Spring constant, (b) g .
6. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille'smethod).
7. To determine the Young's Modulus of a Wire by suitable method.
8. To determine the Modulus of Rigidity of a Wire by suitable method.
9. To determine the elastic Constants of a wire by Searle's method.
10. To determine the value of g using Bar Pendulum.
11. To determine the value of g using Kater's Pendulum.

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Reference Books:

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia PublishingHouse
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Edn, 2011, KitabMahal
4. B.Sc. Practical Physics, N. N. Ghosh, Bharati Bhawan Publishers.
5. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company, 19th Edition, 1995, Reprint 2014.
6. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt.Ltd.
7. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

SEMESTER III

PHYSICS- MN-1B: THEORY ELECTRICITY & MAGNETISM

(Credits: Theory-03, Practicals-01)

MN-1B: Theory

Credits: 03 Lectures: 45

Marks: 75 (End Semester Examination-60, Internal Examination-10, Attendance & Class Performance-5 Attendance =05) Pass Marks (Internal + End Semester) = 40

Instruction to Question Setter for

Semester Internal Examination (SIE 10 marks):

There will be two group of questions. Question No.1 will be ***very short answer type in Group A*** *consisting of five questions of 1 mark each.* ***Group B will contain descriptive type*** *two questions of five marks each, out of which any one to answer.*

End Semester Examination (ESE 60 marks):

There will be two group of questions. ***Group A is compulsory*** *which will contain three questions.* ***Question No.1 will be very short answer type consisting of*** *five questions of 1 mark each.* ***Question No.2 & 3 will be short answer type of*** *5 marks.* ***Group B will contain descriptive type*** *two questions of three marks each, out of which any three are to answer.*

Note: *There may be subdivisions in each question asked in Theory Examinations.*

COURSE OBJECTIVE

This course begins with static electric field and magnetic field. By the end of the course student should have in depth knowledge of electrostatics and magnetostatics, learn about Faraday's and Len'z laws of electromagnetic induction and also appreciate Maxwell's equations.

COURSE LEARNING OUTCOMES

At the end of this course, students will be able to

- Demonstrate Gauss law, 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.
- 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.
- Articulate knowledge of electric current, resistance and capacitance in terms of electric field and electric potential.

- Demonstrate a working understanding of capacitors
- Calculate the magnetic forces that act on moving charges and the magnetic fields due to currents (Biot- Savart and Ampere laws)
- Have brief idea of dia-, para- and ferro-magnetic materials
- Understand the concepts of induction and self-induction, to solve problems using Faraday's and Lenz's laws
- Have an introduction to Maxwell's equations
- In the laboratory course the student will get an opportunity to verify various laws in electricity and magnetism.
- Should be able to verify of various circuit laws, network theorems elaborated above, using simple electric circuits.

SKILLS TO BE LEARNED

- This course will help in understanding basic concepts of electricity and magnetism and their applications.
- He / she shall comprehend the role of Maxwell's equation in unifying electricity and magnetism.
- Enable the student to understand propagation of electromagnetic waves through different bound and unbound media.

COURSE CONTENT

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. **(20 Lectures)**

Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro- magnetic materials. **(10 Lectures)**

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. **(5 Lectures)**

Maxwell's equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves. **(10 Lectures)**

Reference Books:

1. Classical Electromagnetism , H.C. Verma, Bharati Bhawan (Publishers & Distributors); First Edition (1 February 2022).
2. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
3. Electricity & Magnetism, J.H. Fewkes&J.Yarwood. Vol. I, 1991, Oxford Univ. Press
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Introduction to Electrodynamics, D.J.Griffiths, 3rd Edn, 1998, Benjamin Cummings.

