PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY

PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
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Criterion 1 – Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.3	Average percentage of courses having focus on employability/ entrepreneurship/ skill Development offered by the Physics

DEPARTMENT OF PHYSICS

SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

1. List of courses for the programmes in order of

S. No.	Programme Name
i.	Bachelor of Science (Physics)(Full Time)
ii.	Master of Science (Physics)(Full Time)

2. Syllabus of the courses as per the list.

Legend : Words highlighted with **Blue Color** - Entrepreneurship

Words highlighted with **Red Color** - Employability

Words highlighted with **Green Color** - Skill Development

S. No	Name of the Course	Course Code	Year of introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
	B.Sc. Physics			
1	Tamil - I	XGT101	2022-23	Skill Development
2	English - I	XGE102	2022-23	Skill Development
3	Properties of Matter and Sound	XPH103	2017-18	Employability
4	Mechanics and Relativity	XPH104	2021-22	Employability
5	Mechanics and Properties of Matter - laboratory	XPH105	2021-22	Employability
6	Algebra, Trigonometry Applications of Laplace Transforms and Fourier series	XMG106	2021-22	Employability
7	Human Ethics, Values, Rights, and Gender Equality	XUM001	2017-18	*****
8	Tamil - II	XGT201	2022-23	Skill Development
9	English - II	XGE202	2022-23	Skill Development
10	Electricity and Magnetism	XPH203	2017-18	Employability
11	Atomic Physics	XPH204	2017-18	Employability
12	Electricity and Magnetism - laboratory	XPH205	2021-22	Employability
13	Calculus and Differential Equations	XMG206	2021-22	Employability
14	Environmental Studies	XUM002	2017-18	Employability
15	Physics Workshop Skills	XPH301	2017-18	Entrepreneurship
16	Inorganic, Organic and Physical Chemistry – I	XCG302	2017-18	Employability
17	Thermal Physics and Statistical Mechanics	XPH303	2022-23	Employability
18	Basic Electronics	XPH304	2022-23	Employability
19	Volumetric and Organic Qualitative Analysis Practical – I	XCG305	2017-18	Employability
20	Disaster Management	XUM306	2017-18	*****
21	Thermal and Electronics -Lab	XPH307	2022-23	Employability
22	Electrical Circuit Network Skills	XPH401	2017-18	Employability
23	Inorganic, Organic and Physical Chemistry – II	XCG402	2017-18	Employability
24	Waves and Optics	XPH403	2022-23	Employability
25	Digital Electronics	XPH404	2022-23	Employability
26	Volumetric and Organic Qualitative Analysis –II Lab	XCG405	2017-18	Employability
27	Optics and Digital Electronics - Lab	XPH406	2022-23	Employability
28	Basic Instrumentation Skills	XPH501	2017-18	Entrepreneurship
29	Solid State Physics	XPH502A	2017-18	Employability

30	Atomic & Molecular Spectroscopy	XPH502B	2017-18	Employability
31	Nuclear and Particle Physics	XPH503A	2017-18	Employability
32	Principles of Modern Physics	XPH503B	2017-18	Employability
33	Microprocessor and C programming	XPH504A	2017-18	Employability
34	Micro Processor and Microcontroller	XPH504B	2017-18	Employability
35	Physics Practical V A	XPH505	2017-18	Employability
36	Physics Practical V B	XPH506	2017-18	Employability
37	Renewable Energy	XPH601	2017-18	Entrepreneurship
38	Relativity & Quantum Mechanics	XPH602A	2017-18	Employability
39	Material Science	XPH602B	2017-18	Employability
40	Micro Electro Mechanical System	XPH603A	2017-18	Employability
41	Numerical methods in Physics	XPH603B	2017-18	Employability
42	Physics Practical VI A	XPH604	2017-18	Employability
43	Physics Practical VI B	XPH605	2017-18	Employability
44	Project	XPH606	2017-18	Entrepreneurship
M.Sc. Physics				
1	Mathematical Methods of Physics - I	YPH101	2021-22	Employability
2	Classical Mechanics	YPH102	2021-22	Employability
3	Electronics	YPH103	2021-22	Employability
4	Numerical Methods and Computation	YPH104A	2021-22	Employability
5	Thermodynamics and Statistical Mechanics	YPH104B	2021-22	Employability
6	Instrumental Methods of Analyses	YPH104C	2021-22	Employability
7	Basic General & Electronics Laboratory	YPH105	2017-18	Employability
8	Mathematical Methods of Physics-II	YPH201	2021-22	Employability
9	Quantum Mechanics - I	YPH202	2021-22	Employability
10	Microprocessor and Microcontroller	YPH203	2021-22	Employability
11	Physics and Technology of Thin films	YPH204A	2021-22	Employability
12	Crystal Growth and Characterization Techniques	YPH204B	2017-18	Employability
13	Nanoscience and Technology	YPH204C	2021-22	Employability
14	Digital & Microprocessor Laboratory	YPH205	2021-22	Employability

15	Solid State Physics	YPH301	2017-18	Employability
16	Quantum Mechanics - II	YPH302	2021-22	Employability
17	Electromagnetic Theory	YPH303	2017-18	Employability
18	Micro Electro Mechanical Systems (MEMS)	YPH304A	2021-22	Employability
19	Solar Thermal and Photovoltaic Technology	YPH304B	2021-22	Employability
20	Industrial Electronics	YPH304C	2021-22	Employability
21	Advanced General & Electronics Laboratory	YPH305	2017-18	Employability
22	Atomic and Molecular Spectroscopy	YPH401	2021-22	Employability
23	Nuclear and Particle Physics	YPH402	2017-18	Employability
24	Project Work and Viva voce	YPH403	2017-18	Employability

Course Code	**XGT101**	L	T	P	C
Course Name	**தமிழ் - 1**	3	0	0	3
Prerequisite		L	T	P	H
C:P:A	**3:0:0**	3	0	0	3

COURSE OUTCOMES :		DOMAIN	LEVEL
After the completion of the course, students will be able to			
CO1	Recognize (அடையாளம் காணுதல்) பல்வேறு அறிஞர் பெருமக்களின் தொண்டுகளைத் தமிழ்மொழி மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO2	Choose (தெரிவு செய்தல்) பன்முகப் பரிமாணங்களின் கவிதைகளை இலக்கியங்கள் மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO3	Describe (விளக்குதல்) தமிழ் மகளிரின் உரையாடல் சிறப்புச் செய்திகளை உணர்தல்.	Cognitive	Understand
CO4	Apply (விளக்குதல்) பல்வேறு கலைத்துறைச் சார்ந்த பிரிவுகள், மண்ணின் பாடல்கள் குறித்துத் தெளிவு பெறல்.	Cognitive	Apply
CO5	Analyze (பகுத்தல்) சிறுகதைகளின் தோற்றம் மற்றும் வளர்ச்சி நிலை நாடகங்கள் - கவிதை குறித்துத் தெளிவு பெறுதல்.	Cognitive	Analyze

அலகு-1	1 தமிழ் அறிஞர்களும் தமிழ்த்தொண்டும்	9

பாரதியார், பாரதிதாசன், நாமக்கல் கவிஞர், சி.இலக்குவனார், உ.வே.சாமிநாத அய்யர், தெ.பொ.மீனாட்சி சுந்தரம், கவிமணி தேசியவிநாயகம் பிள்ளை தொடர்பான செய்திகள், சிறந்த தொடர்கள், சிறப்புப் பெயர்கள்.

அலகு-2	**கவிதைகள் (மரபுக்கவிதை, புதுக்கவிதை)**	9

மரபுக்கவிதை : முடியரசன், வாணிதாசன், சுரதா, கண்ணதாசன், உடுமலை நாராயண கவி, பட்டுக்கோட்டை கல்யாண சுந்தரம், மருதகாசி தொடர்பான செய்திகள்.
புதுக்கவிதை : ந.பிச்சமூர்த்தி, சி.சு.செல்லப்பா, மு.மேத்தா, ஈரோடு தமிழன்பன், அப்துல் ரகுமான், ஞானக்கூத்தன், ஆலந்தூர் மோகனரங்கன் தொடர்பான செய்திகள்.

அலகு-3	**உரையாடல்கள், தமிழ் மகளிரின் சிறப்பு**	9

ஜி.யு.போப் மற்றும் வீரமாமுனிவரின் தமிழ்ப்பணி, பெரியார், அண்ணா, முத்துராமலிங்கத்தேவர், அம்பேத்கர், காமராசர், மா.பொ.சிவஞானம், காயிதே மில்லத் சமுதாயத் தொண்டு.
அன்னி பெசண்ட் அம்மையார், மூவாலூர் ராமாமிர்தம்மாள், டாக்டர் முத்துலட்சுமி ரெட்டி, வேலுநாச்சியார், வள்ளியம்மை, ராணி மங்கம்மாள் சிறப்பு.

அலகு-4	**நாட்டுப்புறப்பாடல்**	9

தாலாட்டுப்பாடல், தொழில் பாடல், ஒப்பாரிப் பாடல்.

அலகு-5	**இலக்கிய வரலாறு**	9

உரைநடை, சிறுகதை, நாடகம், கவிதைகள்.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	45	---	---	45

பாட நூல்கள்:

1 முனைவர் கா.செல்வகுமார் (தொ.ஆ.), பொதுத்தமிழ், மார்ச் - 2022, துரைகோ பதிப்பகம், அரும்பாக்கம், சென்னை – 106. 9884159972.

2 முனைவர் மு.அருணாசலம் (ப.ஆ.) – தமிழ் இலக்கிய வரலாறு – 2012, அருண் பதிப்பகம், தரைத்தளம், பாலாஜி நகர், ஞடீஜ காலனி, கண்டோன்மெண்ட், திருச்சி - 1. 9894440530

3 சு.சக்திவேல் - நாட்டுப்புற இயல் ஆய்வு, மணிவாசகர் பதிப்பகம் - 12, மேலசன்னதி வீதி, சிதம்பரம் - 1.

4 முனைவர் கோ.பெரியண்ணன் - அடிப்படை எளிய தமிழ் இலக்கணம் - 2003 –வனிதா பதிப்பகம், 11- நானா தெரு, பாண்டி பஜார், தி.நகர், சென்னை - 17.

பார்வை நூல்கள்:

2 முனைவர் ந.லெனின், தாலாட்டுப் பாடல், பிப்ரவரி - 2015, பிருந்தா பதிப்பகம், தஞ்சாவூர் - 5.

3 கோ. வெங்கடாசலம் (தொ.ஆ.) - 2005, தமிழ் இலக்கிய கைவிளக்கு, அன்னை சரஸ்வதி பதிப்பகம், குடியாத்தம்.

4 முனைவர் இராஜா வரதராஜா - பயன்முறைத் தமிழ் - ஜூன் 2015, சிவகுரு பதிப்பகம், 7.∴40, கிழக்குச் செட்டித்தெரு, பரங்கிமலை, சென்னை – 16.

COURSE CODE	**XGE102**	**L**	**T**	**P**	**SS**	**H**	**C**
COURSE NAME	**English - I**	**3**	**0**	**0**	**0**	**3**	**3**
C:P:A - 3:0:0							

COURSE OUTCOMES:		**Domain**	**Level**
CO1	***Recall*** the basic grammar and using it in proper context	Cognitive	Remembering
CO2	***Explain*** the process of listening and speaking	Cognitive	Understanding
CO3	***Adapt*** important methods of reading	Cognitive	Creating
CO4	***Demonstrate*** the basic writing skills	Cognitive	Understanding

SYLLABUS		**HOURS**
UNIT I	**Grammar**	
i. Major basic grammatical categories ii. Notion of correctness and attitude to error correction		9
UNIT II	**Listening and Speaking**	
iii. Importance of listening skills iv. Problems of listening to unfamiliar dialects v. Aspects of pronunciation and fluency in speaking vi. Intelligibility in speaking		9
UNIT III	**Basics of Reading**	
vii. Introduction to reading skills viii. Introducing different types of texts – narrative, descriptive, extrapolative		9
UNIT IV	**Basics of Writing**	
ix. Introduction to writing skills x. Aspects of cohesion and coherence xi. Expanding a		9

given sentence without affecting the structure xii. Reorganizing jumbled sentences into a coherent paragraph xiii. Drafting different types of letters (personal notes, notices, complaints, appreciation, conveying sympathies etc.)	
Total Hours	**36**
Text books 1. Acevedo and Gower M (1999) Reading and Writing Skills. London, Longman 2. Deuter, M et.al. (2015). Oxford Advanced Learner's Dictionary of English (Ninth Edition). New Delhi, OUP 3. Eastwood, John (2008). Oxford Practice Grammar. Oxford, OUP 4. Hadefield, Chris and J Hadefield (2008). Reading Games. London, Longman 5. Hedge, T (2005). Writing. Oxford, OUP 6. Jolly, David (1984). Writing Tasks: Stuidents' Book. Cambridge, CUP 7. Klippel and Swan (1984). Keep Talking. Oxford, OUP 8. Saraswati, V (2005). Organized Writing 1. Hyderabad, Orient Blackswan 9. Swan, Michael. (1980). Practical English Usage. Oxford, OUP 10. Walter and Swan (1997). How English Works. Oxford, OUP	

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XPH103				**3**	**1**	**0**	**4**
C	**P**	**A**	**PROPERTIES OF MATTER AND SOUND**	**L**	**T**	**P**	**H**
3.7	**0**	**0.3**		**3**	**1**	**0**	**4**

COURSE OUTCOMES On the successful completion of this course students would able to		**DOMAIN**	**LEVEL**
CO1	***Identify*** the principles of elasticity, ***derive*** expression for twisting couple and ***determine*** rigidity modulus of a wire.	Cognitive	Remember, Understand Apply
CO2	***Develop*** *Knowledge* on bending of beams, its properties and *application.*	Cognitive	Understand apply
CO3	***Define*** surface tension, ***recall*** the concepts of low pressure and ***explain*** the methods of production of low pressure.	Cognitive	Remember understand
CO4	***Understand*** *flow* of liquid, viscosity and ***identify*** its *applications.*	Cognitive	Understand Analyze
CO5	***Describe*** the production, propagation, perception &***analysis*** of acoustical wave and its application	Cognitive	Remember analyze

UNIT – I: ELASTICITY	**9 + 3**
Elasticity – Stress – Strain – Hooke's law – Stress strain diagram – Factors affecting elasticity– Different moduli of elasticity – Relation between the Elastic moduli – Poisson's ratio Twisting couple on a cylinder – Determination of rigidity modulus by Static torsion – Work done in twisting a wire – Torsional oscillations of a body– Torsion pendulum – Determination of	

Rigidity modulus and moment of inertia.	
UNIT – II: BENDING OF BEAMS	**9 + 3**
Bending of beams – Expression for bending moment – Cantilever – Expression for depression of the loaded end of a cantilever – Young's modulus by measuring the tilt in a loaded cantilever – Oscillation of a cantilever – Non–uniform bending – Expression for depression – Uniform bending – Expression for elevation – Experimental determination of Young's modulus using pin and microscope method (Non–uniform bending – Uniform bending) – Determination of Young's modulus by Koenig's method.	
UNIT – III: SURFACE TENSION	**9 + 3**
Definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – Work done on increasing the area of a surface – Angle of contact – Neumann's triangle– Excess pressure inside a liquid drop and soap bubble – Excess pressure inside a curved liquid surface – Force between two plates separated by a thin layer of a liquid – Experimental determination of surface tension – Jaegar's method – Drop–weight method – Capillary rise method – Variation of surface tension with temperature.	
UNIT – IV: VISCOSITY	**9 + 3**
Newton's law of viscous flow – streamlined and turbulent motion – Reynold's number – Poiseuille's formula for the flow of a liquid through a horizontal capillary tube – Experimental determination of co–efficient of a liquid by Poiseuille's method – Ostwald's viscometer – Terminal velocity and Stokes formula – Viscosity of gases – Meyer's formula – Rankine's method –Variation of viscosity with temperature and pressure – Lubrication. Equation of continuity of flow – Euler's equation for unidirectional flow – Bernoulli's theorem – Filter pump and Wings of Aeroplane – Torricelli's theorem – Pitot tube.	
UNIT – V: ACOUSTICS, ULTRASONICS	**9 + 3**
Acoustics: Classification of sound – Characteristics of musical sound – Loudness – Weber Fechner law – Decibel – Absorption co–efficient – Reverberation – Reverberation time – Sabine's formula (growth & decay) – Factors affecting acoustics of buildings (reverberation time, loudness, focusing, echo, echelon effect, resonance and noise) and their remedies. **Ultrasonics:** Production: Magnetostriction and Piezoelectric methods – Acoustical grating– Determination of velocity – Applications: Ultrasonic flaw Detector, SONAR, Ultrasound scan.	

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**45**	**15**	**60**

TEXT BOOKS

1. Murugeshan R , "Properties of Matter For B. Sc. Students", S Chand & Company Limited, Mohan Co-Operative Industrial Estate, New Delhi - 110 044, First edition 1994, Reprint 2022.
2. R. Murugeshan, Er. Kiruthiga Siva Prasath, "Properties of Matter and Acoustics", S.Chand & Company Ltd, Ram Nagar, New Delhi - 110 055, First edition 2005, Second Edition 2012.
3. Brij Lal, N. Subrahmanyam, "Properties of Matter", Eurasia Publishing House Limited, 1993.
   Textbook of Sound, D. R. Khanna, R. S. Bedi, Atma Ram & Sons, 1971.

REFERENCE BOOKS

1. DS Mathur, "Elements of Properties of Matter", S. Chand Limited, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi - 110 055, First edition 1949, Reprint 2016.
2. Brij Lal, N Subrahmanyam, "*A Textbook of Sound* " 2nd Edition, Vikas Publishing House Pvt. Ltd.A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi–110044, 2018 - 2019 .
3. David Halliday, Robert Resnick, Jearl Walker, "Fundamentals of Physics", Publisher:Wiley, 2013.
4. Satyendra Nath Maiti, "Classical Mechanics and General Properties of Matter", New Age International (P) Limited Publisher, Published in 2007.
5. N Subrahmanyam, "A Textbook Of Sound", Vikas Publishing House Pvt Limited, 1999.

E REFERENCES

1. Biswanath Banerjee and Amit Shaw, Department of Civil Engineering IIT Kharagpur, " THEORY OF ELASTICITY", National Programme on Technology Enhanced Learning (NPTEL), **https://nptel.ac.in/courses/105/105/105105177/**
2. https://chem.libretexts.org/
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html#hph.

Mapping with Programme Outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	3	2	0	0	3	0	1
CO_2	3	1	0	2	3	3	0	1
CO_3	3	3	3	0	0	3	3	2
CO_4	3	3	0	0	3	3	0	2
CO_5	1	3	3	1	2	3	0	2
Total	13	13	8	3	8	15	2	8
Scaled to 1, 2, 3	3	3	2	4	2	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH104			MECHANICS AND RELATIVITY	3	1	0	4
C	P	A		L	T	P	H
3.7	0	0.3		3	1	0	4

COURSE OUTCOMES On the successful completion of this course students would able to		DOMAIN	LEVEL
CO1	***Understand*** basic concepts of dynamics and ***identify*** its ***applications***.	Cognitive	Understanding analyze
CO2	***Explain*** various laws of gravitation and ***how*** it is used in the latest Science of satellite launching.	Cognitive	Remembering understanding
CO3	***Recall*** the laws of floatation ad ***construct*** models for pressure variations	Cognitive	Remembering, understanding apply
CO4	***Identify*** the principles of elasticity, ***derive*** expression for twisting couple and ***determine*** rigidity modulus of a wire.	Cognitive	Remembering, understanding apply
CO5	***Understand*** the theory of relativity, Lorentz transformations and ***derive*** mass– energy equivalence.	Cognitive	Remembering understanding

UNIT – I: INTRODUCTION TO DYNAMICS	**9 + 3**
Newton's Laws of Motion – Forces – work and energy – Conservation of Momentum – Friction– Laws of friction – Impulse – Impact – Direct and oblique impact – Final velocity and loss of kinetic energy. Rigid body: Moment of Inertia – Kinetic energy and angular momentum of rotating body – Theorems of perpendicular and parallel axes – Acceleration of a body rolling down an inclined plane without slipping – Oscillations of a small sphere on a large concave smooth surface – Compound pendulum – Centre of suspension and centre of oscillation – Centre of percussion – Minimum period of a compound pendulum.	
UNIT – II: CENTRE OF GRAVITY, CENTRE OF PRESSURE, FLOATING BODIES, ATMOSPHERIC PRESSURE	**9 + 3**
Centre of gravity of a body – Centre of gravity of a trapezoidal lamina – C.G. of a solid hemisphere – C.G. of a solid tetrahedron – C.G. of a solid cone. Centre of pressure – rectangular lamina – triangular lamina – triangular lamina immersed in a liquid. Conditions of equilibrium of a floating body – Stability of equilibrium of a floating body – Meta-centre –	

Experimental determination of a meta-centric height of a ship – Variation of atmospheric pressure with altitude

UNIT – III: GRAVITATION	**9 + 3**

Newton's law of gravitation – Mass and density of earth – Inertial and Gravitation mass – Determination of G–Boy's experiment – Kepler's Laws of planetary motion – Deduction of Newton's law of gravitation from Kepler's Law – Gravitation – Field – potential – Intensity of Gravitational field – gravitational potential due to a point mass – Equipotential surface – Gravitational potential and field due to a spherical shell and solid sphere – Escape velocity – Orbital velocity.

UNIT – IV: MOTION ON A PLANE CURVE	**9 + 3**

Centripetal and centrifugal forces – Hodograph – Expression for normal acceleration – Motion of a cyclist along a curved path – Motion of a railway carriage round a curved track– upsetting of a carriage – Motion of a carriage on a banked up curve – Effect of earth's rotation on the value of the acceleration due to gravity – Variation of 'g' with altitude, latitude and depth.

UNIT – V: SPECIAL THEORY OF RELATIVITY	**9 + 3**

Lorentz co–ordinate and physical significance of Lorentz invariance – Length contraction – Time dilation – Twin paradox – Velocity addition theorem Variation of mass with velocity – Mass energy equivalence – Transformation of relativistic momentum and energy – Relation between relativistic momentum and energy, Mass, velocity, momentum and energy of zero rest mass

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**45**	**15**	**60**

TEXT BOOKS

1. M. Narayanamoorthy and N. Nagarethnam, "Dynamics", 8th Edition, National publishing Company, Chennai, 2002.
2. M. Narayanamoorthy and N.Nagarethinam, "Statics, Hydrostatics and Hydrodynamics", National Publishing company, Chennai, 2005.
3. Soni, Vidwan Singh, "Mechanics", PHI Learning Pvt. Ltd, 2019.
4. Timon Idema, "Mechanics and Relativity", Publisher:TU Delft Open, 2018 - 2019 .

REFERENCE BOOKS

1. R. Murugeshan ," Mechanics & Mathematical Physics",3rd Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2014.
2. Antonio Romano, Mario Mango Furnari, "The Physical and Mathematical Foundations of the Theory of Relativity", Publisher:Springer International Publishing, 2019.
3. R. Shankar, "Fundamentals of Physics Mechanics, Relativity, and Thermodynamics", Publisher:Yale University Press, 2019.

4. Paul Fleisher, "Relativity and Quantum Mechanics Principles of Modern Physics", Publisher:Living Book Press, 2018 - 2019 .
5. Shangwu Qian, "Essentials Of Quantum Mechanics And Relativity", World Scientific Publishing Company, 2020.

E REFERENCES

1. Shiva Prasad, Department of Physics, IIT Bombay, "*Special theory of Relativity*", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/115/101/115101011/
2. http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html#hph

Mapping with Programme Outcomes

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	3	1	2	3	2	0	1
CO_2	3	2	1	2	3	3	0	1
CO_3	3	3	2	2	3	3	3	2
CO_4	3	3	0	2	3	2	0	2
CO_5	3	2	2	2	3	3	0	2
Total	15	13	6	10	15	13	2	8
Scaled to 1, 2, 3	3	3	2	2	3	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XPH105			**MECHANICS AND PROPERTIES OF MATTER - LABORATORY**	**0**	**0**	**2**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
0	**1.5**	**0.5**		**0**	**0**	**3**	**3**

COURSE OUTCOMES On the successful completion of this course students would able to		**Domain**	**Level**
CO1	***Understand*** basic concepts of physics and ***identify*** its ***applications***	Psychomotor	Mechanism
CO2	***Identify*** the principles of elasticity, ***derive*** expression for twisting couple and ***determine*** rigidity modulus of a wire.	Psychomotor: Affective:	Analyze, Mechanism Respond
CO3	***Develop*** *Knowledge* on bending of beams, its properties and *application.*	Psychomotor: Affective:	Apply Mechanism Receive
CO4	***Define*** surface tension, ***recall*** the concepts of low pressure and ***explain*** the methods of production of low pressure.	Psychomotor: Affective:	Analyze Mechanism Receive

CO5	***Understand*** *flow* of liquid, viscosity and *identify* its *applications.*	Psychomotor: Affective:	Analyze Mechanism Receive

Ex. No	Experiments	Cos
1.	Compound Pendulum – Determination of g and K.	CO1
2.	Screw Gauge and Vernier Caliper (Measurements).	CO1
3.	Torsional pendulum – Determination of the rigidity modulus of thin wire.	CO2
4.	Young's modulus – Non uniform bending –Pin and microscope.	CO3
5.	Young's modulus – Non uniform bending – Scale and telescope	CO3
6.	Koenigs – Uniform Bending Method – Young's Modulus.	CO3
7.	Surface tension and interfacial Surface Tension by Drop weight method.	CO4
8.	Determination of Surface Tension of water by capillary rise method	CO4
9.	Stokes method – Determine the viscosity of the given liquid.	CO5
10.	Determination of Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille‟s method).	CO5

	LECTURE	PRACTICAL	TOTAL
HOURS	**0**	**45**	**45**

TEXT BOOKS

1. C. L. Arora, "B.Sc .Practical Physics", S. Chand & Company Ltd. Ram Nagar, New Delhi–110055. 2007.
2. R. K. Shukla & Anchal Srivastava. "Practical Physics," New Age International (P) Ltd, Publishers, (Formerly Wiley Eastern Limited), 4835/24, Ansari Raod, Daryagani, New Delhi–11002. 2006.