7. Electromagnetic Theory and electrodynamics Satyaprakash, , Kedar Nath Ram Nath Publishers
8. Electricity and Magnetism, K.K.Tiwari, S Chand Publishers.
9. Elements of Electromagnetics, M.N.O. Sadiku, 2001, Oxford University Press.
10. Introduction to Electromagnetic Theory, T.L. Chow, 2006, Jones & Bartlett Learning.
11. Fundamentals of Electromagnetics, M.A.W. Miah, 1982, Tata McGraw Hill.
12. Electromagnetic field Theory, R.S. Kshetrimayun, 2012, Cengage Learning.
13. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer.
14. Electromagnetic Fields & Waves, P.Lorrain&D.Corson, 1970, W.H.Freeman& Co.
15. Electromagnetics, J.A. Edminster, Schaum Series, 2006, Tata McGraw Hill.
16. Electromagnetic Theory, Chopra and Agarwal, K. Nath& Co., Meerut.
17. Electromagnetic Theory and electrodynamics, Satyaprakash, , KedarNath Ram Nath Publishers
18. Electricity and Magnetism, K.K.Tiwari, S Chand Publishers.
19. Electromagnetic field theory fundamentals, B. Guru and H. Hiziroglu, 2004, Cambridge University Press.

MN-1B:Practical

Credit: 01 Lectures: 30(15X2)

Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination will be as per the following guidelines:

Experiment	*= 15 marks*
Practical record notebook	*= 05 marks*
Viva-voce	*= 05 marks*

1. To find the value of a resistor and its tolerance by colour coding.
2. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
3. To study the characteristics of a series RC Circuit.
4. To verify the laws of combination (series and parallel) of resistances using a metre bridge.
5. To determine an unknown Low Resistance using Potentiometer.
6. To verify Ohm's law for the given unknown resistance.
7. To verify the Thevenin theorem.
8. To verify the Norton theorem.
9. To verify the Superposition theorem.
10. To verify Maximum power transfer theorem.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia PublishingHouse.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed., 2011, KitabMahal
4. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, 2010, Springer
5. B.Sc. Practical Physics, N. N. Ghosh, Bharati Bhawan Publishers.
6. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company.

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SEMESTER V

PHYSICS- MN-1C: THERMAL PHYSICS AND STATISTICAL MECHANICS

(Credits: Theory-03, Practicals-01)

MN-1C: Theory

Credits: 03 Lectures: 45

Marks: 75 (End Semester Examination=60, Semester Internal Continuous Assessment=15 (Class Performance=10, Attendance =05) Pass Marks (Internal + End Semester) = 30

Instruction to Question Setter for

Semester Internal Examination (SIE 10 marks):

There will be two group of questions. Question No.1 will be very short answer type in Group A consisting of five questions of 1 mark each. Group B will contain descriptive type two questions of five marks each, out of which any one to answer.

End Semester Examination (ESE 60 marks):

There will be two group of questions. Group A is compulsory which will contain three questions. Question No.1 will be very short answer type consisting of five questions of one mark. Question No.2 & 3 will be short answer type of 5 marks. Group B will contain descriptive type two questions of three marks each, out of which any three are to answer.

***Note:** There may be subdivisions in each question asked in Theory Examinations.*

COURSE OBJECTIVE

This course will introduce Thermodynamics, Kinetic theory of gases and Statistical Mechanics to the students. The primary goal is to understand the fundamental laws of thermodynamics and its applications to various thermodynamical systems and processes.This coursework will also enable the students to understand the connection between the macroscopic observations of physical systems and microscopic behaviour of atoms and molecule through statistical mechanics.

COURSE LEARNING OUTCOMES

At the end of this course, students will

- Learn the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations. They are also expected to learn Maxwell's thermodynamic relations.
- Know the fundamentals of the kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
- Learn about the black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances.
- Learn the quantum statistical distributions, viz., the Bose-Einstein statistics and theFermi-Dirac statistics.
- In the laboratory course, the students are expected to: Measure of Planck's constant using black body radiation, determine Stefan's Constant, coefficient of thermal conductivity of a bad conductor and a good conductor, determine the temperature co- efficient of resistance, study variation of thermo emf across two junctions of a thermocouple with temperature etc.

SKILLS TO BE LEARNED

- In this course the students should be skilled in doing calculations in thermodynamics andin statistical mechanics.
- They should also be proficient in doing calculations with the kinetic theory of ideal and real gases.
- In the laboratory course, the students should acquire the skills of doing basic experiments in thermal physics with the right theoretical explanations of results there from.

COURSE CONTENT

Laws of Thermodynamics: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics (statement only), Unattainability of absolute zero. **(15 Lectures)**

Thermodynamical Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. **(8 Lectures)**

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path, Transport Phenomena: Viscosity, Conduction and Diffusion, Law of equipartition of energy and its applications to specific heat of gases; mono-atomic and diatomic gases. **(8 Lectures)**

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction from Planck's law-Rayleigh- Jeans Law, Stefan Boltzmann Law and Wien's displacement law. **(5 Lectures)**

Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity, Quantum statistics: Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics. **(9 Lectures)**

Reference Books:

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
4. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and G.L. Salinger. 1988, Narosa.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. Advanced Text Book on Heat, P. K. Chakrabarti, 10th Edition, Reprint 2015, Sreedhar Publishers.
7. Heat Thermodynamics and Statistical Physics, Brijlal, Dr. N. Subrahmanyam and P. S. Hemne, S. Chand Publishers.

MN-1C: Practical

Credit: 01 Lectures: 30(15X2)

Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination will be as per the following guidelines:

Experiment = 15 marks
Practical record notebook = 05 marks
Viva-voce = 05 marks

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers.
3. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
4. A text book on Practical Physics, K. G. Mazumdar and B. Ghosh, Sreedhar Publishers, Reprint 2016.
5. Advanced Text Book on Heat, P. K. Chakrabarti, 10th Edition, Reprint 2015, Sreedhar Publishers.
6. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
7. B.Sc. Practical Physics, N. N. Ghosh, Bharati Bhawan Publishers.
8. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company.

SEMESTER VII

PHYSICS- MN-1D: WAVES & OPTICS

(Credits: Theory-03, Practicals-01)

MN-1D: Theory

Credits: 03 Lectures: 45

Marks: 75 (End Semester Examination=60, Semester Internal Examination=10, Class Performance & Attendance =05) Pass Marks (Internal + End Semester) = 30

Instruction to Question Setter for
Semester Internal Examination (SIE 10 marks):
*There will be two group of questions. Question No.1 will be **very short answer type in Group A** consisting of five questions of 1 mark each. **Group B will contain descriptive type** two questions of five marks each, out of which any one to answer.*

End Semester Examination (ESE 60 marks):
*There will be two group of questions. **Group A is compulsory** which will contain three questions. **Question No.1 will be very short answer type** consisting of five parts of 1 mark each. **Question No.2 & 3 will be short answer type** of 5 marks. **Group B will contain descriptive type** two questions of ten marks each, out of which any three are to answer.*
***Note:** There may be subdivisions in each question asked in Theory Examinations.*

COURSE OBJECTIVE

This is one of the core courses in Physics curriculum that begins with explaining ideas of superposition of harmonic oscillations leading to physics of travelling and standing waves. This course helps in understanding forced vibrations, resonance, acoustics of buildings, Reverberation and time of reverberation - absorption coefficient. The course also provides an in depth understanding of wave phenomena of light, namely, interference, diffraction and polarization with emphasis on practical applications of the same.