REFERENCE BOOKS

1. Geeta Sanon, "B. Sc., Practical Physics", 1st Edition, S. Chand and Company, 2007.
2. Chattopadhyay, D., Rakshit, P. C. and Saha, B., "An Advanced Course in Practical Physics," 8th Edition, Books & Allied Ltd., Calcutta, 2007.
3. G. L. Squires, "Practical Physics", Fourth edition, Cambridge University Press, 2001.
4. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics," 11th Edition, Kitab

Mahal, New Delhi, 2011.

5. C. Ouseph,K. Rangarajan, "A Text Book of Practical Physics", Volume I,II, S.Viswanathan Publishers,1997.

E–Resources:

1. Amal Kumar Das , Department of Physics, IIT Kanpur, "Introduction to Electromagnetic Theory", National Programme on Technology Enhanced Learning (NPTEL), https://onlinecourses.nptel.ac.in/noc20_ph16/preview

Mapping of COs with POs

Course Outcomes	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
CO_5	3	1		2	1	2	3	2
Total	15	5		9	5	10	14	10
Scaled to 1, 2, 3	3	1		2	1	2	3	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XMG106			ALGEBRA, TRIGONOMETRY, APPLICATIONS OF LAPLACE TRANSFORMS AND FOURIER SERIES	4	1	0	5
C	P	A		L	T	SS	H
4.7	0	0.3		4	1	0	5

COURSE OUTCOMES On the successful completion of this course students would able to		DOMAIN	LEVEL
CO1	***Find*** the roots of the polynomial equations with real coefficients. ***Explain*** the transformation of equations and to ***solve*** the reciprocal equations using Newton's method.	Cognitive	Remembering Understanding Applying
CO2	***Find*** eigen values and eigen vectors of the matrices and ***Apply*** Cayley Hamilton theorem to find the inverse of a matrix.	Cognitive	Remembering Applying
CO3	***Expand*** the trigonometric functions, hyperbolic and inverse hyperbolic functions and to ***find*** the series of	Cognitive	Remembering Understanding

	trigonometric functions.		
CO4	***Find*** the Laplace transforms and inverse Laplace transforms of standard functions and to ***find*** the Laplace transforms of tf(t), f(t)/t and derivatives.	Cognitive	Remembering
CO5	***Apply*** Laplace transforms to ***solve*** the differential equations of first and second order and to ***find*** Fourier series of a functions.	Cognitive	Remembering Applying

UNIT – I: THEORY OF EQUATIONS	**12+3**
Polynomial Equations with real coefficients irrational roots, complex roots – symmetric function of roots – Transformation of equations by increasing or decreasing roots by a constant – Reciprocal Equations – Newton's method to find a root approximately.	
UNIT – II: MATRICES	**12+3**
Eigen Values and eigen vectors, Cayley–Hamilton theorem (without proof) – Verification and computation of inverse.	
UNIT – III: TRIGONOMETRY	**12+3**
Expansion in Series – Expansion of $\cos^n\theta$, $\sin^n\theta$, in a series of cosines and sines of multiples of θ – Expansions of cos nθ and sin nθ in powers of sines and cosines – Hyperbolic functions and inverse hyperbolic functions.	
UNIT – IV: LAPLACE TRANSFORMS	**12+3**
Definition – Laplace Transform of Standard functions – Linearity property – First shifting theorem – Transform of tf(t), f(t) / t and derivatives – Inverse Laplace transforms of standard functions.	
UNIT – V: APPLICATIONS OF LAPLACE TRANSFORMS AND FOURIER SERIES	**12+3**
Applications of Laplace transforms of differential equations of first and second order – Finding the Fourier series of functions.	

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**60**	**15**	**75**

TEXT BOOKS

1. Kandasamy. P, Thilagavathi. K, "Allied Mathematics", Volume I and II, S. Chand and Company Ltd, New Delhi, 2004.

REFERENCES

1. Manichavasagam Pillai T.K. and Narayanan S., "Trigonometry", Viswanathan Publishers and Printers Pvt. Ltd.
2. Narayan S. and Manicavachagam Pillay T.K., "Ancillary Mathematics," Viswanathan

Publishers and Printers Pvt. Ltd.
WEBSITE www.NPTEL.ac.in

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2		1		2			2
CO2	2		1		2			2
CO3	2		1		2			2
CO4	2		1		2			2
CO5	2		1		2			2
Total	10		5		10			10
Scaled to 1, 2, 3	2		1		2			2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE	**XUM001**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME	**HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY**	**1**	**0**	**0**	**1**	**1**
PREREQUISITES	**Not Required**	**L**	**T**	**P**	**SS**	**H**
C:P:A	**0.8:0.1:0.1**	**1**	**0**	**0**	**1**	**2**

COURSE OUTCOMES		**Domain**	**Level**
CO1	***Relate*** and ***Interpret*** the human ethics and human relationships	Cognitive	Remember, Understand
CO2	***Explain*** and ***Apply*** gender issues, equality and violence against women	Cognitive	Understand, Apply
CO3	***Classify*** and ***Develop*** the identify of women issues and challenges	Cognitive & Affective	Analyze Receive
CO4	***Classify*** and ***Dissect*** human rights and report on violations.	Cognitive	Understand, Analyze
CO5	***List*** and **respond** to family values, universal brotherhood, fight against corruption by common man and good governance.	Cognitive & Affective	Remember, Respond

UNIT I HUMAN ETHICS AND VALUES	**3+3**
HUMAN ETHICS AND VALUES Human Ethics and values - Family and Society, Social service, Social Justice, Integrity, Caring and Sharing, Honesty and Courage, Time Management, Co-operation, Commitment, Sympathy and Empathy, Self respect, Self-Confidence, Personality Development	
UNIT II GENDER EQUALITY	**3+3**

Gender Discrimination in society and in family, Gender equity, equality, and empowerment. Social and Economic Status of Women in India in Education, Health, Employment, Definition of HDI, GDI and GEM. Contributions of Dr.B.R. Ambethkar, Thanthai Periyar and Phule to Women Empowerment.

UNIT III	**WOMEN ISSUES AND CHALLENGES**	**3+3**

Women Issues and Challenges- Female Infanticide and Feticide, Violence against women, Domestic violence, Sexual Harassment, Trafficking, Remedial Measures – Acts related to women: Political Right, Property Rights, and Rights to Education, Dowry Prohibition Act.

UNIT IV	**HUMAN RIGHTS**	**3+3**

Human Rights and Duties, Universal Declaration of Human Rights (UDHR), Civil, Political, Economical, Social and Cultural Rights, Rights against torture, Forced Labour, Child helpline- Intellectual Property Rights (IPR) and its types. National Policy on occupational safety and health.

UNIT V	**GOOD GOVERNANCE**	**3+3**

Good Governance - Democracy, People's Participation, Transparency in governance and audit, Corruption, Impact of corruption on society and Remedial measures, Government system of Redressal. Creation of People friendly environment and universal brotherhood.

	LECTURE	**SELF STUDY**	**TOTAL**
	15	**15**	**30**

REFERENCES

1. Aftab A, (Ed.), Human Rights in India: Issues and Challenges, (New Delhi: Raj Publications, 2012).
2. Bajwa, G.S. and Bajwa, D.K. Human Rights in India: Implementation and Violations (New Delhi: D.K. Publications, 1996).
3. Chatrath, K. J. S., (ed.), Education for Human Rights and Democracy (Shimala: Indian Institute of Advanced Studies, 1998).
4. Jagadeesan. P. Marriage and Social legislations in Tamil Nadu, Chennai: Elachiapen Publications, 1990).
5. Kaushal, Rachna, Women and Human Rights in India (New Delhi: Kaveri Books, 2000)
6. Mani. V. S., Human Rights in India: An Overview (New Delhi: Institute for the World Congress on Human Rights, 1998).
7. Singh, B. P. Sehgal, (ed) Human Rights in India: Problems and Perspectives (New Delhi: Deep and Deep, 1999).
8. Veeramani, K. (ed) Periyar on Women Right, (Chennai: Emerald Publishers, 1996)
9. Veeramani, K. (ed) Periyar Feminism, (Periyar Maniammai University, Vallam, Thanjavur: 2010).
10. Planning Commission report on Occupational Health and Safety http://planningcommission.nic.in/aboutus/committee/wrkgrp12/wg_occup_safety.p
11. Central Vigilance Commission (Gov. of India) website: http://cvc.nic.in/welcome.html.
12. Weblink of Transparency International: https://www.transparency.org/
13. Weblink Status report: https://www.hrw.org/world-report/2015/country-chapters/india

Course Code	XGT201	L	T	P	C
Course Name	தமிழ் - II	3	0	0	3
Prerequisite		L	T	P	H
C:P:A	3:0:0	3	0	0	3

COURSE OUTCOMES		DOMAIN	LEVEL
After the completion of the course, students will be able to			
CO1	***Recognize*** (அடையாளம் காணுதல்) பல்வேறு இலக்கணக் குறிப்புகள், கலைச்சொல்லாக்க உத்திகள் போன்றவற்றைச் தமிழ்மொழி மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO2	***Choose*** (தெரிவு செய்தல்) வடமொழிக் வேர்ச்சொற்கள், ஒலி வேறுபாடறிந்து, பழந்தமிழ் இலக்கியங்கள் மூலம் அறிந்து கொள்ளல்.	Cognitive	Remember
CO3	***Describe*** (விளக்குதல்) திருக்குறள் மூலம் அறச்செய்திகளை உணர்தல்.	Cognitive	Understand
CO4	***Apply*** (விளக்குதல்) பல்வேறு அலுவல் சார்ந்த கடிதபபிரிவு கள், குறித்துத் தெளிவு பெறல்.	Cognitive	Apply
CO5	***Analyze*** (பகுத்தல்) கலைகளின் தோற்றம் மற்றும் வளர்ச்சி நிலை சமுதாயப் பங்கு குறித்துத் தெளிவு பெறுதல்.	Cognitive	Analyze

myF-1	இலக்கணம்;	9

பொருத்துதல்: பொருத்தமான பொருளைத் தேர்வு செய்தல், புகழ் பெற்ற நூல் மற்றும் நூலாசிரியர், தொடரால் குறிக்கப்பெறும் சான்றோர், அடைமொழியால் குறிக்கப்பெறும் நூல்கள். பிரித்து எழுதுக: எதிர்ச்சொல்லை எடுத்து எழுதுக, பொருந்தாச் சொல்லைக் கண்டறிதல், பிழைத் திருத்தம், சந்திப் பிழையை நீக்குதல், ஒருமை பன்மை பிழைகளை நீக்குதல், மரபுப் பிழைகள் - மூஉச்சொல் - பிறமொழிச் சொற்களை நீக்குதல்.

myF-2	வேர்ச்சொல் அறிதல்	9

ஆங்கிலச் சொல்லுக்கு நேரான தமிழ்ச் சொல்லை அறிதல் - ஒலி வேறுபாடறிந்து சரியான பொருளை அறிதல், ஒரெழுத்து ஒருமொழிக்குரிய பொருளைக் கண்டறிதல் - வேர்ச்சொல் வினைமுற்று–வினையெச்சம் - தொழிற்பெயர், அகர வரிசைப்படுத்துதல்.

myF-3	இலக்கியம்	9

திருக்குறள் தொடர்பான செய்திகள் மேற்கோள்கள் தொடரை நிரப்புதல், அன்பு, பண்பு, கல்வி, கேள்வி, அறிவு, அடக்கம், ஒழுக்கம், பொறை, நட்பு, கேள்வி, அறிவு - வாய்மை, காலம், ஊக்கமுடைமை, இன்னா செய்யாமை. அறநூல்கள்: நாலடியார், நான்மணிக்கடிகை, பழமொழி, திரிகடுகம், இன்னா நாற்பது பாடல்கள் தொடர்பான செய்திகள்

myF-4	பயன்பாட்டுத்தமிழ்;	9

அலுவல்கள் கடிதம், ஆசிரியர் கடிதம், நூலாக்கப் பணி, மெய்ப்புத் திருத்தல், விளம்பரத் தமிழ்

myF-5	பல்வேறு கலைகளில் கல்விச் சிந்தனை	9

மொழியியல் கல்வி, சமுதாயக் கல்வி, சேய்மைக் கல்வி, இக்காலக் கல்வி, கலை அறிவியல் என்பனவற்றின் விளக்கங்கள்;.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	0	---	45

பாட நூல்கள்:

1. கா.பட்டாபிராமன், மொழிப் பயண்பாடு, நியூ செஞ்சுரி புக் ஹவுஸ் (பி) லிட்., 41,பி., சிட்கோ இண்டஸ்ட்ரியல் எஸ்டேட், அம்பத்தூர், சென்னை.

2. முனைவர் கா.செல்வகுமார், (தொ.) 2022. துரைகோ பதிப்பகம், அரும்பாக்கம், சென்னை - 106.
3. முனைவர் ந.லெனின், மார்ச் - 2016, முகில் தமிழ் இலக்கிய இலக்கண வினா-விடைகள், பிருந்தா பதிப்பகம், தஞ்சாவூர் - 5.
4. முனைவர் இராஜா வரதராஜா - பயன்முறைத் தமிழ் - ஜூன் 2015, சிவகுரு பதிப்பகம், 7/40, கிழக்குச் செட்டித்தெரு, பரங்கிமலை, சென்னை - 16

ghh;it E}y;fs;:

1. முனைவர் இராஜ.வரதராஜா - பயன்முறைத் தமிழ்
2. டாக்டர் வா.செ.குழந்தைசாமி - அறிவியல் தமிழ் - ஜூன் 2006 (ஏழாம் பதிப்பு)–பாரதி பதிப்பகம் - 126/108, உஸ்மான் சாலை, தி.நகர், சென்னை - 17.
3. முனைவர் கோ.பெரியண்ணன் - அடிப்படை எளிய தமிழ் இலக்கணம் - 2003 –வனிதா பதிப்பகம், 11- நானா தெரு, பாண்டி பஜார், தி.நகர், சென்னை - 17.

COURSE CODE	**XGE202**	**L**	**T**	**P**	**SS**	**H**	**C**
COURSENAME	**ENGLISH II**	**2**	**1**	**0**	**0**	**3**	**3**
C:P:A- 3:0:0							

COURSEOUTCOMES:		**Domain**	**Level**
CO1	***Explain*** the basic grammar and using it in proper context	Cognitive	Understand
CO2	***Categorize*** the process of listening and speaking	Cognitive	Analyze
CO3	***Examine*** the important methods of reading	Cognitive	Evaluate
CO4	***Compose*** the basic writing skills	Cognitive	Create

SYLLABUS		**HOURS**
UNIT-I	**Advanced Reading**	
i. Reading texts of different genres and of varying length ii. Different strategies of comprehension iii. Reading and interpreting non-linguistic texts iv. Reading and understanding incomplete texts (Cloze of varying lengths and gaps; distorted texts.)		12
UNIT-II	**Advanced Writing**	
v. Analysing a topic for an essay or a report vi. Editing the drafts arrived at and preparing the final draft vii. Re-draft a piece of text with a different perspective (Manipulation exercise) viii. Summarize a piece of prose or poetry ix. Using phrases, idioms and punctuation appropriately		11
UNIT-III	**Principles of communication and communicative competence**	

x. Introduction to communication–principles and process xi. Types of communication–verbal and non-verbal xii. Identifying and overcoming problems of communication xiii. Communicative competence	11
UNIT-IV **Cross Cultural Communication**	
xiv. Cross-cultural communication	11
Total Hours	**45**

Textbooks

1 Bailey, Stephen(2003).Academic Writing. London and New York, Routledge.
2 Department of English, Delhi University(2006).Fluency in English Part II. New Delhi, OUP
3 Grellet, F (1981).Developing Reading Skills: A Practical Guide to Reading Skills. New York, CUP
4 Hedge, T.(2005). Writing. London, OUP
5 Kumar, S and Pushp Lata (2015).Communication Skills. New Delhi, OUP
6 Lazar, G.(2010). Literature and Language Teaching. Cambridge, CUP
7 Nuttall, C(1996).Teaching Reading Skills in a Foreign Language. London, Macmillan
8 Raman,Meenakshi and Sangeeta Sharma (2011). Technical Communication: Principles and Practice. NewDelhi, OUP

Table1: Mapping of Cos with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0
Scaled Value	2	0	0	0	0	0	2	0	1	0	0	0	0	0
	1	0	0	0	0	0	1	0	1	0	0	0	0	0

1-5= 1, 6-10 = 2, 11-15= 3

0-No Relation, 1-Low Relation, 2–Medium Relation, 3-High Relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH203			ELECTRICITY AND MAGNETISM	3	1	0	4
C	P	A		L	T	P	H
3.7	0	0.3		3	1	0	4

COURSE OUTCOMES On the successful completion of this course students would able to		DOMAIN	LEVEL
CO1	***Identify*** and ***explain*** Gauss theorem and its application and ***apply*** knowledge of the concepts of electrostatics	Cognitive	Remembering Understanding Apply

CO2	***Explain*** Growth and decay of current in a circuit LCR and ***demonstrate*** calibration of ammeter and voltmeter using a potentiometer.	Cognitive	Remembering understanding
CO3	***Recall*** Biot–Savart's law, ***explain*** current passing through straight conductor, coil, solenoid and ***distinguish*** various properties of magnetic materials.	Cognitive	Remembering, understanding analyze
CO4	***Recall*** Laws of thermo e.m.f, and ***apply*** knowledge of the concepts of Thermodynamics to thermocouple.	Cognitive	Remembering ,understanding Analyze
CO5	***Define*** Faraday's law and Lenz's law and ***demonstrate*** mutual and self inductance of the coil and **analyze** the magnetic materials for utilization in varied field.	Cognitive	Remembering understanding

UNIT – I: BASICS OF ELECTROSTATICS	**9 + 3**

Coulomb's Law – Gauss theorem and applications: Electric intensity at a point due to a charged sphere – Electric intensity at a point near an infinite charged conductor – Electric intensity at a point between two parallel plane charged conductors – Electric intensity at a point outside two parallel plane charged conductors. Capacitors**:** Principle of a capacitor – capacitance of a spherical capacitor – outer sphere & inner sphere earthed – cylindrical capacitor – capacity of a parallel plate capacitor – effect of a dielectric – capacitors in series and parallel –uses of capacitors.

UNIT – II: CURRENT ELECTRICITY & TRANSISTENT CURRENT	**9 + 3**

Carey Foster bridge – theory – determination of temperature coefficient of resistance – calibration of ammeter and voltmeter using a potentiometer. Growth and decay of current in a circuit containing resistance and inductance. Growth and decay of charge in circuit containing resistance and capacitor – measurement of high resistance by leakage – growth and decay of charge in a LCR circuit – condition for the discharge to be oscillatory – frequency of oscillation.

UNIT – III: MAGNETISM	**9 + 3**

Magneto statistics: Biot–Savart's law & its applications – straight conductor, circular coil and solenoid carrying current – Ampere's circuital law – Magnetic properties of materials: magnetic intensity, magnetic induction, permeability, magnetic susceptibility – brief introduction of dia, para and ferro magnetic materials.

UNIT – IV: THERMO ELECTRICITY	**9 + 3**

Seebeck effect – Laws of thermo e.m.f – Peltier effect; Peltier Co– efficient – determination of Peltier co–efficient – thermo dynamical consideration of Peltier effect – Thomson effect – Thomson Co–efficient – e.m.f generated in a thermocouple taking both Peltier effect and Thomson effect in the metals – Thermo electric power – Application of thermodynamics to Thermocouple – Thermoelectric diagrams and their uses.

UNIT – V: ELECTROMAGNETIC INDUCTION	**9 + 3**

Faraday's laws of electromagnetic induction – Lenz's law – Laws of electromagnetic induction– self and mutual inductance, L of a single coil, M of two coils – Energy stored in magnetic field.– Coefficient of coupling– Experimental determination of self (Rayleigh's method) and mutual

inductance– Earth inductor – Eddy Currents.			
HOURS	**LECTURE**	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. Murugeshan R., "Electricity And Magnetism", 10th Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2019.
2. Robert Resnick Jearl Walker, David Halliday, "Principles of Physics", 10th Edition, Wiley India Pvt Ltd,, 2015.
3. David J. Griffiths, "Introduction to electrodynamics", 4th Edition, Pearson Education India Learning Private limited,2015

REFERENCE BOOKS

1. Vasudeva D.N., "Fundamentals Of Magnetism And Electricity", 3rd Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2011.

E REFERENCES

1. Manoj Harbola, Department of Physics, IIT Kanpur, "Introduction to Electromagnetic Theory", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/115/104/115104088/

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	0	3	3	3	0	1
CO2	3	3	1	3	2	3	0	1
CO3	3	3	1	3	2	3	3	2
CO4	3	3	1	3	2	3	0	2
CO5	3	3	1	3	2	3	0	2
Total	15	15	4	15	11	15	2	8
Scaled to 1, 2, 3	3	3	1	3	3	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH204			ATOMIC PHYSICS	3	1	0	4
C	P	A		L	T	P	H
3.7	0	0.3		3	1	0	4

COURSE OUTCOMES On the successful completion of this course students would able to	DOMAIN	LEVEL

CO1	***Recall*** Atomic structure, ***Compare*** various atom models, ***Distinguish*** various potentials and ***Compare*** LS &JJ couplings	Cognitive	Remember Understand
CO2	***Explain*** Cathode and Positive Ray Production and its Properties.	Cognitive	Remember, Understand
CO3	***Distinguish*** various potentials and ***Explain*** special quantization and spectra of atom.	Cognitive	Understand , Evaluate
CO4	***Distinguish*** X–rays and A***nalyze*** various applications of X–ray.	Cognitive	Understand Analyze
CO5	***Explain*** Photoelectric Effect ***discuss*** various experiments.	Cognitive	Understand Analyze

UNIT – I: ATOMIC STRUCTURE	**9 + 3**

Vector atom model – Pauli's exclusion principle – explanation of periodic table – various quantum numbers – angular momentum and magnetic moment – coupling schemes – LS and JJ coupling – spatial quantisation – Bohr magnetron – Stern and Gerlach experiment.

Spectral terms and notations – selection rules – intensity rule and interval rule – fine structure of sodium D lines – alkali spectra – fine structure of alkali spectra – spectrum of Helium.

UNIT – II: CATHODE AND POSITIVE RAY – ANALYSIS	**9 + 3**

Production and Properties of Cathode rays – Electronic charge – Millikan's oil– drop method – Production and properties of positive rays – Thomson's parabola method – Aston's, Dempster's and Bainbridges mass –spectrographs (e/m) – Mass defect and Packing Fraction.

UNIT – III: IONISATION POTENTIAL AND SPLITTING OF ENERGY LEVELS	**9 + 3**

Excitation and ionization potential – Davis and Goucher's method – The Stern and Gerlach Experiment – Zeeman effect – Larmor's theorem – Debye's explanation of normal Zeeman effect – Anamalous Zeeman effect – theoretical explanation. Lande's 'g' factor and explanation of splitting of D_1 and D_2 lines of sodium – Paschen back effect–theory – Stark effect (qualitative treatment only).

UNIT – IV: X–RAYS	**9 + 3**

X–rays – production – detection and properties – Bragg's law – Bragg's X–ray spectrometer – Laue's experiment – The Powder crystal method –Rotating crystal method – X–ray spectra – Characteristics of X–ray spectrum – Moseley's law – Compton effect – Determination of wavelength – Symmetry operations and elements of Symmetry.

UNIT – V: PHOTOELECTRIC EFFECT AND FREE ELECTRON THEORY OF METALS	**9 + 3**

Photoelectric effect – Lenard's experiment – Richardson and Compton experiment – Experimental investigations on the photoelectric effect – Laws of photoelectric emission – Einstein's photoelectric equation – Experimental verification – Millikan's experiment – Photoelectric cells – Photo emissive cell – Photovoltaic cell – Photoconductive cell – Applications of Photoelectric cells.

Free electron theory of metals – Properties of metals – Drude and Lorentz theory – Electrical and thermal conductivities – Wiedemann and Franz law.

	LECTURE	TUTORIAL	TOTAL
HOURS	45	15	60

TEXT BOOKS

1. Murugeshan R Kiruthiga Sivaprasath, "Modern Physics", *18th* Edition, S. Chand Publishing, A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2019
2. Jb Rajam ,"Atomic Physics", *7th* Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2009

REFERENCE BOOKS

1. Sehgal Nk, Sehgal Dl, Chopra Kl , "Modern Physics", S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2013.
2. Ghoshal S.N ., "Atomic Physics (Modern Physics)", S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2010
3. Rai Choudhury S., Shobhit Mahajan, Arthur Beiser**,** "CONCEPT OF MODERN PHYSICS ", *6th* Edition, Tata McGrawHill, 2013

E REFERENCES

1. Amal Kumar Das, Department of Physics, IIT Kharagpur, "Atomic and Molecular Physics ", National Programme on Technology Enhanced Learning (NPTEL), https://www.digimat.in/nptel/courses/video/115105100/L20.html

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	0	3	3	3	0	1
CO2	3	2	1	2	3	2	0	1
CO3	3	2	1	2	3	2	3	2
CO4	3	2	1	2	3	2	0	2
CO5	3	2	1	2	3	2	0	2
Total	15	10	4	11	15	11	2	8
Scaled to 1, 2, 3	3	2	1	3	3	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH205			ELECTRICITY AND MAGNETISM - LABORATORY	0	0	2	2
C	P	A		L	T	P	H
0	1.5	0.5		0	0	3	3

COURSE OUTCOMES On the successful completion of this course students would able to	Domain	Level

CO1	***Apply*** knowledge of the concepts of electrostatics	Psychomotor:	Mechanism
CO2	***Explain*** Growth and decay of current in a circuit LCR and ***demonstrate*** calibration of ammeter and voltmeter using a potentiometer.	Psychomotor: Affective:	Analyze, Mechanism Respond
CO3	***Recall*** Biot–Savart's law, ***explain*** current passing through straight conductor, coil, solenoid and ***distinguish*** various properties of magnetic materials	Psychomotor: Affective:	Apply Mechanism Receive
CO4	***Recall*** Laws of thermo e.m.f, and ***apply*** knowledge of the concepts of Thermodynamics to thermocouple	Psychomotor: Affective:	Analyze Mechanism
CO5	***Define*** Faraday's law and Lenz's law and ***demonstrate*** mutual and self inductance of the coil and **analyze** the magnetic materials for utilization in varied field.	Psychomotor: Affective:	Analyze Mechanism Receive

Ex. No	Experiments	COs
1.	Meter bridge – determination of specific resistance.	CO1
2.	Determination of Internal resistance of the given cell using Potentiometer.	CO1
3.	Calibration of low range ammeter using Potentiometer .	CO2
4.	Calibration of low range voltmeter using Potentiometer.	CO2
5.	Carey Foster Bridge – Temperature Coefficient.	CO3
6.	Potentiometer – E.M.F of a Thermocouple.	CO3
7.	Deflection magnetometer – TAN A & TAN B.	CO4
8.	Deflection magnetometer – TAN C.	CO4
9.	Variation of magnetic field at axis of circular coil.	CO5
10.	Determination horizontal component of earth magnetic field–Field along the axis of the coil.	CO5

	LECTURE	PRACTICAL	TOTAL
HOURS	**0**	**45**	**45**

TEXT BOOKS

1. Arora C. L., "B.Sc .Practical Physics", S. Chand & Company Ltd. Ram Nagar, New Delhi–110055. 2007.
2. Shukla R. K. & Anchal Srivastava. "Practical Physics," New Age International (P) Ltd, Publishers, (Formerly Wiley Eastern Limited), 4835/24, Ansari Raod, Daryagani, New Delhi–11002. 2006.