COURSE LEARNING OUTCOMES

At the end of this course, students will

- Understand Simple harmonic oscillation and superposition principle.
- Understand superposition of a range of collinear and mutually perpendicular simpleharmonic motions and their applications.
- Understand the importance of classical wave equation in transverse and longitudinalwaves and solving a range of physical systems on its basis.
- Understand different types of waves and their velocities: Plane, Spherical, Transverse, Longitudinal.
- Understand Concept of normal modes in transverse and longitudinal waves: theirfrequencies and configurations.
- Understand Forced vibrations and resonance, Fourier's Theorem. Acoustics of buildings, Reverberation and time of reverberation - Absorption coefficient - Sabine's formula.
- Understand Interference as superposition of waves from coherent sources derived from same parent source.
- Demonstrate understanding of Interference experiments: Young's Double Slit, Fresnel's biprism, Llyod's Mirror, Newton's Rings, Michelson Interferometer and Fabry-Perot Interferometer
- Demonstrate basic concepts of Diffraction: Superposition of wavelets diffracted fromapertures

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- Understand Fraunhoffer Diffraction from apertures: Rectangular, Slit, Double Slit, Grating, Circular apertures.
- Demonstrate fundamental understanding of Fresnel Diffraction: Half period zones,Zone Plate, Fresnel's Integrals, Cornu's Spiral and its applications.
- Understand the phenomenon of polarization of light, production and analysis of plane, circular and elliptical polarized light.
- In the laboratory course, student will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment can be learnt first hand.
- The motion of coupled oscillators, study of Lissajous figures and behaviour of transverse and longitudinal waves can be learnt in this laboratory course.

SKILLS TO BE LEARNED

- In this course the students should understand waves motion and its properties.
- The students shall develop the skills to understand about Acoustics of buildings, Reverberation and time of reverberation
- The students shall develop an understanding on various opticalphenomena, principles, workings and applications optical instruments

COURSE CONTENT

Superposition of Two Collinear Harmonic oscillations: Linearity & Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). **(4 Lectures)**

Waves Motion: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. **(6 Lectures)**

Sound: Forced vibrations and resonance, Fourier's Theorem - Application to saw tooth wave and square wave. Acoustics of buildings, Reverberation and time of reverberation - Absorption coefficient - Sabine's formula. **(8 Lectures)**

Interference: Interference: Division of amplitude and division of wavefront. Interference in Thin films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. **(8 Lectures)**

Michelson's Interferometer: (1) Idea of form of fringes (no theory needed), (2) Determination of wavelength, (3) Wavelength difference, (4) Refractive index, and (5) Visibility of fringes. **(5 Lectures)**

Diffraction: Fraunhofer diffraction- Single slit; Double Slit. Plane Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. **(9 Lectures)**

Polarization: Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization. **(5 Lectures)**

Reference Books:

1. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
2. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
3. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
4. Oscillations & Waves, Satya Prakash, Pragati Prakashan, Meerut, Edition XI, 2019.

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5. Sound, K. Bhattacharyya, Shreedhar Prakashani, Reprint-2015.
6. A text book of Sound, M. Ghosh, S. Chand & Company, 1998.
7. A text book of Oscillations, Waves and Acoustics, M Ghosh & D Bhattacharya, S. Chand, 2016.
8. A textbook of Sound, N Subrahmanyam, Brij Lal, S, Chand, Second Edition, 2018.
9. Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
10. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
11. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications.
12. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley.
13. Introduction to Geometrical and Physical Optics, B. K. Mathur, Gopal Printing,
14. Geometrical and Physical Optics, P. K. Chakraborty, New Central Book Agancy (P) Ltd,
15. Introduction to Geometrical and Physical Optics, B. K. Mathur, Gopal Printing.
16. A Text Book on Light, B. Ghosh and K. G. Mazumdar, 5th Edn.,Reprint 2015, Sreedhar Publishers.
17. A Text Book of Optics, Dr. N. Subrahmanyam, Brijlal, Dr. M. N. Avadhanulu, S. Chand Publishers.

MN-1D: Practical

Credit: 01 Lectures: 30(15X2)

Instruction to Question Setter for
End Semester Examination (ESE):
There will be one Practical Examination of 3Hrs duration. Evaluation of Practical Examination will be as per the following guidelines:

Experiment	*= 15 marks*
Practical record notebook	*= 05 marks*
Viva-voce	*= 05 marks*

1. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ2 – T Law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster's focusing; determination of angle of prism.
5. To determine the Refractive Index of the Material of a Prism using Sodium Light.
6. To determine Dispersive Power of the Material of a Prism using Mercury Light
7. To determine the value of Cauchy Constants.
8. To determine the Resolving Power of a Prism.
9. To determine wavelength of sodium light using Fresnel Biprism.
10. To determine wavelength of sodium light using Newton's Rings.
11. To determine the wavelength of Laser light using Diffraction of Single Slit.
12. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
13. To determine the Resolving Power of a Plane Diffraction Grating.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted1985, Heinemann Educational Publishers.
3. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.
4. A text book on Practical Physics, K. G. Mazumdar and B. Ghosh, Sreedhar Publishers, Reprint 2016.

5. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
6. A Text Book on Light, B. Ghosh and K. G. Mazumdar, 5th Edn.,Reprint 2015, Sreedhar Publishers.
7. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
8. B.Sc. Practical Physics, N. N. Ghosh, Bharati Bhawan Publishers.
9. B.Sc. Practical Physics, C. L. Arora, S. Chand & Company

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MINOR PAPERS FROM VOCATIONAL STUDIES/ DISCIPLINE-2

SEMESTER II

PHYSICS-MN-2A: ENERGY SOURCES

Credits: 04 (Theory + Practical/Demonstration/ Skill test & Viva voce)

Theory + Practical/ Demonstration/ Skill test & Viva voce Marks: 100 Pass Marks = 40

Instruction to External examiner for Written Test (Theory): 75 marks
There will be two group of questions. ***Group A is compulsory*** *which will contain three questions.* ***Question No.1 will be very short answer type*** *consisting of five questions of 1 mark each.* ***Question No.2 & 3 will be short answer type*** *of 5 marks.* ***Group B will contain descriptive type*** *4 questions of 15 marks each, out of which two four are to answer.*
Note: *There may be subdivisions in each question asked in Theory Examinations.*
Practical/ Demonstration/ Skill test & Viva voce: 25 marks

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

MN-2A: Theory
Lectures: 45

COURSE CONTENT

Non-Renewable energy sources: Introduction: Energy concept-sources in general, its significance & necessity, Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources. **(7 Lectures)**

Conventional energy sources: Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues & challenges. Overview of Indian & world energy scenario with latest statistics- consumption & necessity. Need of eco-friendly & green energy & their related technology. **(8 Lectures)**

Renewable energy sources: Introduction: Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity. **(8 Lectures)**

Solar energy: Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar, cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(7 Lectures)**

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

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Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices, Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.

(8 Lectures)

Geothermal and hydro energy: Geothermal Resources, Geothermal Technologies, Hydropower resources, hydropower technologies, environmental impact of hydro power sources, Carbon captured technologies, cell, batteries, power consumption.

(7 Lectures)

Reference Books:

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

MN-2A: Practical/ Demonstration/ Skill test & Viva voce

Lectures: 30 (15X2)

Practical/ Demonstration/ Skill test & Viva Voce: 25 marks

Instruction to External examiner for End Semester Examination (ESE):

There will be one Practical/Demonstration Examination of 3Hrs duration. Evaluation of Practical/Demonstration Examination will be as per the following guidelines:

Demonstration/Experiment = 15marks
Practical/Demonstration record notebook = 05marks
Viva-voce = 05marks

1. Performance testing of solar cooker.
2. Measurement of I-V characteristics of solar cell.
3. Study the effect of input light intensity on the performance of solar cell.
4. Study the characteristics of wind.
5. Study of charge and discharge characteristics of storage battery.
6. Study of charging and discharging behaviour of a capacitor.
7. Performance estimation of a fuel cell.
8. Study of effect of temperature on the performance of fuel cell.
9. Demonstration of Training modules on Solar energy, wind energy, etc.
10. Conversion of vibration to voltage using piezoelectric materials
11. Conversion of thermal energy into voltage using thermoelectric modules.