REFERENCE BOOKS

1. Geeta Sanon, "B. Sc., Practical Physics", 1st Edition, S. Chand and Company, 2007.

2. Chattopadhyay D., Rakshit P. C. and Saha, B., "*An* Advanced Course in Practical Physics," 8th Edition, Books & Allied Ltd., Calcutta, 2007.
3. Squires G. L., "Practical Physics", Fourth edition, Cambridge University Press, 2001.
4. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics," 11th Edition, Kitab Mahal, New Delhi, 2011.
5. Ouseph C., Rangarajan K., "A Text Book of Practical Physics", Volume I,II, S.Viswanathan Publishers,1997.

E–Resources:

1. Amal Kumar Das , Department of Physics, IIT Kanpur, "Introduction to Electromagnetic Theory", National Programme on Technology Enhanced Learning (NPTEL), https://onlinecourses.nptel.ac.in/noc20_ph16/preview

Mapping with Programme Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1		2	1	2	3	3
CO2	3	1		2	1	2	3	2
CO3	3	1		1	1	2	2	1
CO4	3	1		2	1	2	3	2
CO5	3	1		2	1	2	3	3
Total	15	5		9	5	10	14	11
Scaled to 1, 2, 3	3	1		2	1	2	3	3

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XMG206			CALCULUS AND DIFFERENTIAL EQUATIONS	4	1	0	5
C	P	A		L	T	P	H
4.7	0	0.3		4	1	0	5

COURSE OUTCOMES On the successful completion of this course students would able to		DOMAIN	LEVEL
CO1	**Explain** radius of curvature, centre of curvature and circle of curvature. Change the order of integration and to compute the double integral. ***Apply*** double to find the area between curves.	Cognitive	Understanding Applying

CO2	***Use*** Beta and Gamma function to compute the multiple integrals and to ***explain*** the relation between them.	Cognitive	Understanding Applying
CO3	***Solve*** the linear homogeneous and non– homogeneous differential equation with constant and variable coefficients.	Cognitive	Applying
CO4	***Explain*** general, complete and particular solutions and to ***solve*** standard forms of partial differential equations.	Cognitive	Understanding Applying
CO5	**Define** gradient, divergence and curl of vectors. ***Apply*** theorem to evaluate line, surface and volume integral.	Cognitive	Remembering Applying

UNIT – I: CURVATURE AND DOUBLE INTEGRALS	**12+3**
Curvature – Radius of curvature – centre of curvature – circle of curvature – Evaluation of double integrals – change of order of integration in double integrals– Application of double integral to find the area between curves.	
UNIT – II : TRIPLE INTEGRALS, BETA AND GAMMA FUNCTIONS	**12+3**
Evaluation of triple integrals – Beta and Gamma functions – relations between them – Evaluation of multiple integrals using Beta and Gamma functions.	
UNIT – III: SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS	**12+3**
Solving second order linear differential equations with constant coefficients whose R.H.S is of the form ve^{mx}, where v is any function of x – Linear equations with variable coefficients.	
UNIT – IV: PARTIAL DIFFERENTIAL EQUATIONS	**12+3**
Formation of partial differential equations by elimination of arbitrary constants and functions – Definitions of general, particular and complete solutions – solving standard forms f(p, q) = 0,f(x,p,q) = 0, f(y,p,q) = 0, f(z, p, q) = 0, f(x,p) = f(y,q), z = px +qy + f(p,q) – Lagrange's Differential equations Pp+Qq = R.	
UNIT – V: VECTOR CALCULUS	**12+3**
Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl –Integration of vectors – line integral – surface integral – Green's theorem in the plane – Gauss divergence theorem – Stokes theorem – (Statements only).	

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**60**	**15**	**75**

TEXT BOOKS

1. Kandasamy. P, Thilagavathi. K "Mathematics for B.Sc. Branch I", Volume II, III and IV, S.Chand and Company Ltd, New Delhi, 2004.

REFERENCE BOOKS

1. Narayan .S and Manicavachagam Pillay T.K. "Ancillary Mathematics", Viswanathan Publishers and Printers, 2004.

E REFERENCES

www.nptel.ac.in

1. Advanced Engineering Mathematics Prof. Jitendra Kumar
2. Department of Mathematics Indian Institute of Technology, Kharagpur

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1			1	1	1
CO2	3	2	1			1	1	1
CO3	3	2	1			1	1	1
CO4	3	2	1			1	1	1
CO5	3	2	1			1	1	1
Total	15	6	5	0	0	5	5	5
Scaled to 1, 2, 3	3	2	1	0	0	1	1	1

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

	SEMESTER II	L	T	P	SS	C
COURSE CODE	**XUM002**	**1**	**0**	**0**	**1**	**1**
COURSE NAME	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**SS**	**H**
C: P: A	**0.7:0:0.3**	**1**	**0**	**0**	**1**	**2**

COURSE OUTCOMES:		**Domain**	**Level**
CO1	***Describe*** the significance of natural resources and ***explain*** anthropogenic impacts.	Cognitive	Remember Understand
CO2	***Illustrate*** the significance of ecosystem, biodiversity and natural geo bio chemical cycles for maintaining ecological balance.	Cognitive	Understand
CO3	***Identify*** the facts, consequences, preventive measures of major pollutions and ***recognize*** the disaster phenomenon.	Cognitive Affective	Remember Receiving
CO4	***Explain*** the socio-economic, policy dynamics and ***practice*** the control measures of global issues for sustainable development.	Cognitive	Understand Analyse
CO5	***Recognize*** the impact of population and the concept of various welfare programs, and ***apply*** the modern technology towards environmental protection.	Cognitive Psychomotor	Understand Apply

UNIT - I NATURAL RESOURCES AND ENERGY	**3+3**
World Environment Day and its need- Forest resources: Use, Deforestation– Water resources: over-utilization of surface and ground water- Mineral resources: Environmental effects of mining–	

Food resources: Modern agriculture, Fertilizer-Pesticide problems, Water logging, Salinity-Energy resources: Renewable and Non-renewable energy sources; Alternate energy resources-Role Of individual in Conservation of Resources.	
UNIT - II ECOSYSTEMS AND BIODIVERSITY	**3+3**
Structure and function of an ecosystem – Producers, consumers and decomposers – Biogeochemical cycles- Food chains, Food webs, Structure and Function of the Forest ecosystem and Aquatic ecosystem– Introduction to Biodiversity- Endemic, Extinct and Endangered species- Conservation of Biodiversity: In-situ and Ex-situ conservation.	
UNIT – III ENVIRONMENTAL POLLUTION	**3+3**
Definition – Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards – Solid waste management: Causes, effects and control measures of industrial wastes – Role of an individual in prevention of pollution – Pollution case studies.	
UNIT –IV SOCIAL ISSUES AND THE ENVIRONMENT	**3+3**
Rain water harvesting– Resettlement and Rehabilitation of people, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and Holocaust – Environment Protection Act – Water Act – Wildlife Protection Act – Forest Conservation Act.	
UNIT –V HUMAN POPULATION AND THE ENVIRONMENT	**3+3**
Population growth, Variation among nations - Population explosion - Environment and Human health- HIV / AIDS – Role of Information Technology in Environment and human health – Case studies.	

LECTURE	TUTORIALS	PRACTICALS		TOTAL
30	0	-------		30

TEXT BOOKS

1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, (2000).
2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, (2003).
3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, (2003).
4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, (2006).
5. Introduction to International disaster management, Butterworth Heinemann, (2006).

REFERENCES

1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, (2009).
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, (2001).
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, (2012).
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, (2003).
5. Sundar, Disaster Management, Sarup & Sons, New Delhi, (2007).

E RESOURCES

	1. http://www.e-booksdirectory.com/details.php?ebook=10526 2. https://www.free-ebooks.net/ebook/Introduction-to-Environmental-Science 3. https://www.free-ebooks.net/ebook/What-is-Biodiversity 4. https://www.learner.org/courses/envsci/unit/unit_vis.php?unit=4 5. http://bookboon.com/en/pollution-prevention-and-control-ebook 6. http://www.e-booksdirectory.com/details.php?ebook=8557 7. http://www.e-booksdirectory.com/details.php?ebook=6804 8. http://bookboon.com/en/atmospheric-pollution-ebook 9. http://www.e-booksdirectory.com/details.php?ebook=3749 10. http://www.e-booksdirectory.com/details.php?ebook=2604

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	0	0	0	1	0	3	1
CO2	1	0	0	0	0	0	2	2
CO3	0	0	0	1	1	0	1	0
CO4	0	0	0	0	0	0	1	1
CO5	0	0	0	0	0	0	1	1
Total	2	0	0	1	2	0	8	5
Scaled to 1, 2, 3	1	0	0	1	1	0	2	1

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH301			PHYSICS WORKSHOP SKILLS	0	0	2	2
C	P	A		L	T	P	H
0	1.5	0.5		0	0	4	4

COURSE OUTCOMES On the successful completion of this course students would able to		Domain	Level
CO1	***Relate*** SI and CGS units and ***Apply*** their knowledge in various measuring instruments.	Cognitive	Understand, Apply
CO2	***Recall and Develop*** their knowledge to find welding defect & handling of various tools and ***Distinguish*** like metal, composites and alloy materials.	Cognitive	Apply Analyze
CO3	***Apply*** their knowledge to handle multimeter and soldering to construct circuit.	Cognitive	Apply
CO4	***Identify*** the diode, transistor and FET – ICs on PCB and ***Construct*** the regulated power supply and timer circuits.	Cognitive	Understand, Apply

CO5	***Infer*** small mechanism of lever, break and gear and ***Adapt*** working principle of power generation system.	Cognitive	Understand, Compare

UNIT – I: MEASURING INSTRUMENTS AND UNITS	**7**
Measuring units, conversion to SI and CGS., Familiarization with meter scale, Vernier caliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc.	
UNIT – II: MECHANICAL SKILL	**11**
Concept of workshop practice, Overview of manufacturing methods: casting, foundry, machining, forming and welding – Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing – introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools – lubricating oils – Cutting of a metal sheet using blade – Smoothening of cutting edge of sheet using file – Drilling of holes of different diameter in metal sheet and wooden block – Use of bench voice and tools for fitting – Make funnel using metal sheet.	
UNIT – III: ELECTRICAL SKILL	**9**
Use of Multimeter – Soldering of electrical circuits having discrete components (R, L and C)	
UNIT – IV: ELECTRONIC SKILL	**9**
Basic principle of diode, transistor and FET – ICs on PCB – Operation of oscilloscope – Making regulated power supply, timer circuit, electronic switch using transistor and relay	
UNIT – V: INTRODUCTION TO PRIME MOVERS	**9**
Mechanism, gear system, wheel, fixing of gears with motor axel – Lever mechanism – lifting of heavy weight using lever, breaking systems, pulleys, working principle of power generation systems – demonstration of pulley experiment.	
HANDS ON TRAINING IN THE FOLLOWING FOR LAB SKILLS	
1. To determine volume of one meter (length) thin wire using screw gauge.	CO1
2. To determine volume of cylindrical body by using vernier caliper.	CO1
3. Comparison of diameter of a thin wire using screw gauge and travelling microscope.	CO1
4. Drilling of Hole in metal, wood and plastic.	CO2
5. Cutting of metal sheet & glass sheet.	CO2
6. Fabrication of regulated power supply using Regulated ICs.	CO3
7. To construct using soldering and check the voltage and current of given circuit (L, C & R).	CO3
8. To design PCB for given circuit.	CO4
9. To design basic gates using discrete components.	CO4
10. Lifting of heavy weights using simple pulley/lever arrangement.	CO5

HOURS	**LECTURE**	**PRACTICAL**	**TOTAL**

	–	**40**	**40**

TEXT BOOKS

1. Theraja B.L., "A text book in Electrical Technology", S. Chand and company.
2. Say M.G., "Performance and design of AC machines," ELBS Edn.
3. John K.C., "Mechanical workshop practice", PHI learning Pvt, Ltd., 2010

REFERENCES

1. Bruce J. Black, "Workshop processes, practices and materials", 3rd Edn., Editor Newnes [ISBN: 0750660732], 2005
2. Lawrence Smyth/Liam Hennessy, "New engineering technology", The Educational company of Ireland [ISBN: 0861674480]

Mapping with Programme Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1		2	1	2	3	3
CO2	3	1		2	1	2	3	2
CO3	3	1		1	1	2	2	1
CO4	3	1		2	1	2	3	2
CO5	3	1		2	1	2	3	3
Total	15	5		9	5	10	14	11
Scaled to 1, 2, 3	3	1		2	1	2	3	3

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XCG302			**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – I**	**3**	**0**	**0**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
2.8	**0**	**0.2**		**3**	**0**	**0**	**3**

COURSE OUTCOMES On the successful completion of this course students would able to		**Domain**	**Level**
CO1	***Describe*** the key features, shapes and structures of coordination complexes and ***understand*** the solid state chemistry.	Cognitive	Remembering Understand,
CO2	***Describe*** and ***Recall*** the fundamental principles of organic chemistry that include chemical bonding, nomenclature, structural isomerism, stereochemistry, chemical reactions and mechanism.	Cognitive	Remembering
CO3	***Understand*** the structures and properties of carbohydrates and amino acids.	Cognitive	Understand
CO4	***Explain*** the kinetic molecular theory of gases and its properties and ***Use*** of phase rule.	Cognitive	Understand

CO5	***Relate*** the rate of formation of a product to the rate of disappearance of a reactant for the given experimental data and reaction stoichiometry.	Cognitive	Remembering

UNIT – I: CO–ORDINATION CHEMISTRY AND SOLID STATE CHEMISTRY	**9+2**
IUPAC nomenclature of mono nuclear coordination compounds, Isomerism, Geometrical isomerism in four co–ordinate and six co–ordinate complexes, Theories of Coordination compounds–Werner's theory, Valence bond theory. Amorphous, Crystalline Solid–Lattice– unit cell, crystal systems, types of crystals, packing in solids, ionic crystals, defects in solids, Principles of X–ray diffraction.	
UNIT – II: BASICS OF ORGANIC CHEMISTRY	**9+3**
Nomenclature of straight chain and closed ring compounds–mono and poly–functional organic compounds. Hybridisation – sp, sp2 and sp3. –Bond length, bond angle, dipole moment– inductive effect, mesomeric effect and hyperconjucation. Isomerism – geometrical; and optical isomerism, optical activity, asymmetry, dissymmetry, elements of symmetry, R, S notations.	
UNIT – III: CARBOHYDRATES, AMINO ACIDS & PROTEINS	**9+2**
Carbohydrates: Classification – glucose and fructose – preparation and properties – Elucidation of structure of glucose – configuration of glucose – Fischer and Haworth cyclic structures. Amino acids & proteins **:** Amino acids – Classification– Preparation and properties –isoelectric point – peptides (elementary treatment) – Proteins – Classification based on physical properties and biological functions. Structures of proteins – primary and secondary (elementary treatment).	
UNIT – IV: GASEOUS STATE AND PHASE RULE	**9+4**
Gaseous state **–** Postulates of kinetic theory of gases – derivation of expression for pressure of an ideal gas on the basis of kinetic theory–gaseous laws. Deviation of real gases from ideal behaviour–reasons – derivation for vander Waals gas equation – behaviour of real gases Average, root mean square, and most probable velocities – (equations only–no derivation) relationship between these different velocities. Phase rule **–** Definition – phase, component, degree of freedom, phase rule – application to one component system – water system.	
UNIT – V: CHEMICAL KINETICS AND CHEMICAL EQUILIBRIUM	**9+4**
Chemical kinetics **–** Rate of reaction, rate law, order, molecularity, first order reaction, half life period of first order reaction, pseudo first order reaction, zero and second order reactions– experimental determination of order of reactions –Theories of reaction rate – Arrhenius and collision theories – postulates. Chemical equilibrium **–** Criteria of homogeneous and heterogeneous equilibria, decomposition of HI, N_2O_4, $CaCO_3$,PCl_5.	

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**45**	**0**	**60**

TEXT BOOKS

1. Vishnoi N.K., "Textbook of Physical Chemistry",– Vol 1–Paperback , Jan 2010 .
2. Neeraj Kumar , "Avanced Problems in Physical Chemistry", 2015.
3. Paula B. Y., "Organic Chemistry", 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, 2002.
4. Shriver D. F. and Atkins P. W., "Inorganic Chemistry", 3rd Ed., W. H. Freeman and Co, London, 1999.
5. Puri. B.R., Sharma. L.R., & Kalia .C., "Principles of Inorganic Chemistry" , Vallabh publications, New Delhi, 2003.
6. Dogra S.K. and Dogra S. "Physical Chemistry through Problems", New age international, 4th edition 1996.

REFERENCE BOOKS

1. Bahl B.S., Tuli G.D. and Arun Bahl, "Essentials of Physical Chemistry", Chand & Co., Delhi, 2012.
2. Lee.J.D ., "A New Concise Inorganic Chemistry" , ELBS, London, 2010.
3. Morrison R. T, Boyd R.N.," Organic Chemistry" , 7th edition , Prentice Hall, New Delhi, 2008.
4. Soni. P.L, Chawala H.M., "Text book of Organic Chemistry", 26th edition, Sultan Chand, Delhi , 2011.
5. Raj.K. Bansal, "Organic Reaction Mechanisms", 3rd edition, Tata MCGraw–Hill Publishing Company Limited, New Delhi, 2012.
6. Madan. R.D. ., "Modern Inorganic Chemistry", S. Chand & sons, New Delhi, 2013.
7. Soni P.L., "Textbook of Inorganic Chemistry", Sultan Chand & Sons, New Delhi,2013.
8. Finar I.L., Organic Chemistry Vol. II, Pearson Education, New Delhi, 2000.
9. Srivastava V.K., Srivastava K.K., "Introduction to Chromatography", 2nd edition, 2000.

E RESOURCES

1. http://freevideolectures.com/Course/2380/Chemistry–Laboratory–Techniques
2. http://freevideolectures.com/Course/2642/Chemistry–51A–Organic–Chemistry

Mapping of CO's with PO's:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1		2	2	2	1	2
CO2	3	2		2	1	1		
CO3	2		1	2		1		1
CO4	2	1		1				
CO5	2	1	1	2	2	2	2	1
Total	12	5	2	9	5	6	3	4
Scaled to 1, 2, 3	3	1	1	2	2	2	1	1

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH303			THERMAL PHYSICS AND STATISTICAL MECHANICS	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3

COURSE OUTCOMES On the successful completion of this course students would able to		DOMAIN	LEVEL
CO1	***Define*** Coefficient of thermal conductivity, ***Determine*** thermal conductivity of bad conductor and ***Discuss*** the various laws for heat flow.	Cognitive	Remembering, compare and Evaluate
CO2	***Explain*** the nature of heat radiation and ***List*** the laws related to radiation	Cognitive	Remembering and applying
CO3	***Explain*** the different low temperature methods and ***List*** the related applications	Cognitive	Remembering and understanding
CO4	***List*** the laws of thermodynamics and ***Explain*** latent heat and entropy	Cognitive	Remembering, understanding
CO5	***Understand*** basic concepts of statistical mechanics, explain various distribution laws and ***Compare*** the three statistics	Cognitive	Remembering and understanding

UNIT – I: TRANSMISSION OF HEAT	**9**
Conduction in solids : Thermal conduction – thermal conductivity of a good conductor – theory and determination – Forbe's method – thermal conductivity of a poor conductor – theory and determination – Lee's disc method – Derivation of Wiedmann – Franz law and its limitations – practical applications of conduction of heat	
UNIT – II: RADIATION	**9**
Radiation – Stefan's law – Deduction of Newton's law from Stefan's law – Boltzmann's law – Black body radiation – Wein's law – Rayleigh–Jean's law – Planck's law – Angstrom Pyrheliometer – Solar constant – Surface temperature of sun – Sources of solar energy – Photo voltaic cell – Greenhouse effect.	
UNIT – III: LOW TEMPERATURE	**9**
Joule – Thomson's effect – Porous plug experiment – Liquefaction of gases –Linde's method – Liquefaction of hydrogen – Adiabatic demagnetization – Liquefaction of He– Practical applications of low temperature – Refrigerating mechanism – Air conditioning mechanism – solid carbon dioxide (dry ice).	
UNIT – IV: THERMODYNAMICS	**9**
Zeroth law of thermodynamics – First law of thermodynamics – Heat engines –Reversible and irreversible process – Carnot's theorem – Second law of thermodynamics – Thermodynamic Scale of temperature – Entropy – Change of entropy in reversible and irreversible processes – Temperature – entropy diagram (T.S) – Law of increase of entropy – Maxwell's thermo dynamical relations – Clausius' – Claypeyron's latent heat equations.	

UNIT – V: STATISTICAL MECHANICS	9
Phase space, Micro and Macro – canonical – Ensembles – Different types of ensembles – Definition of Probability – Relation between entropy & probability – Degrees of Freedom – Statement of theorem of equipartition of energy – Classical Statistics – Group Velocity and Phase velocity – Maxwell – Boltzmann law–distribution of velocity–Quantum statistics–Fermi–Dirac distribution law–Bose–Einstein distribution law–comparison of three statistics.	

	LECTURE	TUTORIAL	TOTAL
HOURS	45	0	45

TEXT BOOKS

1. Murugeshan R. and Kiruthiga Sivaprasath, "Thermal Physics", 2nd Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2004.
2. Subrahmaniyam N., "Heat Thermodynamics And Statistical Physics", Revised Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2008.

REFERENCE BOOK

1. Brij Lal, N Subrahmanyam and P.S.Hemne, " Heat Thermodynamics and Statistical Physics", 3rd Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2012
2. Mark Zemansky and Richard Dittman, "Heat and Thermodynamics – SIE" 8th Edition, McGraw Hill (India) Private Limited, B–4, SECTOR – 63, NOIDA,Gautam Buddha Nagar, Uttar Pradesh – 201301, 2017

E REFERENCES

1. Dipanjan Chakraborty, Department of Physics, IISER Mohali, "Statistical Mechanics", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/115/106/115106126/

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	0	3	3	3	0	1
CO2	3	2	0	2	3	2	0	1
CO3	3	2	0	2	3	2	3	2
CO4	3	2	0	2	3	2	0	2
CO5	3	2	0	2	3	2	0	2
Total	15	10	0	11	15	11	2	8
Scaled to 1, 2, 3	3	2	0	3	3	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH304			BASIC ELECTRONICS	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3

COURSE OUTCOMES On the successful completion of this course students would able to		DOMAIN	LEVEL
CO1	***Recall*** the function of PN junction diode, zener diode LED and ***Construct*** the full wave rectifier filters, regulated power supply– zener regulator, photo diode.	Cognitive	understand and Analyze and Apply
CO2	***Demonstrate*** the transistor construction and working characteristics, ***Determine*** the h– parameters.	Cognitive	understand and Evaluate
CO3	***Compare*** the FET and Transistor and ***Explain*** the characteristics & applications of special semiconductor devices.	Cognitive	understand and Evaluate
CO4	***Classify*** Amplifiers, ***Discuss*** the feedback principle for amplifier, Oscillators and ***Explain*** the Hartley and Collpitt's oscillators.	Cognitive	understand and Evaluate
CO5	***Distinguish*** the modulations and ***Appraise*** the function of detectors.	Cognitive	Analyze and Evaluate

UNIT – I: SEMICONDUCTORS, DIODES AND RECTIFIERS	**9**
Properties of semiconductors – Types of semiconductors– PN junction diode – Biasing–V–I Characteristics– Rectifiers – Half wave – full wave and Bridge rectifiers – ripple factor –filters – L–section, Π–section filters Break down mechanisms – Zener diode– characteristics of Zener diode – Zener diode as voltage regulator– Photo Diode and Uses.	
UNIT – II: BIPOLAR TRANSISTORS	**9**
Bipolar junction transistor – Basic configurations –Relation between α and β – Characteristic curves of transistor – CB, CE mode – DC load line –DC bias and stabilization – fixed bias – voltage divider bias– Two port representation of a Transistor – Parameters– Determination of h–parameters.	
UNIT – III: SPECIAL DEVICES	**9**
Special semiconductor devices – FET, JFET, MOSFET (Construction And Working) – FET parameters – Comparison between FET and Transistor – Phototransistor – SCR, UJT characteristics– Applications of SCR as relay and UJT as relaxation oscillator.	
UNIT – IV: AMPLIFIERS AND OSCILLATORS	**9**
Single stage CE amplifier – Analysis of hybrid equivalent circuit – Power amplifiers – Efficiency of class A,B & C Power amplifier – Push Pull connection – push pull class B Power amplifier – Gain of amplifier with feedback – Properties of negative feedback – Criterion for oscillations – Hartley oscillator – Colpitt's oscillator– Phase shift oscillator.	

UNIT – V: MODULATORS AND DETECTORS	9
Modulation – Amplitude modulation–Modulation factor – Power in AM waves – Limitations of amplitude modulation–Frequency modulation – Phase modulation –Demodulation–Essentials in demodulation– Linear Diode Detector	

	LECTURE	TUTORIAL	TOTAL
HOURS	45	0	45

TEXT BOOKS

1. Mehta V K and Rohit Mehta, "Principles Of Electronics,", 12th Edition, S. Chand Publishing, A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2020.
2. Bhargava N. N., D. C. Kulshreshtha and S. C. Gupta's, "Basic Electronics and Linear Circuits", 2nd edition, Tata McGraw–Hill Education, 2017.
3. Sedha R.S, "A Textbook Of Applied Electronics", revised Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2008.

REFERENCE BOOK

1. Ben Streetman and Sanjay Banerjee, "Solid State Electronic Devices", 7th Edition Pearson Prentice Hall, 2014.
2. Sanjeev Gupta, "Electronic Devices & Circuits", Dhanpat Rai Publications (p) Ltd.–new Delhi, 2010.

E REFERENCES

1. PROF. M.B. PATIL, Department of Electrical and Electronics Engineering, IITB, "BASIC ELECTRONICS", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/108/101/108101091/
2. Prof. Chitralekha Mahanta Department of Electronics and Communication Engineering, IIT Guwahati "BASIC ELECTRONICS", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/117/103/117103063/

Mapping with Programme Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	0	2	3	3	0	1
CO2	3	2	0	2	3	2	0	1
CO3	3	2	1	2	3	2	3	2
CO4	3	2	1	2	3	2	0	2
CO5	3	2	1	2	3	2	0	2
Total	15	10	3	10	15	11	2	8
Scaled to 1, 2, 3	3	2	1	2	3	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XCG305			VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSIS PRACTICAL – I	0	0	2	2
C	P	A		L	T	P	H
1	0.75	0.25		0	0	4	4

COURSE OUTCOMES On the successful completion of this course students would able to		DOMAIN	LEVEL
CO1	***Recall*** the principle of volumetric titration and ***identify*** the quantity of the substance present in the sample	Cognitive Psychomotor	Remember Perception
CO2	***Infer*** the nature of compound and describe the functional group and chemical components of the given organic compound.	Cognitive Psychomotor Affective	Understand Analyse Perception Receive
CO3	***Compute*** and outline the results of the estimation and organic analysis.	Cognitive	Remember Apply

Volumetric and organic Qualitative Analysis

Volumetric Analysis

1. Determination of hardness of water.
2. Conductometric titration of strong acid Vs strong base
3. Determination of HCl by pH metric method.
4. Estimation of ferrous sulphate by Permanganometric method.

Organic Qualitative Analysis

A study of the reactions of the following organic Compounds.

1. Carbohydrate
2. Amide
3. Aldehyde
4. Alcohol

The students may be trained to perform the specific reactions like tests for elements (nitrogen only), aliphatic or aromatic, saturated or unsaturated and functional group present and record their observations.

	LECTURE	PRACTICAL	TOTAL
HOURS	0	40	40

TEXT BOOKS

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.

REFERENCE BOOKS

1. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of

Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.

E RESOURCES

1. Chemistry Practical for B. Sc. (Part II) by Dr Deepak Pant
2. Hand Book of Practical Chemistry by Dr.S.P.Ghosh
3. College Practical Chemistry by V K Ahluwalia, Sunita Dhingra, Sunita Dhingra
4. www.freebookcentre.net › Chemistry Books http://www.bookrix.com

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	3	2	1	3	1
CO2	3	2	1	3	2	1	3	1
CO3	3	2	1	3	2	1	3	1
Total	9	6	3	9	6	3	9	3
Scaled to 1, 2, 3	**3**	**2**	1	**3**	**2**	**1**	**3**	**1**

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XUM306			DISASTER MANAGEMENT	3	0	0	3
C	P	A		L	T	SS	H
3	0	0		3	0	0	3

COURSE OUTCOMES On the successful completion of this course students would able to		Domain	Level
CO1	***Relate*** and ***Interpret*** the Disaster and its' classification.	Cognitive	Remembering, Understanding
CO2	***Explain*** and ***Apply*** Disaster cycle, Institutional Processes and Framework	Cognitive	Understand, Apply
CO3	***Understand*** the Factors affecting Vulnerabilities violations.	Cognitive	Analysing
CO4	***Analyze*** Disaster Risk Management in India	Cognitive	Understand
CO5	***Evaluate*** the Case Studies	Cognitive	Remembering, Response

UNIT – I: INTRODUCTION TO DISASTERS	6+0+0
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc – Classification, Causes, 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– Dos and Don'ts during various types of Disasters	
UNIT – II: APPROACHES TO DISASTER RISK REDUCTION	**6+0+0**
Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural– non structural measures, Roles and responsibilities of– community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake–holders– Institutional Processes and Framework at State and Central Level– State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies	
UNIT – III: INTER–RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	**6+0+0**
Factors affecting Vulnerabilities, differential impacts, 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.	
UNIT – IV: DISASTER RISK MANAGEMENT IN INDIA	**6+0+0**
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: DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS	**6+0+0**
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management	

	LECTURE	TUTORIAL	TOTAL
HOURS	30	0	30

TEXT BOOKS

1. Singhal J.P., (2010) Disaster Management, Laxmi Publications.
2. Tushar Bhattacharya, (2012) Disaster Science and Management, McGraw Hill India

Education Pvt. Ltd.,

REFERENCE BOOKS

1. Gupta, A.K., & Nair, S.J., (2011) Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi.
2. Kapur Anu, (2010) Vulnerable India, A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi.

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1					3	2	
CO2	2					1	2	
CO3	1					2	2	1
CO4	1					2	2	1
CO5						3	2	3
Total	5					11	10	5
Scaled to 1, 2, 3	2					2	2	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH307			THERMAL AND ELECTRONICS LAB	0	0	2	2
C	P	A		L	T	P	H
0	1.5	0.5		0	0	4	4

COURSE OUTCOMES On the successful completion of this course students would able to		Domain	Level
CO1	***Define*** Coefficient of Thermal Conductivity, ***Determine*** thermal conductivity of bad conductor and ***Discuss*** the various laws for heat flow.	Psychomotor:	Mechanism
CO2	***Explain*** the nature of heat radiation and ***List*** the laws related to radiation	Psychomotor: Affective:	Analyze, Mechanism Respond
CO3	***Recall*** the function of PN junction diode, zener diode LED and ***Construct*** the full wave rectifier filters, regulated power supply– zener regulator, photo diode	Psychomotor: Affective:	Apply Mechanism Receive
CO4	***Demonstrate*** the transistor construction and working characteristics, ***Determine*** the h– parameters.	Psychomotor: Affective:	Analyze Mechanism Receive
CO5	***Compare*** the FET and Transistor and ***Explain*** the characteristics & applications of special semiconductor devices.	Psychomotor: Affective:	Analyze Mechanism Receive

Ex. No	Experiments	COs
1.	Lee's disc –Specific heat capacity of the bad conductor.	CO1
2.	Specific heat by Joules calorimeter.	CO2
3.	Newton's law of cooling – Specific heat capacity of the liquid.	CO2
4.	Junction diode and Zener diode – Characteristics	CO3
5.	Zener diode – Regulated Power Supply.	CO3
6.	Bridge Rectifier - Construction	CO3
7.	Transistor characteristics – Common base.	CO4
8.	Transistor characteristics – Common Emitter	CO4
9.	FET Characteristics and constants determination.	CO5
10.	UJT Relaxation oscillator – Construction	CO5

	LECTURE	PRACTICAL	TOTAL
HOURS	0	40	40

TEXT BOOKS

1. Arora C. L., "B.Sc .Practical Physics", S. Chand & Company Ltd. Ram Nagar, New Delhi–110055. 2007.
2. Shukla R. K. & Anchal Srivastava. "Practical Physics," New Age International (P) Ltd, Publishers, (Formerly Wiley Eastern Limited), 4835/24, Ansari Raod, Daryagani, New Delhi–11002. 2006.
3. Chattopadhyay D. and Rakshit P. C., "An Advanced course Practical Physics", New Central Book Agency

REFERENCE BOOK

1. Geeta Sanon, "B. Sc., Practical Physics", 1st Edition, S. Chand and Company, 2007.
2. Chattopadhyay, D., Rakshit, P. C. and Saha, B., "An Advanced Course in Practical Physics," 8th Edition, Books & Allied Ltd., Calcutta, 2007.
3. Squires G. L., "Practical Physics", Fourth edition, Cambridge University Press, 2001.
4. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics," 11th Edition, Kitab Mahal, New Delhi, 2011.
5. Ouseph C., Rangarajan K. "A Text Book of Practical Physics", Volume I, II, S. Viswanathan Publishers,1997.

E–Resources:

1. Department of Physics, AMRITA VISHWA VIDYAPEETHAM, "Heat and thermodynamics lab", National Programme on Technology Enhanced Learning (NPTEL), https://www.vlab.co.in/ba–nptel–labs–physical–sciences

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1		2	1	2	3	3
CO2	3	1		2	1	2	3	2
CO3	3	1		1	1	2	2	1
CO4	3	1		2	1	2	3	2
CO5	3	1		2	1	2	3	3
Total	15	5		9	5	10	14	11
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**3**

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

SEMESTER IV

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XPH401			**ELECTRICAL CIRCUIT NETWORK SKILLS**	**0**	**0**	**2**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
0	**1.5**	**0.5**		**0**	**0**	**4**	**4**

COURSE OUTCOMES On the successful completion of this course students would able to		**Domain**	**Level**
CO1	***Recall*** Basic Electricity Principles, ***Analyze*** electrical circuits and ***Distinguish*** single phase and three phase	Cognitive	Remembering, Understanding, Analysing
CO2	***Recall*** symbols, ***Explain*** circuits and diagram, ***Distinguish*** capacitance, inductance and impedance	Cognitive	Remembering, Understanding, Evaluate, Analysing
CO3	***Describe*** DC&AC power sources, ***Distinguish*** DC/AC Generator and motor.	Cognitive	Remembering, Analysing
CO4	***Classify*** all Solid–State Devices, ***Explain*** response of inductors and capacitors with sources. ***Describe*** how the electrical components are protected.	Cognitive	Understanding, Evaluate
CO5	***Discuss*** about electrical wiring and ***Distinguish*** the types of wiring.	Cognitive	Analysing

UNIT – I: ELECTRICAL PRINCIPLES AND CIRCUITS	**10**
Basic Electricity Principles: Voltage, current, resistance and power – Ohm's law – Series, parallel and series–parallel combinations – AC Electricity and DC electricity – Familiarization with	

multimeter, voltmeter and ammeter. Understanding Electrical Circuits: Main electric circuit elements and their combination – Rules to analyze DC sourced electrical circuits – Current and voltage drop across the DC circuit elements – Single–phase and three–phase alternating current sources – Rules to analyze AC sourced electrical circuits – Relay, imaginary and complex power components of AC source – Power factor – Saving energy and money.	
UNIT – II: ELECTRICAL DRAWING AND COMPONENTS	**9**
Drawing symbols – Blueprints – reading schematics – ladder diagrams – electrical schematics – Power circuits – control circuits – Reading of circuit schematics – Tracking the connections of elements and identify current flow and voltage drop. Inductance – capacitance – impedance – Operation of transformers.	
UNIT – III: ELECTRIC GENERATORS AND MOTORS	**9**
DC power sources – AC/DC generators – Single–phase and three–phase DC motors – Basic design – Interfacing DC or AC sources to control heater &motors – Speed & power of AC motor.	
UNIT – IV: ELECTRICAL DEVICES AND PROTECTION	**10**
Solid–State Devices: Resistors – inductors – capacitors – diode and rectifiers – components in series or in shunt – response of inductors and capacitors with DC or AC sources. Electrical Protection: Relays – Fuses and disconnect switches – circuit breakers – overload devices – Ground–fault protection – Grounding and isolating – phase reversal – surge protection – interfacing DC or AC sources to control elements (relay protection device).	
UNIT – V: ELECTRICAL WIRING	**8**
Different types of conductors and cables – Basics of wiring – Star and delta connection – Voltage drop and losses across cables and conductors – Instruments to measure current – voltage – power in DC and AC circuits – Insulation – solid and standard cable – Conduit Cable trays – Splices : wire nuts – crimps –terminal blocks – split bolts and solder – Preparation of extension board.	
HANDS ON TRAINING IN THE FOLLOWING FOR LAB SKILLS	
1. To determine total capacitance when three capacitors connected in series.	**CO1**
2. To determine total capacitance when three capacitors connected in parallel.	**CO1**
3. To obtain the value of three resistances using colour codes and verify with multimeter.	**CO1**
4. To design and verify Ohm‟s law.	**CO2**
5. Series and Parallel combinations: Verification of Kirchoff's law.	**CO2**
6. Demonstration of AC and DC generator.	**CO3**
7. To prepare wiring for a fluorescent tube light with switch control.	**CO4**
8. To wire for a stair case arrangement using a two–way switch.	**CO4**
9. To measure electrical quantities for the given single phase circuit	**CO5**
10. To prepare residential wiring using Fuse, Switch, Indicator, Lamp and Energy meter.	**CO5**

HOURS	**LECTURE**	**PRACTICAL**	**TOTAL**

	0	**45**	**45**

TEXT BOOKS

1. Theraja B.L. A text book in Electrical Technology, S Chand & Co. New Delhi.
2. Theraja A. K., A text book of Electrical Technology.

REFERENCES

1. Say MG. Performance and design of AC machines, ELBS Edn.

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	0	3	3	3	0	1
CO2	3	2	0	2	3	2	0	1
CO3	3	2	0	2	3	2	3	2
CO4	3	2	0	2	3	2	0	2
CO5	3	2	0	2	3	2	0	2
Total	15	10	0	11	15	11	2	8
Scaled to 1, 2, 3	3	2	0	2	3	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XCG402			**INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY – II**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
2.8	**0**	**0.2**		**3**	**1**	**0**	**4**

COURSE OUTCOMES On the successful completion of this course students would able to		**Domain**	**Level**
CO1	***Explain*** the ability to describe oxidation–reduction reactions using appropriate chemical equations, to identify oxidation and reduction, and to ***apply*** those concepts to electrochemical cells	Cognitive	Understanding, Apply
CO2	***Illustrate*** the nuclear reactions and ***describe*** the extraction of ores.	Cognitive	Remembering, Understanding
CO3	***Illustrate*** the bonding and molecular orbital theory.	Cognitive	Understanding
CO4	***Describe*** the basic laws of thermodynamics and to ***apply*** those laws to chemical reactions.	Cognitive : Affective	Understanding, Apply, Receive
CO4	***Explain*** the structure of organic molecules using various spectral data and ***recognize*** the use of chemicals in industries and their impacts on environment.	Cognitive	Understand, Response

UNIT – I: REDOX REACTIONS AND ELECTROCHEMISTRY	9+3

Concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number. Electrolytic and metallic conduction, conductance in electrolytic solutions, molar Conductivities and their variation with concentration, Kohlrausch's law and its applications. Electrochemical cells, Electrolytic and Galvanic cells, different types of electrodes, Electrode potentials including standard electrode potential, half cell and cell reactions. EMF of a Galvanic cell and its measurement, Nernst equation and its applications. Relationship between cell potential and Gibbs energy change.

UNIT – II: NUCLEAR CHEMISTRY	9+3

Radio activity –Half life period – Group displacement law – Radioactive series. Nuclear Fission and Fusion – Application of nuclear chemistry in Medicine, agriculture, industries – C_{14} dating. Extraction of Radioactive Minerals – Uranium and Thorium.

UNIT – III: CHEMICALBONDING	10+2

Overlapping of atomic orbitals – s–s, s–p and p–p overlap–principle of hybridization–sp, sp2 and sp3 hybridization– Valence Bond theory –postulates of Valence Bond theory–application to the formation of simple molecules like H_2 and O_2 —VSEPR theory. Molecular Orbital theory–bonding, anti bonding and non bonding orbitals. M.O. diagram for H_2, He, $N_2$and F_2.

UNIT – IV: THERMODYNAMICS AND CHEMICAL KINETICS	9+4

Importance of thermodynamics–terms used in thermodynamics–open and closed systems, state functions and path functions, extensive and intensive properties, reversible and irreversible processes, statement and mathematical form of first law of thermodynamics–heat capacity at constant volume and pressure, relation between Cp and Cv. Statement of second law of thermodynamics.

Chemical kinetics: Reaction rate–rate law–order and molecularity of reactions. First order reaction–derivation of rate equation.

UNIT – V: SPECTROSCOPY AND INDUSTRIAL CHEMISTRY	8+3

Electromagnetic spectrum, Absorption of radiation, Principles and applications of UV–visible, IR and NMR in the determination of structures of organic molecules.

Fuel gases – Water gas, producer gas, LPG gas, Gobar gas and natural gas – NPK and mixed Fertilizer, micronutrients and their role in Plant life and Bio Fertilizers soaps and detergents – an elementary idea about preparation and manufacture cleaning action of soap and detergents.

	LECTURE	TUTORIAL	TOTAL
HOURS	45	15	60

TEXT BOOKS

1. Bahl B.S., Tuli G.D. and Arun Bahl, Essentials of Physical Chemistry, Chand & Co., Delhi, 2012.
2. Puri.B.R., Sharma.L.R., &Kalia.C., Principles of Inorganic Chemistry , Vallabh publications, New Delhi, 2013.
3. Soni. P.L, Chawala H.M., Text book of Organic Chemistry, 26th edition, Sultan Chand,

Delhi ,2013.
4. Madan.R.D., Modern Inorganic Chemistry , S. Chand & sons, New Delhi, 2013.
5. Finar I.L., Organic Chemistry Vol. I , Longman Publishing group, New York, 2007.

REFERENCE BOOKS

1. Lee J.D ., A New Concise Inorganic Chemistry , ELBS, London, 2010.
2. Morrison R. T, Boyd R.N., Organic Chemistry , 7th edition , Prentice Hall, New Delhi, 2008.
3. Raj.K.Bansal, Organic Reaction Mechanisms , 3rd edition, Tata MCGraw–Hill Publishing Company Limited, New Delhi, 2012.
4. Soni P.L., Textbook of Inorganic Chemistry , Sultan Chand & Sons, New Delhi, 2011.
5. Finar I.L., Organic Chemistry Vol. II, Pearson Education, New Delhi, 2010.
6. Srivastava V.K., Srivastava K.K., Introduction to Chromatography, 2nd edition, 2000.

E RESOURCES

1. http://freevideolectures.com/Course/3001/Chemistry–I
2. http://freevideolectures.com/Course/3001/Chemistry–I/5
3. http://freevideolectures.com/Course/3518/Chemical–Engineering–Thermodynamics

Mapping of CO's with PO's:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2			3	2	2	2	2
CO2	1			3	2	1		2
CO3	2	1				1	1	
CO4	1	3			1		3	1
CO5	1			3	2	2	3	3
Total	7	4		9	7	6	9	8
Scaled to 1, 2, 3	2	1		2	2	2	2	

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XPH403			**WAVES AND OPTICS**	**3**	**1**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**1**	**0**	**4**

COURSE OUTCOMES On the successful completion of this course students would able to		**DOMAIN**	**LEVEL**
CO1	***Define*** super position principle and ***Relate*** the collinear an perpendicular harmonic oscillators.	Cognitive	Remember and Understand
CO2	***Recall*** transverse wave**,** ***List*** the types of waves and ***Explain*** Group velocity, phase velocity	Cognitive	Remember and Evaluate
CO3	***What*** is interference and ***Identity*** various method to	Cognitive	Remember, and

	produce interference.		Apply
CO4	***Define*** diffraction and ***Analyze*** diffraction effect.	Cognitive	Remember and Analyze
CO5	***Explain*** polarization and ***Distinguish*** the polarizer and analyser, holography and identify its applications	Cognitive	Understand and Analyze

UNIT – I: SUPERPOSITION OF HARMONIC OSCILLATIONS	**9+3**
Oscillations**:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Superposition of Two Collinear Harmonic Oscillations: Linearity and Super position Principle (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats) Superposition of Two Perpendicular Harmonic Oscillations: Graphical and analytical methods – Lissajous figures – Generation – Application.	
UNIT – II: WAVE THEORY	**9+3**
One dimensional Waves – Harmonic waves – Phase velocity and group velocity – Wave packet – Dispersion – Normal dispersion – Anomalous dispersion – Complex representation of waves – Phasors – Addition of waves of same frequency – Addition of waves of different frequency – Plane waves – Huygen‟s principles and its applications	
UNIT – III: INTERFERENCE	**9+3**
Interference by division of wavefront: Superposition of two sinusoidal waves, Interference, coherence ,conditions for interference, the inference patterns, intensity distribution .Fresnel's two mirror arrangement, Fresnal Biprism, Determination of λ and dλ of Sodium Light Interference by division of amplitude: Interference by a plane film illuminated by a plane wave, cosine law, non–reflecting films (the subsections excluded), interference by a film with two nonparallel reflecting surfaces, colours of thin films, Newton's rings, The Michelson interferometer, white light fringes	
UNIT – IV: DIFFRACTION	**9+3**
Fraunhofer Diffraction: Preliminaries, single slit diffraction pattern, diffraction by circular aperture, limit of resolution, two slit Fraunhofer diffraction pattern, N slit diffraction pattern, plane diffraction grating, resolving power. Fresnel Diffraction: Preliminaries, Fresnel half period zones, explanation of rectilinear propagation of light, zone plate, diffraction at straight edge.	
UNIT – V: POLARIZATION AND HOLOGRAPHY	**9+3**
Double refraction – Nicol prism – polarizer and analyzer, Hygiene's explanation of double refraction, positive and negative uniaxial crystals, quarter and half wave plates, types of polarized light, production and analysis of plane, circularly and elliptically polarized light, optical activity. Principles of holography, Theory of construction and reconstruction, Hologram, Applications of Holography.	

HOURS	**LECTURE**	**TUTORIAL**	**TOTAL**

	45	**15**	**60**

TEXT BOOKS

1. Brij Lal, M N Avadhanulu & N Subrahmanyam, "A Text Book of Optics,", 25th Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2012.
2. Subrahmaniyam N., "A Text Book Of Optics", Revised Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044, 2006.
3. Murugeshan R., Kiruthiga Sivaprasath, "Optics and Spectroscopy", *10*th Edition, S. Chand Publishing , A–27, 2nd Floor, Mohan Co–operative Industrial Estate, New Delhi – 110044,1997

REFERENCE BOOK

1. Francis A. Jenkins , Harvey E. White, "Fundamentals of Optics ", 4th Edition, McGraw–Hill Science Engineering , P.O. Box 182605, Columbus, OH 43218,2001.
2. Ajoy Ghatak, "Optics ", 4th Edition, Tata Mcgraw Hill Education Private Limited,2008.

E REFERENCES

1. Santhanam MS, Department of Physics, IISER PUNE, "Waves and oscillations", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/115/106/115106119/, https://onlinecourses.nptel.ac.in/noc19_ph18/preview
2. Srivastava M.K., Department of Physics, IIT Roorkee, "Polarization", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/122/107/122107035/

Mapping with Programme Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	0	3	3	1	0	1
CO2	3	3	0	1	2	1	0	1
CO3	3	3	0	1	2	1	3	2
CO4	3	3	0	1	2	1	0	2
CO5	3	3	0	1	2	1	0	2
Total	15	14	0	7	11	5	2	8
Scaled to 1, 2, 3	3	3	0	2	3	1	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			COURSE NAME	L	T	P	C
XPH404			DIGITAL ELECTRONICS	3	1	0	4
C	P	A		L	T	P	H
3	0	0		3	1	0	4

COURSE OUTCOMES	DOMAIN	LEVEL

On the successful completion of this course students would able to			
CO1	***Analyze*** various number systems and codes, ***Develop*** their knowledge to do arithmetic calculations and ***Discuss*** operation of all the gates.	Cognitive	Analyze, Apply and calculate
CO2	***Show*** the simplification of Boolean expression using the methods of Boolean algebra and Karnaugh map.	Cognitive	understand
CO3	***Solve*** the arithmetic calculations by a fixed function of combinational logical circuits and their implementation	Cognitive	Apply
CO4	***Develop*** the fundamentals flip flops, registers and counters, and ***Design*** the sequential logic circuits.	Cognitive	Apply and calculate
CO5	***Demonstrate*** and classify the D/A and A/D Converters	Cognitive	understand

UNIT – I: DIGITAL FUNDAMENTALS AND LOGIC GATES	**9+3**
Number systems – decimal, binary, octal and hexadecimal system – Conversion from one number system to another. Codes – BCD code – Excess 3 code, Gray code – ASCII code – Binary arithmetic –Binary addition – subtraction – unsigned binary numbers – sign magnitude numbers – 1's and 2's complement – Binary multiplications and division – AND, OR circuits using diodes and transistors – NOT using transistors – NAND, NOR and EXOR – functions and truth tables. NAND & NOR as universal gates.	
UNIT – II: BOOLEAN ALGEBRA AND SIMPLIFICATION OF LOGIC CIRCUITS	**9+3**
Laws and theorems of Boolean algebra – De Morgan's theorems and their circuit implications – Simplification of Boolean equations – Karnaugh map – pairs, quads, octets – 2,3 and 4 variables – Arithmetic building blocks – Half adder – Full adder – parallel binary adder – Half subtractor – Full subtractor – The adder–subtractor – digital comparator – parity checker / generator.	
UNIT – III: DATA PROCESSING CIRCUITS AND SEQUENTIAL LOGICS	**9+3**
Multiplexers – Demultiplexers – Decoders – 1 of 16 decoder BCD to decimal decoder – seven segment decoder – Encoders – Flip Flops – RS Flip Flop – Clocked RS Flip–flop – D flip–flop – JK flip–flop – JK master slave flip–flop – T type flip–flop.	
UNIT – IV: SHIFT REGISTERS AND COUNTERS	**9+3**
Types of registers – serial in serial out – serial in parallel out – parallel in serial out – parallel in parallel out – ring counter – asynchronous counter – decoding gates – omitted states – modulus counters –BCD counter – up down counter – synchronous counter – combination counters – decade counter – cascaded counters.	
UNIT – V: D/A AND A/D CONVERTERS	**9+3**
Introduction – variable resistor network – binary ladder – D/A converter – D/A accuracy and resolution – A/D converter – simultaneous conversion – A/D accuracy and resolution.	

HOURS	**LECTURE**	**TUTORIAL**	**TOTAL**

	45	**15**	**60**

TEXT BOOKS

1. Albert Paul Malvino; Donald P Leach; Goutam Saha, "Digital principles and applications", 8th Edition, McGraw Hill Education, New Delhi, 2015.
2. Jacob Millman, Christos Halkias, "Analog and Digital Circuit and Systems", 2nd edition, Tata McGraw–Hill Education, 2017

REFERENCE BOOK

1. Thomas L Floyd, "Digital Fundamentals", 10th Edition ,Pearson, 2013.
2. Herbert Taub and Donald Schilling, "Digital Integrated Electronics", Indian edition,Tata McGraw–Hill Education, 2017.