SEMESTER IV

PHYSICS- MN-2B: BASIC INSTRUMENTATION SKILLS

Credits: 04 (Theory + Practical/ Demonstration/ Skill test & Viva voce)

Theory + Practical/ Demonstration/ Skill test & Viva voce: Marks-100 Pass Marks- 40

Instruction to External examiner for Written Test (Theory): 75 marks

There will be two group of questions. ***Group A is compulsory*** *which will contain* ***five questions*** ***Question No.1 will be very short answer type*** *consisting of* ***five questions*** *of* ***1 mark*** *each.* ***Question No.2 & 3 will be short answer type*** *of* ***5 marks.*** ***Group B will contain descriptive type*** ***two questions*** *of* ***fifteen marks*** *each, out of which* ***one from*** *are to answer.*

***Note:** There may be subdivisions in each question asked in Theory Examinations.*
Practical/ Demonstration/ Skill test & Viva voce: 25 marks

The aim of this course is to enable the students to be familiar with various aspects of instruments and also their usage through hands-on mode. This course enables students to understand the basics of measurement, measurement devices such as electronic voltmeter, Oscilloscope, signal and pulsegenerators, Impedance bridges, digital instruments etc.

MN-2B: Theory
Lectures: 45

COURSE CONTENT

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.
(5 Lectures)

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. **AC millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications and their significance. **(8 Lectures)**

Cathode Ray **Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence &chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. **(8 Lectures)**

Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. **(5 Lectures)**

Signal Generators and Analysis Instruments: Block diagram, explanation and specificationsof low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **(6 Lectures)**

Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic(balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges. **(5 Lectures)**

Digital Instruments: Principle and working of digital meters. Comparison of analog &digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.
(5 Lectures)

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time- base stability, accuracy and resolution. **(3 Lectures)**

Reference Books:

1. Text book in Electrical Technology - B L Theraja - S Chand and Co.

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

MN-2B: Practical/ Demonstration/ Skill test & Viva voce

Lectures: 30 (15X2)

Practical/ Demonstration/ Skill test & Viva Voce: 25 marks

Instruction to External examiner for End Semester Examination (ESE):

There will be one Practical/Demonstration Examination of 3Hrs duration. Evaluation of Practical/Demonstration Examination will be as per the following guidelines:

Demonstration/Experiment	= 10 marks
Practical/Demonstration record notebook	= 05 marks
Viva-voce	= 05 marks

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/ frequencycounter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

SEMESTER VI

PHYSICS- MN-2C: OPTICAL INSTRUMENTS

Credits: 04 (Theory + Practical/ Demonstration/ Skill test & Viva voce)

Theory + Practical/ Demonstration/ Skill test & Viva voce Marks: 100	Pass Marks: 40

Instruction to External examiner for Written Test (Theory): 75 marks

There will be two group of questions. ***Group A is compulsory*** *which will contain* ***three questions.*** ***Question No.1 will be very short answer type*** *consisting of* ***five questions*** *of* ***1 mark*** *each.* ***Question No.2 & 3 will be short answer type*** *of* ***5 marks.*** ***Group B will contain descriptive type*** ***six questions*** *of* ***fifteen marks*** *each, out of which* ***three*** *are to answer.*

Note: *There may be subdivisions in each question asked in Theory Examinations.*

Practical/ Demonstration/ Skill test & Viva voce: 25 marks

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The course is aimed at equipping the students with the basic understanding of Optics and various optical instruments like different types of microscopes, telescopes, spectrometer, camera and also human eye and enabling them to gain hands-on experience of using these optical instruments.