E REFERENCES

1. PROF. Goutam Saha Department of Electronics & Communication Engineering IIT Kharagpur, "DIGITAL ELECTRONIC CIRCUITS", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/108/101/108101091/
2. Prof. S. Srinivasan Department of Electrical Engineering, IIT Madras, "Digital Circuits and Systems", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/117/106/117106086/

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	0	3	3	3	0	1
CO2	3	1	0	1	3	2	0	1
CO3	3	1	0	1	3	2	3	2
CO4	3	1	0	1	3	2	0	2
CO5	3	1	0	1	3	2	0	2
Total	15	6	0	7	15	11	2	8
Scaled to 1, 2, 3	3	2	0	2	3	3	1	2

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XCG405			**VOLUMETRIC AND ORGANIC**	**0**	**0**	**2**	**2**
C	**P**	**A**	**QUALITATIVE ANALYSIS**	**L**	**T**	**P**	**H**
1	**0.75**	**0.25**	**PRACTICAL – II**	**0**	**0**	**4**	**4**

COURSE OUTCOMES On the successful completion of this course students would able to		**DOMAIN**	**LEVEL**
CO1	***Outline*** the principle of volumetric titration and ***detects*** the quantity of the substance present in the sample	Cognitive Psychomotor	Remember Perception

CO2	***Interprets*** the nature of compound and ***identify*** the functional group and chemical components of the given organic compound.	Cognitive Psychomotor Affective	Understand Analyse Perception Receive
CO3	***Contrast*** and outline the results of the estimation and organic analysis.	Cognitive	Remember Apply

Volumetric and organic Qualitative Analysis

Volumetric Analysis

1. Estimation of oxalic acid by Permanganometric method.
2. Estimation of copper by Iodometric method.
3. Estimation acid by Potentiometric method.

Organic Qualitative Analysis

A study of the reactions of the following organic Compounds.

1. Ketone
2. Acid
3. Amine
4. Phenol
5. Ester

The students may be trained to perform the specific reactions like tests for elements (nitrogen only), aliphatic or aromatic, saturated or unsaturated and functional group present and record their observations.

	LECTURE	PRACTICAL	TOTAL
HOURS	**0**	**30**	**30**

REFERENCE BOOKS

1. Gnanapragasam N.S. and Ramamurthy G., Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. Gurthu J.N. and Kapoor R., Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
3. Furniss B.S., Hannaford A.J., Smith P.W. G. and Tatchell A.R., Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.
4. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.

E RESOURCES

1. Chemistry Practical for B. Sc. (Part II) by Dr Deepak Pant
2. Hand Book of Practical Chemistry by Dr.S.P.Ghosh
3. College Practical Chemistry by V K Ahluwalia, Sunita Dhingra, Sunita Dhingra
4. www.freebookcentre.net › Chemistry Books http://www.bookrix.com

Mapping of COs with POs

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	3	2	1	3	1
CO2	3	2	1	3	2	1	3	1
CO3	3	2	1	3	2	1	3	1
Total	9	6	3	9	6	3	9	3
Scaled to 1, 2, 3	3	2	1	3	2	1	3	1

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

COURSE CODE			**COURSE NAME**	**L**	**T**	**P**	**C**
XPH406			**OPTICS AND DIGITAL ELECTRONICS - LAB**	**0**	**0**	**2**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
0	**1.5**	**0.5**		**0**	**0**	**4**	**4**

COURSE OUTCOMES On the successful completion of this course students would able to		**Domain**	**Level**
CO1	***What*** is interference and ***Identity*** various method to produce interference.	Psychomotor:	Mechanism
CO2	***Define*** diffraction and ***Analyze*** diffraction effect.	Psychomotor: Affective:	Analyze, Mechanism Respond
CO3	***Discuss*** *and* ***demonstrate*** *all* operation of logic gates.	Psychomotor: Affective:	Apply Mechanism Receive
CO4	***Show*** the simplification of Boolean expression using the methods of Boolean algebra and Karnaugh map	Psychomotor: Affective:	Analyze Mechanism Receive
CO5	***Develop***the fundamentals flip flops, registers and counters, and ***Design*** the sequential logic circuits.	Psychomotor: Affective:	Analyze Mechanism Receive

Ex. No	Experiments	COs
1.	Air Wedge – Determination of Thickness of a thin wire.	CO1
2.	Newton's rings – Determination of radius of curvature of the lens R.	CO1
3.	Spectrometer – Dispersive Power of a prism.	CO2
4.	Spectrometer – Grating – Normal Incidence	CO2
5.	Spectrometer– i–d curve.	CO2
6.	Logic gates IC's verification.	CO3
7.	Logic gates – Discrete components (AND, OR & NOT).	CO3
8.	Half adder and Full adder using basic logic gates IC's.	CO4
9.	Half subtractor and Full subtractor using basic logic gates.	CO5
10.	RS, Clocked RS, and D Flip Flops using NAND gate only.	CO5

	LECTURE	**PRACTICAL**	**TOTAL**
HOURS	**0**	**40**	**40**

TEXT BOOKS

1. C. L. Arora, "B.Sc .Practical Physics", S. Chand & Company Ltd. Ram Nagar, New Delhi–110055. 2007.
2. R. K. Shukla & Anchal Srivastava. "Practical Physics," New Age International (P) Ltd, Publishers, (Formerly Wiley Eastern Limited), 4835/24, Ansari Raod, Daryagani, New Delhi–11002. 2006.
3. D. Chattopadhyay and P. C. Rakshit, "An Advanced course Practical Physics", New Central Book Agency

REFERENCE BOOK

1. Geeta Sanon, "B. Sc., Practical Physics", 1st Edition, S. Chand and Company, 2007.
2. Chattopadhyay, D., Rakshit, P. C. and Saha, B., "An Advanced Course in Practical Physics," 8th Edition, Books & Allied Ltd., Calcutta, 2007.
3. G. L. Squires, "Practical Physics", Fourth edition, Cambridge University Press, 2001.
4. Indu Prakash and Ramakrishna, "A Text Book of Practical Physics," 11th Edition, Kitab Mahal, New Delhi, 2011.
5. C. Ouseph,K. Rangarajan, "A Text Book of Practical Physics", Volume I,II, S.Viswanathan Publishers,1997.

E–Resources:

1. Amal Kumar Das, Department of Physics, IIT Kharagpur ,"Experimental Physics – II", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/115/105/115105120/
2. S. Srinivasan, Department of Electrical Engineering, IIT Madras, " Digital Circuits and Systems", National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/courses/117/106/117106086/

Mapping with Programme Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1		2	1	2	3	3
CO2	3	1		2	1	2	3	2
CO3	3	1		1	1	2	2	1
CO4	3	1		2	1	2	3	2
CO5	3	1		2	1	2	3	3
Total	15	5		9	5	10	14	11
Scaled to 1, 2, 3	3	1		2	1	2	3	3

0 – No relation 1 – Low relation 2 – Medium relation 3 – High relation

XPH501 BASIC INSTRUMENTATION SKILLS

COURSE OUTCOMES:

CO1:Cog: R, U;***Classify*** accuracy, precision, sensitivity, resolution range and Errors and ***Relate*** DC &AC voltage and current.

CO2:Cog: An;***Distinguish*** conventional voltmeter & multimeter and electronically voltmeter & multimeter

CO3:Cog :U, C;***Compare*** CRO & CRT and ***Explain*** operations and specification of CRO.

CO4:Cog: An; ***Analyze***various type of generators and rectifiers.

CO5:Cog: U; ***Explain*** the principle and working of digital meter and ***Compare*** analog & digital meters.

COURSE CODE	COURSE NAME	L	T	P	C
XPH501	**BASIC INSTRUMENTATION SKILLS**	**0**	**0**	**3**	**2**
		L	**T**	**P**	**H**
		0	**0**	**3**	**3**

UNIT - I **Basic of Measurement**	**10**
Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects – Multimeter: Principles of measurement of dc voltage and dc current, ac current and resistance – Specifications of a multimeter and their significance.	
UNIT - II **Electronic Voltmeter**	**11**
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 of a CRO and their significance.

UNIT - III	**Cathode Ray Oscilloscope**	**13**

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

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

UNIT - IV	**Generators and Bridges**	**13**

Signal Generators and Analysis Instruments: Block diagram, explanation and specification of low frequency signal generators – pulse generator and function generator – Brief idea for testing – specifications – Distortion factor meter – wave analysis.

Impedance Bridge & Q-Meters: Block diagram of bridge – working principles of basic (balancing type) RLC bridge – Specifications of RLC bridge – Block diagram & working principles of a Q-meter – Digital LCR bridges.

UNIT - V	**Digital Instruments and Multimeter**	**13**

Principle and working of digital meters – Comparison of analog & digital meters – Working principle of time interval – frequency and period measurement using universal counter/frequency counter – time –base stability – accuracy and resolution.

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

Use of an oscilloscope.

CRO as a versatile measuring device.

Use of digital multimeter.

Winding a coil/transformer.

Circuit tracing of Laboratory electronic equipement.

Trouble shooting a circuit

Balancing of bridges.

	LECTURE	TUTORIAL	TOTAL
	45		45

TEXT BOOKS

1. BL Theraja A text book in electrical technology, S Chand and Co.
2. Venugopal,Digital circuits and systems, 2011, Tata McGraw Hill.
3. Subrata Ghoshal, Digital Electronics, 2012, Cengage Learning.

REFERENCES

1. MG Say, Performance and design of AC machines –ELBS Edn.
2. Shimon O. Vingron, Logic circuit design, 2012, Springer.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	**3**	**2**	**0**	**3**	**2**	**1**	**0**	**1**
CO_2	**3**	2	**0**	**3**	**2**	**1**	**0**	**1**
CO_3	**3**	2	**0**	**3**	**2**	**1**	**3**	**2**
CO_4	**3**	2	**0**	**3**	**2**	**1**	**0**	**2**
CO_5	**3**	2	**0**	**3**	**2**	**1**	**0**	**2**
	15	10	**0**	**15**	**10**	**5**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**2**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH502A - SOLID STATE PHYSICS

COURSE OUTCOMES:

CO1: Cog: U,Ap;***Demonstrate*** and ***apply*** knowledge of the crystal studies.

CO2: Cog: U,Ap ,E;***Explain*** and ***apply*** the definition of the Lattice vibrations and Phonons in lattice dynamics.

CO3: Cog : Ap***;Apply*** knowledge of Dia, Para, Ferri and ferromagnetic materials.

CO4: Cog: Ap;***Solve*** problems concerning the definition of the dielectric properties of materials

CO5: Cog: U, AP;***Explain***and ***apply*** the knowledge of energy bands of solids and their application to modern electrical devices.

COURSE CODE	COURSE NAME	L	T	P	C
XPH502A	SOLID STATE PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I Crystal Structure	7+3

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements, Unit cell, Miller Indices, Reciprocal Lattice, Types of Lattices, Brillouin Zones

UNIT - II Elementary Lattice Dynamics	8+3

Lattice vibrations and Phonons, Linear Monoatomic and Diatomic Chains. Acoustical and optical phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulog and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3 law.

UNIT - III Magnetic Properties of Matter	10+3

Dia, Para, Ferri and ferromagnetic materials, Classical Langevin theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve, Hysteresis and Energy Loss.

UNIT - IV Dielectric Properties of Materials	10+3

Polarization: Local Electric field at an Atom, Depolarization Field, Electric Susceptibility, Polarizability. Clausius Mosotti Equation, Classical theory of electric polarizability, Normal and Anomalous Dispersion - Langevin-Debye equation.

UNIT - V Elementary band theory	10+3

Krong Penny model, Band gaps, conductors, Semiconductors and insulators, P and N type Semiconductors, conductivity of semiconductors, mobililty, Hall effect, Hall coefficient.

Superconductivity:

Superconducting Phenomena, Critical temperature, critical magnetic field, Meissner effect, Type I and Tupe II suiperconductors. London's equation and Penertration Depth, Isotope effect.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. Charless Kittel,Introduction to Solid State Physics, 8th Ed., 2004, Wiley India Pvt.Ltd.

2. J.P. Srivastava, Elements of solid state physics, 2nd Ed., 2006, Prentice-Hall of India.

3. Leonid V. Azaroff, Introduction to solids, 2004, Tata Mc-Graw Hill

REFERENCES

1. Neil W. Ashcroft and N. David Mermin, Solid State Physics, 1976, Cengage Learning.

2. 1/e M. Ali Omar,Elementary Solid State Physics, 1999,

3. M.A. Wahab, Pearson India. Solid State Physics, 2011, Narosa Publications.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**3**	**3**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**3**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**2**	**3**	**2**	**3**	**2**
CO_4	**3**	2	**0**	**2**	**3**	**2**	**0**	**2**
CO_5	**3**	2	**0**	**2**	**3**	**2**	**0**	**2**
	15	10	**0**	**11**	**15**	**11**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**3**	**3**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH502B- Atomic & Molecular Spectroscopy

COURSE OUTCOMES:

CO1:Cog: U;***Explain*** various atomic models and give the corresponding principles.

CO2:Cog: U;***Extend*** their knowledge of interaction of electrons with external fields.

CO3:Cog :Ap; ***Develop*** their knowledge about rotational spectra of molecules.

CO4:Cog: An;***Analyze*** the rotational Spectra of diatomic and polyatomic Molecules.

CO5:Cog: U, C;***Explain*** Basic principles of Raman spectroscopy and ***Discuss*** structural determination of molecules

COURSE CODE	COURSE NAME	L	T	P	C
XPH502B	ATOMIC & MOLECULAR SPECTROSCOPY	3	1	0	4
		L	T	P	H
		3	1	0	4

Unit 1 : Basic atomic models	7+3
Optical spectrum of Hydrogen atom - Bohr's Postulates – Quantitative conclusions –Principal quantum number - Spectra of hydrogen-like atoms – Sommerfeld's extension of the Bohr model – Orbital quantum number –Lifting of orbital degeneracy - Limits of the Bohr-Sommerfeld theory – The Correspondence principle – Rydberg atoms –Lifting of orbital degeneracy in the spectra of Alkali atoms - Magnetic moment of orbital motion – Spin and magnetic moment of electron –Spin-orbit splitting in the Bohr model – Fine structure in Hydrogen atom	
Unit 2: Interactions with external fields and many-electron atoms	**8+3**
Zeeman effect – Normal and anomalous – Stark effect - Paschen-Back effect – Double resonance and Optical pumping – The spectrum of Helium – Electron repulsion and Pauli principle – Angular momentum coupling – X-ray from outer shell & Bremsstrahlung spectra – Emission line spectra – Fine structure of X-rays – Absorption spectra – Auger effect	
Unit 3: Rotational Spectroscopy	**10+3**
The rotation of molecules – Rotational spectra – Diatomic molecules – Rigid molecule – Intensities of spectral line – isotopic substitution – Non-rigid rotator – Polyatomic molecules – Techniques and Instrumentation – Chemical analysis	
Unit 4: Vibrational Spectroscopy	**10+3**
Vibrating diatomic molecule – Diatomic vibrating rotator –Vibration – Rotation spectrum of Carbon Monoxide – Breakdown of the Born-Oppenheimer approximation – Vibration of Polyatomic molecules – Analysis by infra-red techniques - Techniques and Instrumentation	
Unit 5: Raman Spectroscopy	**10+3**
Classical theory & Quantum theory of Raman scattering – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of Light and the Raman effect – Structure determination from Raman and IR spectroscopy - Techniques and Instrumentation – Near IR – FT Raman spectroscopy.	

	LECTURE	TUTORIAL	TOTAL

	45	**15**	**60**

TEXT BOOKS

1. Haken, Wolf, Springer-Verlag, *Atomic and Quantum Physics*, Second edition (1987).
2. Colin Banwell& Elaine McCash, *Fundamentals of Molecular spectroscopy*, Tata McGraw-Hill Publishing Company, Fourth edition (2005).

REFERENCES

1. 1 Arthur Beiser, *Concepts of Modern Physics*, Tata McGraw Hill Publishing company, Sixth edition (2005).
2. Aruldhas, *Molecular structure and Spectroscopy*, Prentice-Hall of India, First edition (2004).

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**2**	**1**	**0**	**1**
CO_2	**3**	2	**0**	**3**	**2**	**1**	**0**	**1**
CO_3	**3**	2	**0**	**3**	**2**	**1**	**3**	**2**
CO_4	**3**	2	**0**	**3**	**2**	**1**	**0**	**2**
CO_5	**3**	2	**0**	**3**	**2**	**1**	**0**	**2**
	15	10	**0**	**15**	**10**	**5**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**2**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH503A NUCLEAR AND PARTICLE PHYSICS

COURSE OUTCOMES:

CO1: Cog: R,U;***Recall*** the general properties of nucleus and ***Discuss*** the angular momentum and magnetic moment.

CO2: Cog: R, U,E;***List*** and ***Explain***the various models of nuclear

CO3: Cog :U, An; ***Distinguish*** and ***Demonstrate*** the various radioactivity decay of nucleus

CO4: Cog: Ap U, C; ***Classify*** the type of reaction and ***discuss*** the concepts

CO5: Cog: U;***Classify*** the elementary particles.

COURSE CODE	COURSE NAME	L	T	P	C
XPH503A	NUCLEAR AND PARTICLE PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I General Properties of Nuclei	7+3
Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments nuclear excites states.	
UNIT - II Nuclear Models	**8+3**
Liquid drop model approach – Semiempirical mass formula and significance of various terms – condition of nuclear stability – Two nucleon separation energies – Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas) evidence for nuclear shell structure – nuclear magic numbers – basic assumption of shell model – concept of mean field – residual interaction – concept of nuclear force.	
UNIT - III Radioactivity decay	**10+3**
Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttal law, α-decay spectroscopy - β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis – Gamma decay: Gamma rays emission &kinematics , internal conversion.	
UNIT - IV Nuclear Reactions	**10+3**
Types of reactions – conservation laws – kinematics of reaction – Q-value – reaction rate, reaction cross section – Concept of compound and direct reaction, resonance reaction – Coulomb scattering (Rutherford scattering).	
UNIT - V Particle physics	**10+3**
Particle interactions: basic features, types of particles and its families - Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.	

	LECTURE	TUTORIAL	TOTAL

	45	**15**	**60**

TEXT BOOKS

1. Kenneth S. Krane, Introductory nuclear physics,wiley India Pt. Ltd., 2008.
2. Bernard L. Cohen, Concepts of nuclear physics, Tata Mcgraw Hill, 1998.
3. R.A. Dulap, Introduction to the physics of nuclei & particles, Thomson Asia, 2004.

REFERENCES

1. D. Griffith, Introduction to Elementary Particles, Hohn Wiley & Sons.
2. F.Halzen and A.D. Martin, Quarks and Leptons, Wiley India, New Delhi.
3. J.M. Blatt & V.F. Weisskopf, Theoretical Nuclear Physics, (Dover Pub. Inc., 1991)

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**3**	**1**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**0**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**2**	**0**	**0**	**3**	**2**
CO_4	**3**	2	**0**	**0**	**3**	**0**	**0**	**2**
CO_5	**3**	2	**0**	**0**	**2**	**1**	**0**	**2**
	15	10	**0**	**7**	**8**	**4**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**2**	**2**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH503B- PRINCIPLE OF MODERN PHYSICS

COURSE OUTCOMES:

CO1: Cog: R,Ap, C;***Recall***Planck's constant and knowledge about photons and ***Solve*** the problems of stability and instability of atoms.

CO2: Cog: U,E;***Infer***theuncertainty principle and***Estimate*** minimum energy of a confined particle using uncertainty principle

CO3: Cog :U, E; ***Explain*** particle in box, energy eigenvalues and eigenfunctions, normalization and tunneling across a rectangular potential barrier.

CO4: Cog: R,U;***Recall***Size and structure of atomic nucleus and ***Demonstrate***nuclear force and binding energy

CO5: Cog:R,U, E;***Define*** radioactive decay, Mean life and half-life and ***Explain***γ decay,β decay andα emission.

COURSE CODE	COURSE NAME	L	T	P	C
XPH503B	PRINCIPLE OF MODERN PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT – I	7+3
Planck's quantum, Planck's constant and light as a collection of photons; Photoelectric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment.Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability.	
UNIT – II	**8+3**
Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.	
UNIT – III	**10+3**
One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunneling in one dimension - across a step potential and across a rectangular potential barrier.	
UNIT – IV	**10+3**
Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy	
UNIT –V	**10+3**
Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; -rayγ decay - energy released, spectrum and Pauli's prediction of neutrino; β decay; α emission.	

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. J.R.Taylor, C.D.Zafiratos, M.A.Dubson,Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill Modern Physics, 2009, PHI Learning

REFERENCES

1. Thomas A. Moore,Six Ideas that Shaped Physics: Particle Behave like Waves, 2003,
2. E.H. Wichman, McGraw Hill Quantum Physics, Berkeley Physics,Vol.4. 2008, Tata McGraw-Hill Co.
3. R.A. Serway, C.J. Moses, and C.A.Moyer,Modern Physics, 2005, Cengage Learning

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	3	3	1	0	1
CO_2	3	2	0	3	2	2	0	1
CO_3	3	1	0	2	2	0	3	2
CO_4	3	1	0	0	2	0	0	2
CO_5	3	2	0	0	2	0	0	2
	15	8	0	8	11	3	2	8
Scaled to 1, 2, 3	3	2	0	2	3	1	1	2

3 – Strong: 2 – Medium: 1 – Low

XPH504A MICROPROCESSOR AND C PROGRAMMING

COURSE OUTCOMES:

CO1: Cog: U;***Explain***the basic concepts of digital computer, evolution of microprocessors.

CO2: Cog Ap;***Develop*** their knowledge about the architecture and instruction set of an eight bit 8085 microprocessor.

CO3: Cog: Ap; ***Organize*** assembly language to write programs for an 8085 microprocessor.

CO**4**: Cog:U;***Summarize*** Structure of C language, operators and library function

CO5: Cog: Ap;***Utilize***various input, out statement, loop statements, while do else statements and basic functions for programme.

COURSE CODE	COURSE NAME	L	T	P	C
XPH504A	MICROPROCESSOR AND C PROGRAMMING	3	1	0	4
		L	T	P	H
		3	1	0	4

Unit 1 BASICS OF DIGITAL COMPUTER	9+3

Basic components of a digital computer - Evolution of microprocessors - Important INTEL microprocessors - Buses - Hardware, Software and Firmware - Memory - Semiconductor memories - RAM,ROM - Flash memory.

Unit 2 INTEL 8085 AND ITS ARCHITECTURE	9+3

INTEL 8085 - Pin Diagram - Architecture - Various registers - Status Flags - Interrupts and their order of priority - Addressing modes - Direct, Register, Register indirect, Immediate and implicit addressing - Instruction set - Data transfer group - Arithmetic Group - Logical group - Branch control group and stack and I/O- Machine control group.

Unit 3 ASSEMBLY LANGUAGE PROGRAMMING	9+3

Addition - Subtraction - Multiplication -Division of two 8- bit numbers - Finding the largest number in a data array - Finding the smallest number in a data array-Arranging a list of numbers in ascending or descending order.

Unit 4 Introduction to C	9+3

Structure of 'C' – Fundamentals of C – Character set – identifiers and key words – data types constants – variables – declarations – expressions – symbolic constants – arithmetic operators- Relational, Logical and assignment operators, Unary, Bitwise and Ternary operators – conditional operators – I/O function – library function.

Unit 5 Preliminaries and Functions	9+3

Data input and output – getchar, putchar, scanf, printf, gets, puts functions – Control statements- while, do…. While, for nested loops, if … else, switch, break, continue and goto statements.

Basic functions – Return values and their types- Calling functions – storage class- automatic variables- External Variables- Static Variables- Recursion.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. B.Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai publication pr. Ltd., New Delhi
2. Ramesh S.Goankar,Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing (India) Pvt. Ltd.
3. Kenneth J.Ayala,The 8051 microcontroller Architecture, Programming and applications', second edition ,Penram international.

REFERENCES

1. Yn-cheng Liu, Glenn A. Gibson, "Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design", second edition, Prentice Hall of India, 2006.
2. Douglas V. " Microprocessors and Interfacing : Programming and Hardware", Hall, second edition , Tata McGraw Hill,2006.
3. A.K.Ray& K.M Bhurchandi, "Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing", Tata McGraw Hill , 2006.
4. Mohamed Ali Mazidi, Janice GillispieMazidi, "The 8051 microcontroller and embedded systems using Assembly and C", second edition, Pearson education /Prentice hall of India, 2007.
5. Venugopal, K.R. And Sudep, R.P.Programming with C, Tata McGraw Hill Pub. Co. Ltd.
6. E. Balagurusamy,Programming in C, Tata McGraw Hill Pub. Co.(2008).

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**3**	**3**	**0**	**1**
CO_2	**3**	2	**0**	**3**	**2**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**3**	**2**	**0**	**3**	**2**
CO_4	**3**	2	**0**	**3**	**2**	**0**	**0**	**2**
CO_5	**3**	2	**0**	**3**	**2**	**1**	**0**	**2**
	15	10	**0**	**15**	**11**	**6**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**3**	**2**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	Category			
		L	T	P	CREDITS
XPH504B	MICROPROCESSOR AND MICROCONTROLLER	3	1	0	4

COURSE OUTCOMES:

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

		Domain	Level
CO_1	To study the basic concepts of digit al computer, evolutes ion microprocessors, semiconductor memories RAM and ROM	Cog	Understadni ng
CO_2	To study the architecture and instruction set of an eight bit 8085 microprocessor	Cog	Remebering
CO_3	To write assembly language programs for an 8085 microprocessor.	Cog	Evaluating
CO_4	To study Structure of C language, operators, library function	Cog	Understandi ng
CO_5	To study various input and out statement loop statements while do else statements	Cog	Analyzing

SYLLABUS:

UNIT I BASICS OF DIGITAL COMPUTER	**9**
Basic components of a digital computer - Evolution of microprocessors - Important INTEL microprocessors - Buses - Hardware, Software and Firmware - Memory - Semiconductor memories - RAM,ROM - Flash memory.	
UNIT II INTEL 8085 AND ITS ARCHITECTURE	**9**
INTEL 8085 - Pin Diagram - Architecture - Various registers - Status Flags - Interrupts and their order of priority - Addressing modes - Direct ,Register, Register indirect, Immediate and implicit	
UNIT III INSTRUCTION SET	**9**
Instruction set - Data transfer group - Arithmetic Group - Logical group - Branch control group and stack and I/O- Machine control group.	
UNIT IV ASSEMBLY LANGUAGE PROGRAMMING .	**9**
Addition - Subtraction - Multiplication -Division of two 8- bit numbers - Finding the largest number in a data array - Finding the smallest number in a data array-Arranging a list of numbers in ascending or descending order	
UNIT V MICROCONTROLLERS	**9**
Architecture of 8051 Microcontroller – signals – I/O ports – memory – counters and timers – serial data I/O – interrupts Interfacing -keyboard, LCD, ADC & DAC	

Books for Study:

1. Fundamentals of Microprocessors and Microcomputers- B.Ram.
2. Microprocessor Architecture, Programming and Applications with the 8085, Ramesh. S.Goankar, Penram International Publishing (India) Pvt. Ltd.
3. 'The 8051 microcontroller Architecture, Programming and applications'Kenneth J.Ayala, second edition ,Penram international.

Books for Reference:

1. "Microcomputer systems: The 8086 / 8088 Family architecture, Yn-cheng Liu,Glenn A.Gibson, Programming and Design", second edition, Prentice Hall of India , 2006 .
2. " Microprocessors and Interfacing : Programming and Hardware", Douglas V.Hall, second edition , Tata Mc Graw Hill ,2006.
3. "Advanced Microprocessor and Peripherals – Architecture, A.K.Ray & K.M Bhurchandi, Programming and Interfacing", Tata Mc Graw Hill , 2006.
4. "The 8051 microcontroller and embedded systems using Assembly and C", Mohamed Ali Mazidi,Janice Gillispie Mazidi,second edition, Pearson education /Prentice hall of India , 2007.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**2**	**3**	**0**	**2**	**3**	**2**	**0**	**1**
CO_2	**2**	**2**	**0**	**2**	**2**	**1**	**0**	**1**
CO_3	**2**	**2**	**0**	**2**	**2**	**0**	**3**	**2**
CO_4	**2**	**2**	**0**	**0**	**2**	**0**	**0**	**2**
CO_5	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**2**
	10	**9**	**0**	**6**	**11**	**3**	**2**	**8**
Scaled to 1, 2, 3	**2**	**2**	**0**	**2**	**3**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	**SUBJECT NAME**	**L**	**T**	**P**	**C**
XPH505	**PHYSICS PRACTICAL –V A**	**0**	**0**	**3**	**2**
		L	**T**	**P**	**H**
		0	**0**	**3**	**3**

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: R; Ap, Psy: Mech; Compare theatrical output value with experimental output value.

CO5: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

1. Spectrometer – Grating –normal incidence
2. Field along the axis of a coil- H determination.
3. Demorgan's theorem verification using IC gates.
4. Voltage Doublers and Tripler.
5. Deflection magnetometer – M & H.
6. Air wedge – Determine the thickness of a thin wire.
7. Carey Foster Bridge – Specific Resistance.
8. Potentiometer – E.M.F of a Thermocouple.
9. Spectrometer – Refractive index of the prism.
10. Half adder and full adder using basic logic gates IC's.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.

3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
CO_5	3	2		2	1	2	3	2
	15	6		9	5	10	14	10
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	**SUBJECT NAME**	**L**	**T**	**P**	**C**
XPH506	**PHYSICS PRACTICAL –VB**	**0**	**0**	**3**	**2**
		L	**T**	**P**	**H**
		0	**0**	**3**	**3**

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: R; Ap, Psy: Mech; Compare theatrical output value with experimental output value.

CO5: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

2. Operational Amplifier – Differentiator, Integrator.
3. Tan C – determination of M & BH.
4. Focal length – Concave lens – Combination method (Two types)
5. Half subtractor and full subtractor using basic logic gates.
6. FET Characteristics and constants determination.
7. B.G – Figure of Merit – Voltage and Current Sensitiveness.
8. Newton's rings – Determination of radius of curvature of the lens R.
9. Half Adder, Full Adder using NAND/NOR gate
10. Spectrometer – i-d curve.
11. Construction Dual power supply 5-0-5 or 9-0-9v.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3

CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
CO_5	3	2		2	1	2	3	2
	15	6		9	5	8	14	10
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH601 RENEWABLE ENERGY

COURSE OUTCOMES:

CO1:Cog: Ap;***Identify*** the various alternate Sources of energy.

CO2:Cog:U;***Explain***Solar energy and applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell absorption air conditioning.

CO3:Cog :U;***Demonstrate*** the fundamentals of wind energy.

CO4:Cog: C;***Discuss***Ocean Energy and Tide energy technologies

CO5:Cog: U, R;***Explain***Geothermal Energy, Geothermal resources, geothermal technologies and Hydro energy, hydropower technologies and ***Relate*** the environmental impact.

COURSE CODE	COURSE NAME	L	T	P	C
XPH601	RENEWABLE ENERGY	0	0	4	2
		L	T	P	H
		0	0	4	4

UNIT - I **Alternate Sources of energy**	**7+3**
Fossil fuels and Nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wav energy systems, Ocean Thermal Energy conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	
UNIT - II **Solar energy**	**8+3**
Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar	

distillation, solar cooker, solar green houses, solar cell absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

UNIT - III	**Wind Energy**	**10+3**

Fundamentals of wind energy, wind Turbines and different electrical machines in wind turbines, Power electronic interfaces and grid interconnection topologies.

UNIT - IV	**Ocean Energy**	**10+3**

Ocean Energy Potential against wind and solar, wave characteristics and statistics, wave energy devices. Tide characteristics and Statistics, Tide energy technologies, Ocean Thermal energy, Osmotic power, ocean Bio-mass

UNIT - V	**Geothermal and Hydro Energy**	**10+3**

Geothermal Energy: Geothermal resources, geothermal technologies. Hydro energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. G.D.Rai,Non conventional energy sources, Khanna publisher, New Delhi.
2. M.P. Agarwal,Solar energy, S Chand and Co. Ltd.
3. Suhas P Sukhative,Solar energy, Tata McGraw – Hill Publishing Company Ltd.

REFERENCES

1. Godfrey Boyle, Renewable energy, Power for a sustainable future, Oxford University Press, in association with The open University (2004).
2. Dr. P, Jayakumar, Solar energy Resource Assessment Handbook, (2009)

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**2**	**2**	**0**	**1**
CO_2	**2**	1	**0**	**3**	**2**	**1**	**0**	**1**
CO_3	**2**	1	**0**	**3**	**2**	**1**	**3**	**2**
CO_4	**2**	1	**0**	**3**	**2**	**0**	**0**	**2**
CO_5	**2**	1	**0**	**3**	**2**	**0**	**0**	**2**

	11	6	**0**	**15**	**10**	**4**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**2**	**1**	**1**	**2**

XPH602A- RELATIVITY & QUANTUM MECHANICS

COURSE OUTCOMES:

CO1:Cog: U,E; ***Recall***the properties of wave function and ***Interpret*** the wave function probability and probability current densities in three dimensions.

CO2:Cog: U,E; ***Explain***the time dependent Schrodinger equation and its ***influence***.

CO3:Cog : Ap; ***Identify*** the continuity of wave function, boundary condition and emergence of energy levelsand ***Applied*** in square well potential.

CO4:Cog: C; ***Discuss*** thetime independent Schrodinger equation in spherical polar coordinates and Orbital angular momentum quantum numbers l and m; s, p, d,.. shell.

CO5:Cog: U;**Explain**electron spin and spin angular momentum and Electron MagneticMoment and Magnetic Energy.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XPH602A	**RELATIVITY & QUANTUM MECHANICS**	**3**	**1**	**0**	**4**
		L	**T**	**P**	**H**
		3	**1**	**0**	**4**

UNIT - I Time dependent Schrodinger Equation	**7+3**
Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of wave function – Interpretation of wave function probability and probability current densities in three dimensions – Conditions for Physical Acceptability of wave functions – Normalization – Linearity and Superposition Principles – Eigenvalues and Eigenfunctions – Position – momentum & Energy operators; Expectation values of position and momentum – Wave function of a free particle.	

UNIT - II Time independent Schrodinger Equation	**8+3**
Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wave function as a linear combination of energy eigenfunctions – General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states – Application to the spread of Gaussian wave packet for a free particle in one dimension – wave packets – Fourier transforms and momentum space wave function – position –momentum uncertainty principle.	

UNIT - III	General discussion of bound states in an arbitrary potential	10+3

Continuity of wave function, boundary condition and emergence of discrete energy levels – application to one – dimensional problem – square well potential, - Quantum mechanics of simple harmonic oscillator –energy levels and energy eigenfunctions using – Frobenius method.

UNIT - IV	Quantum theory of hydrogen-like atoms	10+3

Time independent Schrodinger equation in spherical polar coordinates – separation of variables for the second order partial differential equation – angular momentum operator and quantum numbers – Radial wavefunctions from Frobenius method – Orbital angular momentum quantum numbers l and m; s, p, d,.. shell (idea only).

UNIT - V	Relativity	10+3

Galelian transformation – Michelson Morely experiemtn - Lorentz transformation Special theory of relativity – length contration – time dilation – mass variation – energy – momentum relationship

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. A Text Book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill.
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley.
3. Quantum Mechanics, G. Aruldhas, 2ndEdn 2002, PHI Learning of India.

REFERENCES

1. Quantum Mechanics, Leoard I. Schiff, 3rdEdn, 2010, Tata McGraw Hill.
2. Quantum Mechanics, Bruce Cameron Reed, 2008, Jone and Bartlett Learning.
3. Quantum Mechanics for Scientists & Engineers, DA.B. Miller, 2008, Cambridge University Press.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	2	3	1	0	1
CO_2	3	2	0	2	3	2	0	1
CO_3	3	2	0	2	3	0	3	2
CO_4	3	2	0	2	3	0	0	2

CO_5	**3**	2	**0**	**0**	**0**	**0**	**0**	**2**
	15	10	**0**	**8**	**12**	**3**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**2**	**3**	**1**	**1**	**2**

XPH602B- MATERIAL SCIENCE

Course Outcome: *On the successful completion of the course, students will be able to*		**Domain & Level**
CO1 :	Recall and distinguish various crystal structures.	Cognitive (Rem, Analyze)
CO2 :	Know about the impacts of defects at the atomic and microstructure scales.	Cognitive (Rem, Understand)
CO3 :	Describe the various Ceramic, Electrical & Electronic Materials.	Cognitive (Rem, Analyze)
CO4 :	Describe the basics of mechanical properties of material and identify how they can be tested.	Cognitive (Rem, Analyze)
CO5 :	Recognize and Describe various Magnetic Materials and Nano Materials.	Cognitive (Remember)

SUBCODE	**MATERIALS SCIENCE**	**L**	**T**	**P**	**C**
XPH602B		**3**	**1**	**0**	**4**
		L	**T**	**P**	**H**
		3	**1**	**0**	**4**

UNIT - I	**Crystal Structure**	**9 + 3**

Atomic structure and inter-atomic bonding; Structure of crystalline solids; Lattices, unit cells; Crystal systems, Bravais lattices; Indexing of directions and planes, notations, Inter-planar spacings and angles, co- ordination number, packing factors.

UNIT – II	**Defects in Crystals**	**9 + 3**

Point defects; Dislocations, Types of dislocations, Burgers vector and its representation; Planar defects, stacking faults, twins, grain boundaries.

UNIT - III	**Ceramic, Electrical & Electronic Materials**	**9 + 3**

Ceramic Materials:Introduction, ceramic structures, silicate structures, processing of ceramics; Properties, glasses; Composite Materials- Introduction, classification, concrete, metal-matrix and ceramic –matrix composites.Electrical& Electronic Properties of Materials: Electrical

Conductivity, Electronic and Ionic Conductivity, Intrinsic and Extrinsic Semi conductivity, Semiconductor Devices, Dielectric Properties, Piezo-electricity.		
UNIT – IV	**Mechanical Properties of Materials**	**9 + 3**
Concepts of stress and strain, Stress-Strain diagrams; Properties obtained from the Tensile test; Elastic deformation, Plastic deformation. Impact Properties, Strain rate effects and Impact behavior. Hardness of materials.		
UNIT - V	**Magnetic Materialsand Nano Materials**	**9 + 3**
Magnetic Materials: Introduction, Magnetic fields or quantities, types of magnetism, classification of magnetic materials, soft magnetic materials, H magnetic materials, Ferrites, Ferro, Para Magnetic materials.NanoMaterials:Introduction – Nano material preparation, purification, sintering nano particles of Alumina and Zirconia, Silicon carbide, nanoop, nano-magnetic, nano-electronic, and other important nano materials.		

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

Text Books:

1	Askeland D.R.,& P. P. Fullay (2007), The Science and Engineering of Materials – 7thCengage Learning Publishers.
2	William D. Callister, Jr (2008), Callister‟s Materials Science and Engineering, (Adopted by R. Balasubramaniam) Wiley-Eastern

Reference books :

1	A.S. Edelstein and R.C. CammarataEd.(1998), Nano Materials: Synthesis, Properties and Applications, Inst. Of Physics Publishing, UK.
2	Raghavan V (2007), Materials Science and Engineering - A First Course, Prentice Hall, India
3	James F. Shackelford (1996), Introduction to Materials Science for Engineers, Prentice Hall, India

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**2**	**3**	**1**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**3**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**2**	**3**	**0**	**3**	**2**

CO_4	**3**	2	**0**	**2**	**3**	**0**	**0**	**2**
CO_5	**3**	2	**0**	**0**	**0**	**0**	**0**	**2**
	15	10	**0**	**8**	**12**	**3**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**2**	**3**	**1**	**1**	**2**

XPH603A MICRO ELECTRO MECHANICAL SYSTEM

COURSE OUTCOMES

CO1:Cog: U;***Understand process of MEMS and their applications***.

CO2:Cog: U,Ap ,E;***understand processes for fundamental devices*** and ***apply***their knowledge for basic mechanics and electrostatics.

CO3:Cog : U;***Summarize***MUMPs processing sequence and design rules. MUMPs and SUMMIT: design rules.

CO4:Cog: Ap;***Develop*** CMOS foundry processes and ***Utilize***their knowledge in various applications.

CO5:Cog: U, An; ***Infere knowledge of the scalling laws and MEMSs Assembly*** *of future applications*.

COURSE CODE	COURSE NAME	L	T	P	C
XPH603A	MICRO ELECTRO MECHANICAL SYSTEM	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I INTRODUCTION	**7+3**
History of MEMS, market for MEMS, overview of MEMS processes, properties of silicon, a sample MEMS process. Basics of Microtechnology: definitions and terminology, a sample process, lithography and etching. MEMS Biosensors: Bio Flow Sensors, MEMS Images. Introduction to MEMS Pro design software.	
UNIT - II MICROMACHINING	**8+3**
Subtractive processes (wet and dry etching), additive processes (evaporation, sputtering, epitaxial growth). Fundamental Devices and Processes: basic mechanics and electrostatics for MEMS, parallel plate actuators, pull-in point, comb drives.	
UNIT - III FUNDAMENTAL DEVICES AND PROCESSES	**10+3**

More electrostatic actuators; MEMS foundries, Cronos MUMPs (multi user MEMS process). MUMPs Multi User MEMS Process: JDS Uniphase MUMPs processing sequence and design rules. MUMPs and SUMMIT: design rules; applications; micro hinges and deployment actuators.

UNIT - IV CMOS MEMS	**10+3**

CMOS foundry processes, integrated IC/MEMS, MEMS postprocessing, applications. Cleanroom lab techniques: clean rooms, gowning procedures; safety, fire, toxicity; acids and bases; photolithography.

UNIT – V SCALING LAWS AND MEMS ASSEMBLY	**10+3**

Scaling Laws. Wireless MEMS: mechanical and electrical resonators, Q-factor, switches, filters. Power for MEMS: thin film batteries, micro fuel cells, energy fields. MEMS Packaging and Assembly: microassembly: serial and parallel, deterministic and stochastic; microgrippers: HexSil process; packaging techniques. The Future of MEMS: bioMEMS – neural implants, gene chips, diagnostic chips; MEMS in space; mechanical computers; invisible and ubiquitous computing.

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. HSU, TAI RAN, Mems And Microsystems Design And Manufacture, Tata McGraw-Hill,2002.
2. Rai-Choudhury, Prosenjit; MEMS and MOEMS Technology and Applications SPIE 2000.

REFERENCES

1. Mohamed Goad-el-Hak, "MEMS: Introduction and Fundamentals",CRC Press edition 2005
2. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan, "Smart Material Systems and MEMS: Design and Development Methodologies".

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	2	3	0	3	3	2	0	1
CO_2	2	2	0	2	2	1	0	1
CO_3	2	2	0	2	2	0	3	2
CO_4	2	2	0	1	2	0	0	2
CO_5	2	0	0	0	2	0	0	2
	10	9	0	8	11	3	2	8
Scaled to 1, 2, 3	2	2	0	2	3	1	1	2

3 – Strong: 2 – Medium: 1 – Low

XPH603B - NUMERICAL METHODS IN PHYSICS

COURSE OUTCOMES:

CO1: Cog: E,Ap;***Identify*** errors and ***Measure*** errors using General formula.

CO2: Cog: R,E;***Define*** various iteration method and ***Determine*** the false position using these method.

CO3: Cog :R, Ap;***Find*** the unequal intervals***Applying*** various interpolation formula.

CO4: Cog: U, Ap, E;***Explain*** numerical differentiation and integration and ***Solve***problems byNewton's forward, trapezoidal, Simpson'srule.

CO5: Cog: U, AP;**Explain** n^{th} order ordinary differential equations and **apply** the knowledge to Solve the differential equation.

COURSE CODE	COURSE NAME	L	T	P	C
XPH603B	NUMERICAL METHODS IN PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

Unit I : Measurements and errors	**7+3**
Errors and the measurements General formula for errors – Errors of observation and measurement – Empirical formula – Graphical method – Method of averages – Least square fitting – curve fitting – parabola, exponential.	

Unit II : Iteration methods	**8+3**
Numerical solution of algebraic and transcendental equations The iteration method – The method of false position – Newton – Raphson method – Convergence and rate of convergence – C program for finding roots using Newton – Raphson method. Simultaneous linear algebraic equations Gauss elimination method – Jordon's modification – Gauss – Seidel method of iteration.	
Unit III : Interpolation formula	**10+3**
Interpolation Linear interpolation – Lagrange interpolation Gregory – Newton forward and backward interpolation formula – Central difference interpolation formula – Gauss forward and backward interpolation formula – Divided differences – Properties – Newton's interpolation formula for unequal intervals.	
Unit IV : Numerical differentiation and Integration	**10+3**
Numerical differentiation and integration, Newton's forward and backward difference formula to compute derivatives – Numerical integration: the trapezoidal rule, Simpson's rule – Extended Simpson's rule.	
Unit V : Differential equations for Numerical solutions	**10+3**
Numerical Solutions of ordinary differential equations Nth order ordinary differential equations – Power series approximation – Point wise method – Solutions of Taylor series – Euler's method – Improved Euler's method – Runge-Kutta method – second and third order – Runge-Kutta method for solving first order differential equations.	

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. S.S. Sastry, Introductory Methods of Numerical analysis, Prentice, Hall of India, New Delhi (2003) 3rd Edition.
2. M. K. Venkatraman, Numerical methods for Physicists.

REFERENCES

1. Numerical Methods in Science and Engineering – The National Publishing Co., Madras (2001).
2. W.H. Press, B.P.Flannery, S.A.Teukolsky, W.T.Vetterling,Numerical Recipes in C,

Cambridge University (1996).

3. K.P.N. Murthy,Monte Carlo : Basics ISRP, Kalpakkam, 2000.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	2	3	1	0	1
CO_2	2	2	0	2	2	0	0	1
CO_3	2	2	0	2	2	0	3	2
CO_4	2	2	0	3	1	0	0	2
CO_5	2	2	0	3	0	2	0	2
	11	10	0	12	6	3	2	8
Scaled to 1, 2, 3	3	2	0	3	2	1	1	2

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH604	PHYSICS PRACTICAL –VI A	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: R; Ap, Psy: Mech; Compare theatrical output value with experimental output value.

CO5: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

1. NAND, NOR Universal gates – Verification.
2. RC Coupled Transistor Amplifier – Band width.

3. UJT relaxation oscillator.
4. RS- Filp Flop.
5. Operational amplifier – Adder and subtractor.
6. Emitter Follower.
7. AstableMultivibrator.
8. Monostable multivibrator using transistor.
9. Microprocessor – 8 bit addition and subtraction.
10. Microprocessor – 8 bit multiplication and division.

TEXT BOOKS

1. B.Sc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1

CO_4	3	1		2	1	2	3	2
CO_5	3	2	1	2	2	3	2	2
	15	6	1	9	6	11	13	10
Scaled to 1, 2, 3	**3**	**1**	**1**	**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH605	**PHYSICS PRACTICAL –VI B**	**0**	**0**	**3**	**2**
		L	**T**	**P**	**H**
		0	**0**	**3**	**3**

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: R; Ap, Psy: Mech; Compare theatrical output value with experimental output value.

CO5: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

1. JK-Flip Flop.
2. Decade counter 7490.
3. Wien's bridge oscillator.
4. FET Amplifier – Band width.
5. Feedback Amplifier - Transistor.
6. B.G. – Comparison of mutual inductance.
7. Half Subtractor and Full Subtractor using NAND/NOR gates.
8. Microprocessor – Decimal to Octal and Octal to Decimal Conversion.

9. Microprocessor –Study of DAC Interfacing.
10. Microprocessor – Decimal to Hexadecimal and Hexadecimal to Decimal Conversion.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
CO_5	3	2	1	2	2	3	2	2
	15	6	1	9	6	11	13	10
Scaled to 1, 2, 3	**3**	**1**	**1**	**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

M.Sc. Physics Syllabus

YPH101			MATHEMATICAL METHODS OF PHYSICS -I	L	T	P	C
				4	1	0	5
C	P	A		L	T	P	H
3	0.75	0.25		4	1	0	5

PREREQUISITE: Basic knowledge on vectors and their properties.

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

	Course Outcome	Domain	Level
CO1	***Solve*** problems in orthogonality of vectors, Eigen values and Eigen vectors.	**Cognitive**	Apply
CO2	***Explain*** the basic properties of complex functions and related theorems.	**Cognitive**	Comprehension
CO3	***Solve*** both differential equations using Laplace Transform.	**Cognitive**	Knowledge, Apply
CO4	***Solve*** differential equations using Fourier's series and transform.	**Cognitive**	Knowledge, Apply
CO5	***Understand*** and ***compute*** different probability distribution in probability theory.	**Cognitive**	Knowledge, Apply

UNIT - I	**Vector Analysis and Matrices**	**12+3**

Vector Analysis: The Scalar and vector fields – Gradient, divergence and curl – Orthogonal curvilinear coordinates – Cylindrical and spherical coordinates as a special curvilinear system – Vector integration – Line, surface and volume integrals – Gauss divergence theorem - Stokes theorem in the space - Green's theorem in the plane. Matrices: Matrices inverse – Orthogonal and unitary matrices – Independent elements of matrix – Eigen values and Eigen vectors – Cayley Hamilton theorem – Diagonalization – complete orthonormal set of functions.

UNIT - II	**Functions of a Complex Variable**	**12+3**

Functions of complex variable - Analytic functions-Cauchy - Riemann equations - integration in the Complex plane – Cauchy's theorem - Cauchy's integral formula - Taylor and Laurent expansions- Singular Points- Cauchy's residue theorem - poles - evaluation of residues - evaluation of definite integrals.

UNIT - III	**Laplace Transforms**	**12+3**

Laplace transforms: Linearity property, first and second translation property of LT – Derivatives of Laplace transforms – Laplace transform of integrals – Initial and Final value theorems; Methods for finding LT: direct and series expansion method, Method of differential equation; Inverse Laplace transforms: Linearity property, first and second translation property, Convolution property – Application of LT to differential equations and boundary value problems.

UNIT - IV	**Fourier Series, Integrals and Transforms**	**12+3**

Fourier series definition and expansion of a function x – Dirichlet's conditions- Complex representation of Fourier series – problems related to periodic functions – Fourier integrals – convergence of FS – solving simple partial differential equations using Fourier's series- Fourier transforms: sin, cosine & complex transforms- solving simple partial differential equations using Fourier transform.		
UNIT - V	**Probability Theory**	**12+3**
Fundamental laws of probability- Random variables - Probability distributions-Moments of the distributions - Binomial - Poisson and Normal distributions- Conditional probability distribution joint probability distribution- Characteristic functions- Central limit theorem- Random walks (1D, 2D and 3D) and their applications to physical processes (diffusion, paramagnetism).		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	15	0	75

TEXT BOOKS

1.	Mathematical Physics - H.K.Dass and R.Verma. S. Chand & Co Pvt Ltd., 1997.
2.	Mathematical Physics - B.D. Gupta, Vikas, Publishing House Pvt Ltd., New Delhi, 2003.
3.	Mathematical Physics – Satya Prakash, Sultan Chand & Sons, 2014.

REFERENCE BOOKS

1.	Topics in Mathematical Physics, Parthasarathy H, Ane Books Pvt. Ltd, 2007.
2.	Advanced Engineering Mathematics, Kreyszig, Wiley Eastern Ltd, 1993.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	1	2	1	1	2	3	2	1
CO2	3	2	1	2	1	1	2	3	2	1
CO3	3	2	1	2	1	1	2	3	2	1
CO4	3	2	1	2	2	1	2	3	2	1
CO5	2	2	1	2	2	1	2	3	2	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH102			CLASSICAL MECHANICS	L	T	P	C
				4	1	0	5
C	P	A		L	T	P	H
3	0.75	0.25		4	1	0	5

PREREQUISITE: Basics knowledge in Calculus (Vector, Differential, Integral).