MN-2C: Theory
Lectures: 45

COURSE CONTENT

Basics of Optics: Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin), convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation. Focal and nodal points, focal length, image formation, combination of lenses, dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation. (No derivations; concepts to be discussed qualitatively). **(20 Lectures)**

Camera and microscopes: Human eye (constitution and working), Photographic camera (principle, construction and working), construction, working and utilities of

(i) Simple microscopes
(ii) Compound microscope
(iii) Electron microscopes
(iv) Binocular microscopes **(13 Lectures)**

Telescopes and Spectrometer: Construction, working and utilities of

(i) Astronomical telescopes
(ii) Terrestrial telescopes
(iii) Reflecting telescopes,

Spectrometer — Construction, working and utilities, measurement of refractive index. **(12 Lectures)**

Reference Books:

1. Galen Duree, Optics for Dummies, Wiley, 2011.
2. J. W. Blaker Optics: An Introduction for Students of Engineering, Pearson, 2015.
3. E. Hecht, Optics. Pearson. 5th Edition, 2019.
4. A K. Khurana, Theory and Practice of Optics & Refraction, Elsevier India, 2016.
5. Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
6. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
7. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
8. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley.
9. Introduction to Geometrical and Physical Optics, B. K. Mathur, Gopal Printing,
10. Geometrical and Physical Optics, P. K. Chakraborty, New Central Book Agancy (P) Ltd.
11. Introduction to Geometrical and Physical Optics, B. K. Mathur, Gopal Printing,
12. A Text Book on Light, B. Ghosh and K. G. Mazumdar, 5th Edn., Reprint 2015, Sreedhar Publishers.
13. A Text Book of Optics, Dr. N. Subrahmanyam, Brijlal, Dr. M. N. Avadhanulu, S. Chand Publishers.

MN-2C: Practical/ Demonstration/ Skill test & Viva voce
Lectures: 30 (15X2)

Practical/ Demonstration/ Skill test & Viva Voce: 25 marks

Instruction to External examiner for End Semester Examination (ESE):

There will be one Practical/Demonstration Examination of 3Hrs duration. Evaluation of Practical/Demonstration Examination will be as per the following guidelines:

Demonstration/Experiment = 15 marks
Practical/Demonstration record notebook = 05 marks
Viva-voce = 05 marks

1. Find position and size of the image in a magnifying glass and magnification.
2. Observe rain bows and understand optics. Create a rainbow.
3. Find out what makes a camera to be of good quality.
4. Observe the dispersion of light through prism.
5. Make a simple telescope using magnifying glass and lenses.
6. Learn principle of refraction using prisms.
7. Check bending of light in different substances and find out what matters here.
8. Learn about different telescopes used to see galaxies and their ranges.

SEMESTER VIII

PHYSICS- MN-2D: DIGITAL SYSTEMS

Credits: 04 (Theory + Practical/ Demonstration/ Skill test & Viva voce)

Theory + Practical/ Demonstration/ Skill test & Viva voce: Marks: 100 Pass Marks = 40

Instruction to External examiner for Written Test (Theory): 75 marks
There will be two group of questions. ***Group A is compulsory*** *which will contain* ***three questions.*** ***Question No.1 will be very short answer type*** *consisting of five questions of* ***1 mark*** *each.* ***Question No.2 & 3 will be short answer type*** *of* ***5 marks.*** ***Group B will contain descriptive type*** ***six questions*** *of* ***fifteen marks*** *each, out of which* ***four only*** *are to answer.*
Note: *There may be subdivisions in each question asked in Theory Examinations.*
Practical/ Demonstration/ Skill test & Viva voce: 25 marks

The aim of this course is to enable the students to have a basic understanding of Boolean algebra, Arithmetic Circuits, flip flops etc. and also have a hands-on experience of studying and designing various digital circuits.