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

	Course Outcome	Domain	Level
CO1	***Understand*** and ***solve*** the equations of motion using Lagrangian equations.	**Cognitive**	Knowledge, Apply
CO2	***Understand*** and ***apply*** the equations of motion using Hamilton equations.	**Cognitive**	Knowledge, Apply
CO3	***Understand*** Hamilton-Jacobi equations and eigen value equations.	**Cognitive**	Knowledge
CO4	***Understand*** the kinematics of rigid body through Euler's equation.	**Cognitive**	Knowledge
CO5	***Understand*** and ***solve*** the central force field problems and theory of relativity.	**Cognitive**	Knowledge, Apply

UNIT - I	**Lagrangian Formulation**	**12+3**

System of particles - constraints and degrees of freedom - homogeneity and isotropy - D'Alemberts principle of virtual work - Lagrange's equation of motion - nonholonomic systems applications of Lagrange equations of motion: free particle in space - Atwood's machine.

UNIT - II	**Hamilton's Equation and Canonical Transformation**	**12+3**

Calculus of variation - principle of least action - Hamilton's principle - Hamilton's function - Lagrange's equation from Hamilton's principle - Hamilton's principle for nonholonomic system - variational principle - Hamilton's equations from variational principle - Hamilton's equation of motion - Canonical Transformations - Hamilton's canonical equations.

UNIT - III	**Hamilton –Jacobi Theory and Small Oscillation**	**12+3**

Hamilton-Jacobi equation for Hamilton’s principle function - Example: Harmonic oscillator problem - Hamilton’s characteristic function - Action-angle variable - application to Kepler's problem in action angle variables - Vibrations of linear triatomic molecule.

UNIT - IV	**Kinematics of Rigid Body**	**12+3**

Independent coordinates of rigid body - Euler angle and Euler’s theorem - infinitesimal rotation - Coriolis force - angular momentum and kinetic energy of motion about a point -moment of inertia tensor – Euler equation of motion-torque free motion of a rigid body -heavy symmetrical top.

UNIT - V	**Central Force Problem and Theory of Relativity**	**12+3**

Reduction to the equivalent one body problem - Centre of mass - Equation of motion and first integral - Kepler problem: Inverse - Square law of force-Scattering in a central force field transformation of scattering to laboratory coordinates - Special theory of relativity - Lorentz transformations - Relativistic kinematics - mass–energy equivalence.

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	**15**	**0**	**75**

TEXT BOOKS

1.	Classical Mechanics -H. Goldstein, C. Poole and J. Safko, Pearson Education Asia, New Delhi, 2002.
2.	Classical Mechanics - G. Aruldhas, PHI Learning Private Limited, New Delhi, 2015.
REFERENCE BOOKS	
1.	Classical Mechanics -S. L. Gutpa, V. Kumar and H.V. Sharma, Pragati Prakashan, Meerat, 2016.
2.	Classical Mechanics of Particles and Rigid Bodies -K.C. Gupta, New Age International Publishers, New Delhi, 2018.
3.	Classical Mechanics -N.C. Rana and P.J. Joag, Tata McGraw Hill, New Delhi, 2015.
4.	Classical Mechanics -J. C. Upadhaya, Himalaya Publishing House Pvt. Ltd, Bangalore, 2017.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	**3**	**3**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**1**
CO2	**3**	**3**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**1**
CO3	**3**	**3**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**1**
CO4	**3**	**2**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**1**
CO5	**3**	**2**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**1**

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH103			**ELECTRONICS**	**L**	**T**	**P**	**C**
				4	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0.75**	**0.25**		**4**	**1**	**0**	**5**

PREREQUISITE: Basic knowledge in active and passive components in a circuit and semiconductors.

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

	Course Outcome	**Domain**	**Level**
CO1	***Understand*** the characteristics of various types of diodes and transistors along with their ***applications*** in devices.	**Cognitive**	Knowledge, Apply

CO2	***Construct*** circuits using op-amp for ***executing*** arithmetic operations, ***design*** circuits for a desired input/ output.	**Cognitive**	Knowledge, Synthesis
CO3	***Explain*** the principle of operation and ***performance*** of various oscillators and converters.	**Cognitive**	Knowledge, Comprehension
CO4	***Develop*** an ability to analyse and ***design*** different digital systems.	**Cognitive**	Synthesis
CO5	***Understand*** masking concept as well as IC fabrication technology, ***design*** CMOS layout and Charged coupled device.	**Cognitive**	Knowledge, Synthesis

UNIT - I	**Semiconductor Devices**	**12+3**

PN junction diodes - Varactor diode - Schottky diode - tunnel diode - Gunn diode -optoelectronic diode - LASER diode - LED - photo diode - JFET characteristics - Depletion and enhancement type MOSFFT – Characteristics of UJT and SCR – relaxation oscillator - Power control DIAC and TRIAC.

UNIT - II	**Operational Amplifier**	**12+3**

Operational Amplifier characteristics - inverting and non-inverting amplifier - voltage follower - integrating and differential circuits - log and antilog amplifiers - op-amp as a comparator - voltage to current and current to voltage conversions - active filters: low pass, high pass, band pass and band rejection filters - solving simultaneous and differential equations (Analog computations).

UNIT - III	**Oscillators and Converters**	**12+3**

Wien bridge and phase-shift oscillators – Triangular, saw-tooth and square-waves generators – Schmitt trigger – Voltage control oscillator – Phase-locked loops -- Basic Digital to Analog conversion (DAC) - Weighted resistor DAC and binary R-2R ladder DAC -- Counter type ADC and successive approximation converter - dual slope ADC.

UNIT - IV	**Digital Systems**	**12+3**

Digital comparator – Parity generator/checker – Data selector -- BCD to Seven segment decoder – Encoders – RS, JK, D and JK master-slave flip-flops - Serial-in serial-out, serial-in parallel-out and parallel-in serial-out shift registers – Synchronous, asynchronous, ring and up/down (using mod 10) counters -- Multiplexers – Demultiplexers.

UNIT - V	**IC Fabrication and IC Timer**	**12+3**

Basic monolithic ICs – Epitaxial growth – Masking – Etching impurity diffusion – Fabricating monolithic resistors, diodes, transistors, inductors and capacitors – Circuit layout – Contacts and inter connections – Charge coupled device – Applications of CCDs -- 555 timer: Description of the functional diagram, applications of monostable and astable operations and pulse generation.

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
60	**15**	**0**	**75**

TEXT BOOKS

1. Integrated Electronics - Millman and Halkias, TMH, 2017.

2.	Text Book of Electronics - S. Chattopadhyay, New Central Book Agency P.Ltd, 2012.
REFERENCE BOOKS	
1.	Electronic Devices and Circuits - Anil K. Maini and Varsha Agarwal, Wiley Publications, 2009.
2.	Electronic principles - Malvino, TMH, 2015.
3.	Op-Amps & Linear Integrated Circuits - R.A. Gayakwad, Printice Hall, New Delhi, 1999.
4.	Linear Integrated Circuit - D. Roy Choudhury and S.B. Jain, New Age International Publications, New Delhi, 2010.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PS0O9	PSO10
CO1	3	2	1	1	2	2	3	3	0	1
CO2	3	3	2	1	1	2	3	3	0	1
CO3	3	2	3	1	2	2	3	3	0	1
CO4	3	2	3	1	2	2	3	3	0	1
CO5	3	3	1	1	3	2	3	3	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH104A			COMPUTATIONAL PROGRAM	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Knowledge in UG level Mathematics (Calculus).

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

Course Outcome		Domain	Level
CO1	Understand and apply numerical methods to find out solution of algebraic equation using different methods under different conditions, and numerical solution of system of algebraic equation	Cognitive	Knowledge,
CO2	Apply various interpolation methods and finite difference concept	Cognitive	Remember
CO3	Work out numerical differentiation and integration whenever and wherever routine are not applicable.	Cognitive	Apply
CO4	Identify modern programming methods and describe the extent and limitations of computational methods in physics	Cognitive	Analyse
CO5	Process, analyze and plot data from a variety of physical	Cognitive	evaluate

	phenomena and interpret their meaning.		
UNIT - I	Numerical Differentiation		**12**
Introduction - C program, C programming : Finding Roots of a Polynomial - Bisection Method - Newton Raphson Method - Solution of Simultaneous Linear Equation by Gauss elimination method - Solution of Ordinary Differential Equation by Euler – Runge Kutta Fourth Order Method for solving first order Ordinary Differential Equations			
UNIT - II	Numerical integration		**12**
C programming : Newton's cotes formula – Trapezoidal rule - Simpson's 1/3 rule - Simpson's 3/8 rule - Boole's rule - Gaussian quadrature method (2 point and 3 point formula) - Giraffe's root square method for solving algebraic equation			
UNIT - III	Matlab Fundamentals		**12**
Introduction – Matlab Features – Desktop Windows: Command, Workspace, Command History, Array editor and Current Directory – Matlab Help and Demos – Matlab Functions, Operators and commands, Basic Arithmetic in Matlab – Basic Operations with Scalars - Vectors and Arrays - Matrices and Matrix Operations - Complex Numbers - Matlab Built - In Functions - Illustrative Examples			
UNIT - IV	Matlab Programming		**12**
Control Flow Statements: if else, else if, Switch Statements – For, While Loop Structures – Break Statement – Input / Output Commands – Script 'm' Files – Function 'm' Files – Controlling output			
UNIT - V	Matlab Graphics		**12**
2D Plots - Planar Plots, Log Plots, Scatter Plots, Contour Plots - Multiple Figures, Graph of a Function – Titles, Labels, Text in Graph - Line Types, Marker types, Colors - 3D Graphics - Curve Plots - Mesh and Surface Plots - Illustrative Examples			

LECTURE	TUTORIAL	PRACTICAL	TOTAL
45	**15**	**0**	**60**

TEXT BOOKS

1. Numerical methods in Science and Engineering - M.K. Venkataraman, National Publishing Co. Madras, 1996
2. Getting Started With Matlab – Rudra Pratap, Oxford University Press-New Delhi.

REFERENCE BOOKS

1. Numerical methods using Matlab – John Mathews & Kurtis Fink, Prentice Hall, New Jersey 2006
2. Numerical Methods for Physicists - M. K. Venkatraman, S. Chand & Company, New Delhi, 2005.
3. Matlab Programming - David Kuncicky, Prentice Hall

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
4.	https://onlinecourses.nptel.ac.in/noc20_ma33/preview 2 https://nptel.ac.in/course/103106074/

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	3	1	3	1	3	3	2	1
CO2	2	3	3	1	3	1	3	3	2	1
CO3	3	3	3	1	1	1	3	3	2	1
CO4	2	2	3	1	1	1	3	3	2	1
CO5	3	2	3	1	1	1	3	3	2	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH104B			THERMODYNAMICS AND STATISTICAL MECHANICS	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Basic knowledge on thermodynamic laws and relations.

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

Course Outcome		Domain	Level
CO1	***Understand*** thermodynamic concepts, which are related to materials properties and various areas of research & development.	**Cognitive**	Knowledge
CO2	***Understand*** relation between microscopic and macroscopic particles and their properties.	**Cognitive**	Knowledge
CO3	***Acquire knowledge*** on role of distribution of particles and energy within the available states on properties of the matter.	**Cognitive**	Knowledge
CO4	***Identify*** the possible states of the mater and energy exchange during the change in state of the matter.	**Cognitive**	Knowledge
CO5	***Apply*** thermo-dynamical relations and statistical laws to ***study*** the properties of the matter.	**Cognitive**	Knowledge, Apply

UNIT - I	Thermodynamics, Microstates and Macrostates	12

Basic postulates of thermodynamics – Fundamental relations and definition of intensive variables – Intensive variables in the entropic formulation – Equations of state – Euler relation, densities - Gibbs-Duhem relation for entropy - Thermodynamic potentials– Maxwell relations – Thermodynamic relations – Microstates and macrostates – Ideal gas – Microstate and macrostate in classical systems – Microstate and macrostate in quantum systems – Density of states and volume occupied by a quantum state.		
UNIT - II	**Microcanonical, Canonical and Grand Canonical Ensembles**	**12**
Microcanonical distribution function – Two level system in microcanonical ensemble – Gibbs paradox and correct formula for entropy – The canonical distribution function – Contact with thermodynamics - Partition function and free energy of an ideal gas –The grand partition function – Relation between grand canonical and canonical partition functions – One-orbital partition function.		
UNIT - III	**Bose-Einstein, Fermi-Dirac and Maxwell Boltzmann Distributions**	**12**
Bose-Einstein and Fermi-Dirac distributions – Thermodynamic quantities – Non-interacting Bose gas and thermodynamic relations – Chemical potential of bosons – Number density of photons and Bose condensation - Thermodynamic relations for non-interacting Fermi gas – Fermi gas at zero and low temperature – Fermi energy and Fermi momentum - Maxwell-Boltzmann distribution law for microstates in a classical gas - Physical interpretation of the classical limit – Fluctuations in different ensembles.		
UNIT - IV	**Transport, Equilibrium and Non-Equilibrium processes**	**12**
Derivation of Boltzmann transport equation for change of states without and with collisions – Boltzmann equation for quantum statistics – Equilibrium distribution in Boltzmann equation – Transport processes; One speed and one dimension - All speeds and all directions - Distribution of molecular velocities – Equipartition and Virial theorems - Brownian motion - Non-equilibrium process; Joule-Thompson process - Free expansion and mixing - Thermal conduction.		
UNIT - V	**Heat Capacities, Ising Model and Phase Transitions**	**12**
Heat capacities of hetero-nuclear diatomic gas – Heat capacities of homo-nuclear diatomic gas – Heat capacity of Bose gas –One-dimensional Ising model and its solution by variational method – Exact solution for one-dimensional Ising model - Phase transitions and criterion for phase transitions – Classification of phase transitions by order and by symmetry – Phase diagrams for pure systems – Clausius-Clapeyron equation – Gibbs phase rule.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	0	0	60

TEXT BOOKS

1.	An Introductory Course of Statistical Mechanics - P.B. Pal, Narosa Publishing House, 2008.
2.	An introduction to Thermodynamic and Statistical Mechanics - Keith Stowe, Cambridge University Press, 2013.
3.	Elements of Statistical Mechanics - Kamal Singh & S.P. Singh, S. Chand & Company, 1999.

REFERENCE BOOKS	
1.	Statistical Mechanics An Elementary Outline - Avijit Lahiri, University Press, Hyderabad, 2002.
2.	Thermodynamic and Statistical Mechanics (Lecturers on the theoretical physics) - Arnold Sommerfeld, Levant Books, Kolkatta, 2005.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	2	2	2	3	2	3	2	2	1
CO2	3	2	2	2	3	2	3	2	0	1
CO3	3	2	2	2	3	2	3	2	0	1
CO4	3	2	2	2	3	2	3	2	0	1
CO5	3	2	2	2	3	2	3	2	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH104C			INSTRUMENTAL METHODS OF ANALYSES	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Fundamental knowledge on measuring instruments.

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

Course Outcome		Domain	Level
CO1	***Explain*** the types of errors in experimental methods of analysis.	**Cognitive**	Comprehension
CO2	***Understand*** the principle and working of thermal methods of analysis such as thermogravimetric analysis and differential scanning calorimetric analysis and **apply** for material analysis..	**Cognitive**	Knowledge, Apply
CO3	***Understand*** and ***apply*** X-ray diffraction method for analysing crystalline materials.	**Cognitive**	Knowledge, Apply
CO4	***Utilize*** luminescence methods and electron microscopy methods for material analysis and their application.	**Cognitive**	Knowledge
CO5	***Learn*** the various applications of nanoparticles.	**Cognitive**	Apply

UNIT - I	Errors and Analysis of Experimental Data	12

Types of errors – Mean, variance and standard deviation, standard deviation of standard deviation – sampling techniques – Chi square test. Experimental Stress Analysis: Stress analysis by strain gauging- high temperature strain gauge techniques – photoelasticity and holography.

UNIT - II	Thermal Analysis	12
Introduction – thermo gravimetric analysis – instrumentation of weight loss and decomposition products – differential scanning calorimetric – instrumentation – specific heat capacity measurements – determination of thermo chemical parameters – differential thermal analysis – basic principles – melting point determination and analysis.		
UNIT - III	**X-ray Analysis**	**12**
Single Crystal and powder diffraction – Diffractometer – interpretation of diffraction patterns – indexing – unknown and phase identification – double and four crystal Diffractometer for epitaxial characterization – lattice mismatch – tetragonal distortion – thin film characterization – X-ray fluorescence spectroscopy – uses.		
UNIT - IV	**Optical Methods and Electron Microscopy**	**12**
Photoluminescence – light-matter interaction – fundamental transitions – excitons – instrumentation – electroluminescence – instrumentation – photo reflectanceelectronic transitions – behavior of electronic transitions as a function of electric field. Principles of SEM, TEM, EDAX, AFM, EPMA – Instrumentation – sample preparation – analysis of materials – study of dislocations – ion implantation – uses – Nanolithogrphy.		
UNIT - V	**Electrical Methods**	**12**
Hall Effect – carrier density – resistivity – two probe and four probe methods – scattering mechanism – van der pauw method – CV characteristics – Schottky barrier capacitance – impurity concentration – electrochemical CV profiling – limitations.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	0	0	60

TEXT BOOKS

1. Electron microscopy and Microanalysis of Crystalline Materials - Belk.J.A, Applied Science Publishers, London, 1979.
2. Modern Metallographic Techniques and their Applications - Philips V.A, Wiley Interscience, 1971.

REFERENCE BOOKS

1. Instrumental Methods of Analysis - Willard.M, Steve.D, CBS Publishers, New Delhi, 1986.
2. Electron Microscopy and Microanalysis of Crystalline materials - Stradling, R.A, Applied Science Publishers, London, 1979.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	1	1	3	1	2	3	0	1
CO2	2	3	1	1	3	1	2	3	0	1
CO3	3	3	1	1	1	1	2	3	0	1
CO4	3	2	1	1	1	1	2	3	0	1

CO5	**2**	**3**	**1**	**1**	**2**	**1**	**2**	**3**	**0**	**1**

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH105			**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
				4	**0**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0.75**	**0.25**		**4**	**0**	**0**	**4**

PREREQUISITE: Knowledge in UG level Mathematics (Calculus).

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

	Course Outcome	**Domain**	**Level**
CO1	***Develop*** a comprehensive ***understanding*** on numerical error analysis in physical measurements.	**Cognitive**	Knowledge, Synthesis
CO2	***Demonstrate*** the accurate numerical methods to ***solve*** algebraic equation.	**Cognitive**	Apply
CO3	***Understand*** the Newton's interpolation formula in unequal intervals for numerical problem.	**Cognitive**	Knowledge
CO4	***Understand*** and ***implement*** numerical methods to ***solve*** differential and integral forms of equations.	**Cognitive**	Apply
CO5	***Obtain*** numerical solution of ordinary differential equation using power series approximation and Euler's Runge-Kutta method.	**Cognitive**	Comprehension, Apply

UNIT - I	**Errors and Curve Fitting**	**12**

Errors and the measurements - General formula for errors – Errors of observation and measurement – Empirical formula – Graphical method – Method of averages - Method of least squares – straight line, parabola, y = axn , y = aebx , y = a+bx – sum of squares of residuals for straight line and parabola fit – Weighted least squares approximation – Method of least squares for continuous functions.

UNIT - II	**Roots of Equation and Simultaneous Equations**	**12**

Numerical solution of algebraic and transcendental equations - iteration method –method of false position – Newton Raphson method - Simultaneous Equations: Existence of solutions- Basic Gauss elimination method –Jordan's modification - Gauss Jacobi iteration method – Gauss Seidal iteration method – Inversion of a matrix using Gauss elimination method.

UNIT - III	**Interpolation**	**12**

Interpolation Linear interpolation – Lagrange interpolation Gregory – Newton forward and backward interpolation formula – Central difference interpolation formula – Gauss forward and backward interpolation formula – Divided differences – Properties – Newton‟s interpolation formula for unequal intervals.

UNIT - IV	**Numerical Differentiation and Integration**	**12**

Numerical differentiation - Newton's forward and backward difference formula to compute derivatives

– Numerical integration: the trapezoidal rule, Simpsons rule – Extended Simpsons rule (1/3 rule).		
UNIT - V	**Ordinary Differential Equations**	**12**
Solution by Taylor's series – Picard's method for successive approximation - Basic Euler method – Improved Euler method – Modified Euler method – Runge Kutta fourth order method – Runge Kutta method for simultaneous first order differential equation - Runge Kutta Method for second order differential equation.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	**0**	**0**	**60**

TEXT BOOKS

3.	Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi. 2003.
4.	Numerical Methods for Mathematics, Science and Engineering - John H. Matthews, Prentice Hall of India, 2000.

REFERENCE BOOKS

4.	Numerical Mathematical Analysis - J. B. Scarborough, Oxford Publishing, 1990.
5.	Numerical Methods for Physicists - M. K. Venkatraman, S. Chand & Company, New Delhi, 2005.

YPH106			**BASIC GENERAL AND ELECTRONICS LABORATORY**	**L**	**T**	**P**	**C**
				0	**0**	**3**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
0.5	**2**	**0.5**		**0**	**0**	**6**	**6**

PREREQUISITE: Know the basic laws and have practical experience to use measuring tools.

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

	Course Outcome	Domain	Level
CO1	***Understand*** the concepts behind various physics experiments.	**Cognitive, Psychomotor**	Knowledge
CO2	***Measure*** different physical parameters with maximum accuracy.	**Cognitive, Psychomotor**	Evaluate
CO3	***Determine*** various physical constants through different physics experiments.	**Cognitive, Psychomotor**	Evaluate
CO4	***Construct*** simple electronic circuits and make out the characteristics of transistors, amplifiers, oscillators and filters.	**Cognitive, Psychomotor**	Synthesis

CO5	***Know*** the conceptual difference between analog and digital circuits.	**Cognitive, Psychomotor**	Comprehension

S. No.	**Experiments**
A. General Experiments (Any eight experiments)	
1.	Determination of Young's modulus, rigidity modulus and Poisson ratio by forming elliptical fringes
2.	Determination of Young's modulus, rigidity modulus and Poisson ratio by forming hyperbolic fringes
3.	Determination of Stefan's constant
4.	Determination of e/m of an electron by Thomson's method
5.	Determination of Thermal Conductivity of Metal by Forbe's Method
6.	Determination of Hydrogen Spectra and Rydberg Constant using spectrometer.
7.	Particle size determination using He-Ne Laser.
8.	Determination of Diode Laser wave length and particle size using Optical fibre
9.	Determination of Numerical Aperture of an Optical Fiber.
10.	Determination of wavelength of Laser using Diffraction Grating.
11.	Determination of Bandgap of a semiconductor.
12.	Determination of carrier concentration and Hall coefficients in semiconductors.
B. Electronics Experiments (Any eight experiments)	
1.	Transistor power amplifier
2.	Design and study of Wein bridge Oscillator (Op-amp)
3.	Design and study of phase shift Oscillator (Op-amp)
4.	Construction of dual Regulated Power Supply using ICs
5.	Characteristics of JFET
6.	Characteristics of UJT
7.	Characteristics of LDR
8.	Common source amplifier using FET
9.	Common drain amplifier using FET
10.	Integrator and Differentiator using Op-amp
11.	Filter using Op-amp
12.	Half and Full wave rectifier

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
0	**0**	**90**	**90**

TEXT BOOKS

1. An Advanced Course in Practical Physics - D. Chattopadhyay, P. C. Rakshit, New Central Book Agency (P) Ltd., 2007.
2. A Textbook of Advanced Practical Physics - S. K. Ghosh, New Central Publishers, 2000.
3. Electronic Circuits Lab Manual - C. R. Ramesh, Scitech Publications (India) Pvt. Ltd., Chennai, 2012.

REFERENCE BOOKS

1.	Advanced Practical Physics Volume I – Dr. S.P. Sing, Pragati Prakasan Educational publishers, 2011.
2.	Practical Physics and Electronics – C.C. Ouseph, U.J. Rao, V. Vijayendran, Viswanathan Printers & Publishers Pvt. Ltd., 2007.
3.	Practical Physics - C. L. Arora, S. Chand Publishing, New Delhi, 2015.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	1	1	3	3	2	3	0	1
CO2	2	3	1	1	3	3	2	3	0	1
CO3	3	3	1	1	1	3	2	3	0	1
CO4	3	2	1	1	1	3	2	3	0	1
CO5	2	3	1	1	2	3	2	3	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH201			MATHEMATICAL METHODS OF PHYSICS - II	L	T	P	C
				4	1	0	5
C	P	A		L	T	P	H
3	0.75	0.25		4	1	0	5

PREREQUISITE: Basic knowledge in differential equations.

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

	Course Outcome	Domain	Level
CO1	***Characterize*** the physical system ***using*** group operations and tensors.	Cognitive	Comprehension, Apply
CO2	***Classify*** differential equations and ***choose*** right method to solve problems.	Cognitive	Knowledge, Comprehension
CO3	***Apply*** partial differential equation to ***solve*** problems in physics.	Cognitive	Apply
CO4	***Construct*** the recurrence relation of Legendre's differential equation and Bessel's differential equation.	Cognitive	Synthesis
CO5	***Evaluate*** the Gamma function and ***Obtain*** the orthogonal relation of Beta function.	Cognitive	Evaluate, Comprehension

UNIT - I	Group Theory & Tensor Analysis	12+3

Group Theory: Definitions of a group-elementary properties-sub groups homomorphism and isomorphism of groups-representation of groups-reducible and irreducible representations SU(2), SO(3) groups and their representations. Tensor: Notations and conventions in tensor analysis – Einstein's summation convention covariant and contravariant and mixed tensors-algebraic operations

in tensors symmetric and skew symmetric tensors - tensor calculus.		
UNIT - II	**Ordinary Differential Equations**	**12+3**
Homogeneous linear equations of second order with constant coefficients and their solutions – ordinary second order differential with variable coefficients and their solution by power series and Frobenius methods – extended power series method for indicial equations.		
UNIT - III	**Partial Differential Equations (PDEs)**	**12+3**
Second order PDEs and their types – Solutions of PDEs – Methods for solving PDEs – Laplace, diffusion and wave equations in Cartesian and polar coordinates – Solution of two and three dimensional Laplace, diffusion and wave equations using separation of variable method - Solving simple practical problems.		
UNIT - IV	**Special Functions**	**12+3**
Legendre's differential equation: Legendre polynomials – Generating functions – Recurrence Formulae– Rodrigue's formula–orthogonality of Legendre's polynomial; Bessel's differential equation: Bessel's polynomial –generating functions–Recurrence Formulae–orthogonal properties of Bessel's polynomials; Hermite differential equation– Hermite polynomials – generating functions – recurrence relation; Laguerre's differential equation: Laguerre's polynomial –generating function– Recurrence Formulae–orthogonal properties of Laguerre's polynomials		
UNIT - V	**Gamma, Beta and Error Functions**	**12+3**
Definition of Gamma and Beta functions- Fundamental properties of Gamma functions – Evaluation of (1/2) and graph of the Gamma function- Transformation of Gamma function - Different forms of Beta functions – Relation between Beta and Gamma functions- Reduction of definite integrals to Gamma functions- Error function / probability integral.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	15	0	75

TEXT BOOKS

1.	Mathematical Physics - H.K.Dass and R.Verma. S. Chand & Co Pvt Ltd., 1997.
2.	Mathematical Physics - B.D. Gupta, Vikas, Publishing House Pvt Ltd., New Delhi; 2003.
3.	Mathematical Physics – Satya Prakash, Sultan Chand & Sons; 2014.