MN-2D: Theory
Lectures: 45

COURSE CONTENT

Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates. **(12 Lectures)**

Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **(10 Lectures)**

Data processing circuits: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders. **(5 Lectures)**

Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors. **(8 Lectures)**

Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip- Flops, Preset and Clear operations. Race-around conditions in JK Flip-Flop, M/S J K Flip-Flop. **(10 Lectures)**

Reference Books:

1. Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011, Tata McGraw Hill.
2. Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Digital Electronics G K Kharate ,2010, Oxford University Press.
5. Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
6. Logic circuit design, Shimon P. Vingron, 2012, Springer.
7. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
8. Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill.
9. Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.
10. Digital Electronics, Floyd.
11. Digital Computer Electronics, Malvino.
12. Digital systems & Applications, Dr Umamageswari and Dr. M. Sivakumar, Vishal Publishing Co., 2022-23.

MN-2D: Practical/ Viva voce/ Demonstration/ Skill test

Lectures: 30 (15X2)

Practical/ Demonstration/ Skill test & Viva Voce: 25 marks

Instruction to External examiner for End Semester Examination (ESE):

There will be one Practical/Demonstration Examination of 3Hrs duration. Evaluation of Practical/Demonstration Examination will be as per the following guidelines:

Demonstration/Experiment	=15 marks
Practical/Demonstration record notebook	=05 marks
Viva-voce	=05 marks

1. To design a switch (NOT gate) using a transistor.
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To design a combinational logic system for a specified Truth Table.
4. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
5. To minimize a given logic circuit.
6. To study Half Adder and Full Adder and Truth Table verification.
7. To study Half Subtractor and Full Subtractor and Truth table verification.

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FORMAT OF QUESTION PAPER FOR SEMESTER INTERNAL EXAMINATIONS

Question format for **10 Marks:**

Subject/ Code

F.M. =10 **Time=1Hr.** **Exam Year**

General Instructions:

i. Group A carries very short answer type compulsory questions.
ii. Answer 1 out of 2 subjective/ descriptive questions given in Group B.
iii. Answer in your own words as far as practicable.
iv. Answer all sub parts of a question at one place.
v. Numbers in right indicate full marks of the question.

Group A **[5x1=5]**

1.
i. .....
ii. .....
iii. .....
iv. .....
v. .....

Group B

2. ..... **[5]**
3. ..... **[5]**

Note: There may be subdivisions in each question asked in Theory Examination.

Session 2023-2027 onwards

FORMAT OF QUESTION PAPER FOR END SEMESTER UNIVERSITY EXAMINATIONS

Question format for 60 Marks:

Subject/ Code

F.M. =60 **Time=3Hrs.** **Exam Year**

General Instructions:

i. Group A carries very short answer type compulsory questions.
ii. Answer 3 out of 5 subjective/ descriptive questions given in Group B.
iii. Answer in your own words as far as practicable.
iv. Answer all sub parts of a question at one place.
v. Numbers in right indicate full marks of the question.

Group A **[5x1=5]**

1.
   i. .....
   ii. .....
   iii. .....
   iv. .....
   v. .....
2. ..... [5]
3. ..... [5]

Group B

4. ..... [15]
5. ..... [15]
6. ..... [15]
7. ..... [15]
8. ..... [15]

Note: There may be subdivisions in each question asked in Theory Examination.

Question format for 75 Marks:

Subject/ Code

F.M. = 75 **Time=3Hrs.** **Exam Year**

General Instructions:

i. Group A carries very short answer type compulsory questions.
ii. Answer 4 out of 6 subjective/ descriptive questions given in Group B.
iii. Answer in your own words as far as practicable.
iv. Answer all sub parts of a question at one place.
v. Numbers in right indicate full marks of the question.

Group A **[5x1=5]**

1.
   i. .....
   ii. .....
   iii. .....
   iv. .....
   v. .....
2. ..... [5]
3. ..... [5]

Group B

4. ..... [15]
5. ..... [15]
6. ..... [15]
7. ..... [15]
8. ..... [15]
9. ..... [15]

Note: There may be subdivisions in each question asked in Theory Examination.

Sayantan Sil 30-04-2024 30/04/24 30/4/24 30/4/24 30/4/24