REFERENCE BOOKS

1.	Topics in Mathematical Physics, Parthasarathy H, Ane Books Pvt. Ltd, 2007.
2.	Advanced Engineering Mathematics, Kreyszig, Wiley Eastern Ltd, 1993.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10

CO1	**3**	**3**	**1**	**2**	**1**	**1**	**2**	**3**	**2**	**1**
CO2	**3**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**2**	**1**
CO3	**3**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**2**	**1**
CO4	**3**	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**1**
CO5	**2**	**2**	**1**	**2**	**2**	**1**	**2**	**3**	**2**	**1**

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH202			**QUANTUM MECHANICS - I**	**L**	**T**	**P**	**C**
				4	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0.75**	**0.25**		**4**	**1**	**0**	**5**

PREREQUISITE: Basic knowledge in calculus.

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

	Course Outcome	**Domain**	**Level**
CO1	***Understand*** the fundamental principles of quantum mechanics and the ***formulation*** of Schrodinger equation.	**Cognitive**	Knowledge, Synthesis
CO2	***Solve*** time-independent stationary state problems for the square well, finite and multiple potential wells.	**Cognitive**	Apply
CO3	***Solve*** linear harmonic oscillator and the hydrogen atom problems.	**Cognitive**	Apply
CO4	***Understand*** the matrix formulation of Schrodinger, Heisenberg and Interaction representations and ***understand*** Symmetry and Anti-symmetry wave functions of identical particles.	**Cognitive**	Knowledge
CO5	***Solve*** the eigenvalue problems using commutation rules and addition of angular momenta.	**Cognitive**	Apply

UNIT - I	**Wave Mechanics**	**12+3**

Matter waves- Equation of motion- Schrodinger equation for the free particle – physical interpretation of wave function - normalised and orthogonal wave functions-expansion theorem-admissibility conditions- stationary state solution of Schrodinger wave equation -

Expectation values-probability current density- Ehrenferts theorem. Postulates of wave mechanics - adjoint and self-adjoint operators degeneracy- eigen value, eigen functions-observables – Physical interpretation-expansion coefficients-momentum eigen functions-

Uncertainty principle-states with minimum value-commuting observables - constant of motion-Interacting and Non-interacting systems.

UNIT - II	**Stationary State and Eigen spectrum**	**12+3**

Time independent Schrodinger equation - Particle in a square well potential – Bound states –eigen

values, eigen functions –Potential barrier – quantum mechanical tunnelling-infinite potential – finite potential – multiple potential well –alpha emission.		
UNIT - III	**Exactly solvable Eigen value problems**	**12+3**
One dimensional linear harmonic oscillator – properties of stationary states- abstract operator method - Angular momentum operators- commutation relation-Parity- spherical symmetry systems -Particle in a central potential – radial wave function – Hydrogen atom: solution of the radial equation – stationary state wave functions – bound states-the rigid rotator: with free axis-in a fixed plane-3-Dimentional harmonic oscillator.		
UNIT - IV	**Matrix Formulation of Quantum theory and Equation of Motion**	**12+3**
Quantum state vectors and functions- Hilbert space-Dirac's Bra - Ket notation-matrix theory of Harmonic oscillator – Schrodinger, Heisenberg and Interaction representation – coordinates and momentum representations – Projection operator Identical Particles and Spin Identical Particles – symmetry and antisymmetric wave functions – exchange degeneracy – Spin and statistics: Pauli's exclusion principle-Slater determinant- collision of identical particles - spin and Pauli's matrices - density operator and density matrix.		
UNIT - V	**Angular Momentum**	**12+3**
Angular momentum -commutation rules - eigen value spectrum - matrix representation of J in the |jm> basis – spin angular momentum – spin ½ , spin-1- addition of angular momenta- Clebsch-Gordan coefficients-spin wave functions for a system of two spin- ½ particles.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	15	0	75

TEXT BOOKS

1. A Text book of Quantum Mechanics - P. M. Mathews and K. Venkatesan , Tata McGraw –Hill Publications, 2010.
2. Quantum Mechanics - SatyaPrakash, KedarNath Ram Nath and Co. Publications, 2018.
3. QantumMechanics– Theory and applications -A. K. Ghatak and Lokanathan, Macmillan India Ltd Publication, 2015.

REFERENCE BOOKS

1. Quantum Mechanics - V. K. Thankappan, New Age International (P) Ltd. Publication, 2003.
2. Principle of Quantum Mechanics - R. Shankar, Plenum US Publication, 1994.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	1	2	0	3	3	1	2	1	3	1
CO2	1	3	0	3	3	1	2	1	3	1
CO3	1	3	0	3	3	1	2	1	3	1

CO4	**1**	**1**	**0**	**3**	**3**	**1**	**2**	**1**	**3**	**1**
CO5	**1**	**3**	**0**	**1**	**3**	**1**	**2**	**1**	**3**	**1**

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH203			**MICROPROCESSOR AND MICROCONTROLLER**	**L**	**T**	**P**	**C**
				4	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0.75**	**0.25**		**4**	**1**	**0**	**5**

PREREQUISITE: Fundamental knowledge on electronics.

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

	Course Outcome	**Domain**	**Level**
CO1	***Explain*** the basic concepts of digital fundamentals using microprocessor 8085. Also, ***familiarize*** its internal architecture and operation.	**Cognitive**	Knowledge, Comprehension
CO2	***Apply*** Knowledge and ***demonstrate*** programming of microprocessor 8085 and identify various addressing modes with transfer instructions.	**Cognitive**	Knowledge, Apply
CO3	***Illustrate*** specified programme and ***provide*** assembly language programmes that ***solve*** real-world control applications.	**Cognitive**	Comprehension, Apply
CO4	***Distinguish*** the properties of microprocessor and microcontroller and ***explain*** the basic concepts and design of microcontroller 8051.	**Cognitive**	Comprehension, Synthesis
CO5	Acquire basic ideas related to instruction set and addressing modes of microcontroller 8051 and apply it to write assembly language programme for various real-world problems.	**Cognitive**	Knowledge, Apply

UNIT - I	**Microprocessor Architecture and Interfacing**	**12+3**

Intel 8085 microprocessor architecture – Pin configuration – Instruction cycle –Timing diagram – Instruction and data formats – Addressing modes -- Memory mapping and I/O mapping I/O scheme - Memory mapping I/O interfacing - Data transfer schemes -- Synchronous and asynchronous data transfer – Interrupt driven data transfer - Interrupts of Intel 8085.

UNIT - II	**Assembly Language Programs (8085 only)**	**12+3**

BCD arithmetic -- Addition and subtraction two 8-bit and 16-bit numbers - Largest and smallest numbers in a data set – Ascending order and descending order – Sum of a series of a 8-bit numbers – Sum of a series of multibyte decimal numbers – Square root of a number – Block movement of data - Time delay – Square-wave generator.

UNIT - III	**Peripheral Devices and Microprocessor Applications**	**12+3**

Generation of control signals for memory and I/O devices -- I/O ports -- Programmable peripheral interface -- Architecture of 8255A -- Control word -- Programmable interrupt controller (8259) -- Programmable counter -- Intel 8253 -- Architecture, control word and operation – Block diagram and interfacing of analog to digital converter (ADC 0800) – Digital to analog converter (DAC 0800) – Stepper motor – Traffic control.		
UNIT - IV	**Microcontroller 8051**	**12+3**
Features of 8051 – Architecture – Pin configuration – Memory organization -- External data and program memory -- Counters and timers – Serial data input/output – Interrupt structure – External interrupts – Addressing modes -- Comparison between microprocessor and microcontroller.		
UNIT - V	**8051 Instruction Set and Programming**	**12+3**
Instruction set – Data transfer, arithmetic and logical instructions – Boolean variable manipulation instructions – Program and machine control instructions – Simple programs – Addition and subtraction of two 8-bit and 16-bit numbers – Division – Multiplication -- Largest number in a set – Sum of a set of numbers.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	15	0	75

TEXT BOOKS

1.	Fundamentals of Microprocessor and Microcomputers - B. Ram, Dhanpat Rai Publications, New Delhi, 2006.
2.	Microprocessor Architecture, Programming and Applications with 8085 - R. Gaonkar, Penram International Publishing, Mumbai, 2006.
3.	Microprocessors and Microcontrollers - A.P. Godse and D.A. Godse, Technical Publishers, Pune, 2008.

REFERENCE BOOKS :

1.	The 8051 Microcontroller and Embbeded Systems using Assembly and C - M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, Dorling Kindersley, New Delhi, 2013.
2.	The Microcontroller - K. A, Cengage Learning India, New Delhi, 2013.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	2	1	1	2	1	3	2	0	0
CO2	3	3	2	1	1	1	3	2	0	0
CO3	3	2	3	1	2	1	3	3	0	0
CO4	3	2	3	1	2	1	3	2	0	0
CO5	3	3	2	1	3	1	3	2	0	0

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH204A	PHYSICS AND TECHNOLOGY OF THIN FILMS	L	T	P	C

				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Basic knowledge on material science.

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

	Course Outcome	Domain	Level
CO1	***Know*** the basic thin film processing methods by using vacuum technology	**Cognitive**	Knowledge
CO2	***Understand*** the basic thin film structure and the kinetics of thin films.	**Cognitive**	Knowledge
CO3	***Analyse*** the properties of materials using various characterization tools.	**Cognitive**	Knowledge, Analyse
CO4	***Understand*** thin film structure and properties to critical coating parameters.	**Cognitive**	Knowledge
CO5	***Select*** the most potential method to produce thin films for wanted applications.	**Cognitive**	Knowledge

UNIT - I	**Preparation of Thin Films**	**12**

Film deposition methods - introduction - fundamentals of film deposition – Physical vapour deposition –Thermal evaporation – Electron beam evaporation – Sputtering techniques (RF & DC) – Pulsed laser deposition - Chemical vapour deposition: – Spray pyrolysis – Jet nebulizer spray pyrolysis technique - Chemical bath deposition - Electro chemical deposition – Sol–gel technique – Spin coating- SILAR method. Different Growth Techniques: Liquid Phase Epitaxy, Vapour Phase Epitaxy, Molecular Beam Epitaxy, Metal Organic Vapour Phase Epitaxy.

UNIT - II	**Kinetics of Thin Films**	**12**

Nucleation Kinetics: types of nucleation – kinetic theory of nucleation – energy formation of a nucleus – critical nucleation parameters; spherical and non spherical nucleus (cap, disc and cubic shaped)on the substrates. Growth Kinetics: Kinetics of binary (GaAs, InP, etc.), ternary ($Al_{1-x}Ga_xAs$, $Ga_{1-x}In_xP$, $InAs_{1-x}P_x$, etc.) and quaternary ($Ga_{1-x}In_xAs_{1-y}P_y$, etc.) semiconductors – derivation of growth rate and composition expressions.

UNIT - III	**Characterization**	**12**

X-ray diffraction – Photoluminescence – UV-Vis-IR spectrophotometer – Raman Spectroscopy – Auger emission spectroscopy – Atomic Force Microscope –Scanning Electron Microscope – Hall effect – X-ray Photoemission Spectroscopy (XPS) – Vibrational Sample Magnetometer – Secondary Ion Mass Spectrometry. Thickness Measurement: Microbalance technique, Photometry, Interferometry (MBI, FECO).

UNIT - IV	**Properties of Thin Films**	**12**

Dielectric properties – Important parameters, Measurement of dielectric properties- Effect of annealing and film thickness. Optical properties – Optical constants, determination of optical constants

by Brewster angle method, Normal incidence method and graphical method. Mechanical properties – Concept and origin of stress and strain, Lattice misfit, Thermal misfit, Hardness test and Bulge test.		
UNIT - V	**Applications**	**12**
Optoelectronic devices: LED, LASER and Solar cell – Micro Electromechanical Systems (MEMS) – Fabrication of thin film capacitor – application of ferromagnetic thin films; Data storage, Giant Magnetoresistance (GMR).		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	0	0	60

TEXT BOOKS

1.	Thin Film Fundamentals - A. Goswami, New Age International (P) Ltd. Publishers, New Delhi, 1996.
2.	Thin Film Phenomena - K. L. Chopra, Tata McGraw Hill Book Company, New York, 1969.

REFERENCE BOOKS

1.	Hand Book of Thin Films - Hari Singh Nalwa, Academic Press, 2002.
2.	Physics of Thin Films - L. Eckertova. Plenum Press, New York, 1977.
3.	Material Science of Thin Films - Milton Ohring, Academic Press, 2002.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	1	2	3	3	2	3	2	3	0	1
CO2	1	2	3	3	2	3	2	3	0	1
CO3	1	2	3	3	1	1	2	3	0	1
CO4	1	2	3	3	2	3	2	3	0	1
CO5	1	2	3	3	2	3	2	3	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH204B			CRYSTAL GROWTH AND CHARACTERIZATION TECHNIQUES	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Basic knowledge on crystal physics.

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

Course Outcome		Domain	Level
CO1	***Demonstrate*** a procedure that allows the study of crystal growth, size, and shape and *learn* about the crystal	Cognitive	Knowledge, Apply

	growth mechanism.		
CO2	***Study*** the method of crystal growth from solution.	**Cognitive**	Knowledge
CO3	***Study*** the method of crystal growth from melt.	**Cognitive**	Knowledge
CO4	***Study*** the method of crystal growth from gel.	**Cognitive**	Knowledge
CO5	***Analyse*** the properties of crystals using various characterization tools.	**Cognitive**	Apply, Analyse

UNIT - I	**Fundamentals of Crystal Growth**	**12**

Classification of crystal growth methods – Basic steps: Generation, transport and adsorption of growth reactants – Nucleation: Kinds of nucleation –Classical theory of nucleation: Gibbs Thomson equations for vapour and solution – Kinetic theory of nucleation – Becker and Doring concept on nucleation rate – Energy of formation of a spherical nucleus – Statistical theory on nucleation: Equilibrium concentration of critical nuclei, Free energy of formation.

UNIT - II	**Solution Growth Technique**	**12**

Low temperature solution growth : Solution – Solubility and supersolubility – Expression of supersaturation - Miers T-C diagram – Constant temperature bath and crystallizer – Seed preparation and mounting – Slow cooling and solvent evaporation methods.

UNIT - III	**Gel Growth Technique**	**12**

Principle – Various types – Structure of gel – Importance of gel – Experimental procedure – Chemical reaction method – Single and double diffusion method – Chemical reduction method – solubility reduction method – Complex and decomplexion method – Advantage of gel method.

UNIT - IV	**Melt Growth Technique**	**12**

Bridgman technique – Basic process – Various crucibles design – Thermal consideration – Vertical Bridgman technique – Czochralski technique – Experimental arrangement – Growth process.

UNIT - V	**Characterization Technique**	**12**

X-Ray Diffraction (XRD) – Powder and single crystal – Fourier transform Infrared analysis (FT-IR) – Elemental analysis – Atomic absorption spectroscopy (AAS) – Elemental dispersive – X –ray analysis (EDAX) – Scanning Electron Microscopy (SEM) – UV-VIS spectrograph – Etching (Chemical) – Vickers Micro hardness.

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
60	**0**	**0**	**60**

TEXT BOOKS

1.	Crystal Growth Processes - J.C. Brice, John Wiley and Sons, New York, 1986.
2.	Crystal Growth Processes and Methods - P.Santhana Ragavan and P.Ramasamy, KRU Publications, 2001.

REFERENCE BOOKS	
1.	The growth of single crystals - R.A.Laudise, Prentice Hall, Englewood,1970.
2.	Crystal growth from high temperature solution - D.Elwell and H.J.Scheel, Academic Press, New York,1995
3.	The Basics of Crystallography and Diffraction - C.Hammond, Oxford University Press, 2009.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	1	1	3	2	2	2	3	2	0	1
CO2	1	1	3	2	2	2	3	2	0	1
CO3	1	1	3	2	2	1	3	2	0	1
CO4	1	1	3	2	2	2	3	2	0	1
CO5	1	1	3	2	2	1	1	3	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH204C			NANOSCIENCE AND TECHNOLOGY	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Basic knowledge on materials science.

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

	Course Outcome	Domain	Level
CO1	***Explain*** the quantum approach to the field of nanoscience.	**Cognitive**	Knowledge, Comprehension
CO2	***Identify*** and ***apply*** state of art fabrication method for preparing nanomaterials of metals, semiconductors and ceramics.	**Cognitive**	Knowledge, Apply
CO3	***Describe*** the particle size induced changes in magnetism.	**Cognitive**	Knowledge, Comprehension
CO4	***Describe*** the effect of particle size reduction on specific heat, melting point etc and chemical properties.	**Cognitive**	Knowledge, Comprehension
CO5	***Apply*** interdisciplinary approaches for biomedical field and other fields.	**Cognitive**	Knowledge, Apply

UNIT - I	Introduction to Nanoworld	12

Introduction – Historical perspective on Nanomaterial - Classification of Nanomaterials –Quantum mechanics of low dimensional systems – Bound states and density of states: 3D, 2D, 1D and 0D – Quantum confinement - Quantum wells, wires and dots - size dependent properties- Mossbauer effect

– surface Plasmon resonance – single electron tunneling.		
UNIT - II	**Metals, Semiconductors and Ceramic Nanocrystals**	**12**
Reduction of size – Synthesis of metal nanoparticles and structures – Routes to arrangements – Background on Quantum Dot semiconductors - background on reverse Micellar solution – Synthesis of Semiconductors – Cadmium Telluride Nanocrystals – Cadmium sulfide Nanocrystals – Alloy Semiconductors – 2D and 3D Superlattices of Silver Sulfide Nanocrystals– Synthesis of Ceramics – Bondings and defects - Chemical, Physical and Mechanical properties of Ceramics.		
UNIT - III	**Nanoparticles and Magnetism**	**12**
Magnetism in particles of reduced size and dimensions – variations of magnetic moment with size – magnetism in clusters of nonmagnetic solids – magnetic behavior of small particles – diluted magnetic semiconductors (DMS) – Fe – DMS and IV-VI Mn DMS and their applications – intermetallic compounds – binary and ternaries and their magnetic properties. Importance of nanoscale magnetism.		
UNIT - IV	**Chemical and Catalytic aspects of Nanocrystals**	**12**
Nanomaterials in Catalysis – Nanostructured Adsorbents – Nanoparticles as new Chemical reagents – Nanocrystal Superlattices - Specific Heat and Melting Points of Nanocrystalline Materials: Specific Heat of Nanocrystalline materials – melting points of Nanoparticle materials.		
UNIT - V	**Applications of Nanomaterials**	**12**
Molecular Electronics and nano electronics, nanoboats, Biological applications, band gap engineered quantum devices – nanomechanics – carbon nanotube emitters, photo electrochemical cells – photonic crystal and Plasmon wave guides - Structural and Mechanical materials – Colorants and Pigments.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	0	0	60

TEXT BOOKS

1. Nanoscale Materials in Chemistry - Kenneth J.Klabunde, A John Wiley & Sons, Inc., Publication, 2009.
2. Nanoscience and Nanotechnology: Fundamentals to Frontiers - M.S. Ramachandra Rao & Shubra Singh, Wiley, 2013.

REFERENCE BOOKS

1. Introduction to Nanotechnology - Charles P.Poole, Frank J. Owens, Wiley, India, 2009.
2. Nanostructures and Nanomaterials Synthesis, Properties and Applications - GuozhongGao, Imperial College Press, London, 2004.
3. Metal Oxides - V. Henrich, P.A.Cox, Cambridge University Press, New York, 1994.
4. Introduction to Magnetism and Magnetic Materials - D.Jiles, Chapman and Hall, London, 1991.
5. Physics and Chemistry of Metal Cluster Compounds - J.DeJongh, Kluwer Academic Publishers, Dordrecht, 1994.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	1	1	3	2	2	3	0	1
CO2	2	3	1	1	3	2	2	3	0	1
CO3	3	3	1	1	1	2	2	3	0	1
CO4	3	2	1	1	1	2	2	3	0	1
CO5	2	3	1	1	2	2	2	3	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH105			NUMERICAL METHODS	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Knowledge in UG level Mathematics (Calculus).

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

	Course Outcome	Domain	Level
CO1	***Develop*** a comprehensive ***understanding*** on numerical error analysis in physical measurements.	**Cognitive**	Knowledge, Synthesis
CO2	***Demonstrate*** the accurate numerical methods to ***solve*** algebraic equation.	**Cognitive**	Apply
CO3	***Understand*** the Newton's interpolation formula in unequal intervals for numerical problem.	**Cognitive**	Knowledge
CO4	***Understand*** and ***implement*** numerical methods to ***solve*** differential and integral forms of equations.	**Cognitive**	Apply
CO5	***Obtain*** numerical solution of ordinary differential equation using power series approximation and Euler's Runge-Kutta method.	**Cognitive**	Comprehension, Apply

UNIT - I	**Errors and Curve Fitting**	**12**

Errors and the measurements - General formula for errors – Errors of observation and measurement – Empirical formula – Graphical method – Method of averages - Method of least squares – straight line, parabola, $y = axn$, $y = aebx$, $y = a+bx$ – sum of squares of residuals for straight line and parabola fit – Weighted least squares approximation – Method of least squares for continuous functions.

UNIT - II	**Roots of Equation and Simultaneous Equations**	**12**

Numerical solution of algebraic and transcendental equations - iteration method –method of false position – Newton Raphson method - Simultaneous Equations: Existence of solutions- Basic Gauss elimination method –Jordan's modification - Gauss Jacobi iteration method – Gauss Seidal iteration method – Inversion of a matrix using Gauss elimination method.

UNIT - III	**Interpolation**	**12**

Interpolation Linear interpolation – Lagrange interpolation Gregory – Newton forward and backward interpolation formula – Central difference interpolation formula – Gauss forward and backward interpolation formula – Divided differences – Properties – Newton‟s interpolation formula for unequal intervals.		
UNIT - IV	**Numerical Differentiation and Integration**	**12**
Numerical differentiation - Newton's forward and backward difference formula to compute derivatives – Numerical integration: the trapezoidal rule, Simpsons rule – Extended Simpsons rule (1/3 rule).		
UNIT - V	**Ordinary Differential Equations**	**12**
Solution by Taylor's series – Picard's method for successive approximation - Basic Euler method – Improved Euler method – Modified Euler method – Runge Kutta fourth order method – Runge Kutta method for simultaneous first order differential equation - Runge Kutta Method for second order differential equation.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	**0**	**0**	**60**

TEXT BOOKS

5.	Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi. 2003.
6.	Numerical Methods for Mathematics, Science and Engineering - John H. Matthews, Prentice Hall of India, 2000.

REFERENCE BOOKS

6.	Numerical Mathematical Analysis - J. B. Scarborough, Oxford Publishing, 1990.
7.	Numerical Methods for Physicists - M. K. Venkatraman, S. Chand & Company, New Delhi, 2005.

YPH205			**DIGITAL AND MICROPROCESSOR LABORATORY**	**L**	**T**	**P**	**C**
				0	**0**	**3**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
0.5	**2**	**0.5**		**0**	**0**	**6**	**6**

PREREQUISITE: Know the basic laws and have practical experience in basic electronics

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

	Course Outcome	Domain	Level
CO1	***Understand*** the concepts behind various physics experiments.	**Cognitive, Psychomotor**	Knowledge
CO2	***Construct*** simple electronic circuits and make out the characteristics of transistors, amplifiers, oscillators and	**Cognitive, Psychomotor**	Synthesis

	filters.		
CO3	***Know*** the conceptual difference between analog and digital circuits.	**Cognitive, Psychomotor**	Comprehension
CO4	***Write*** ALP for arithmetic and logical operations in 8051	**Cognitive, Psychomotor**	Apply
CO5	***Execute*** programs in microprocessor (8051)	**Cognitive, Psychomotor**	Apply

S. No.	**Experiments**
A. Digital Electronics (Any eight experiments)	
1.	Study the function of multiplexer and demultiplexer
2.	Study the function of decoder and encoder
3.	Flip flops - RS, T – FF and D - FF
4.	Flip flops - JK, Master & slave
5.	Study of Boolean logic operations using ICs
6.	Half adder and Full adder, using only NAND & NOR gates.
7.	Half subtractor and Full Subtractor (using only NAND & NOR gates)
8.	BCD to seven segment display
9.	Study of counter using IC 7490
10.	Combinational Logic Circuit Design
11.	Asynchronous counter: Mod-N Counters
12.	Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO (using FF & 7495)
B. Microprocessor and Microcontroller Experiments (Any eight experiments)	
1.	Microprocessor – addition, subtraction (8 Bit)
2.	Microprocessor – addition, subtraction (Array)
3.	Microprocessor – Multiplication 8 bit by 8 bit and 16 bit by 8 bit
4.	Microprocessor – Division 8 bit by 8 bit and 16 bit by 8 bit
5.	Microprocessor – To find the largest and smallest number in an array
6.	Microprocessor – Ascending and descending order.
7.	Microprocessor - addition and subtraction of two BCD numbers.
8.	Microprocessor - addition and subtraction of two Hexadecimal numbers.
9.	Microprocessor - Counter and Time Delay
10.	Microcontroller – Assembly language program to generate 10KHz square wave
11.	Microcontroller – To study implementation & interfacing of display devices like LCD, LED and seven segment display devices with microcontroller 8051.
12.	Microcontroller – To study implementation & interfacing of different motors like stepper motor, DC motor & servo motors with microcontroller 8051.

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
0	**0**	**90**	**90**

TEXT BOOKS

1. An Advanced Course in Practical Physics - D. Chattopadhyay, P. C. Rakshit, New Central

	Book Agency (P) Ltd., 2007.
2.	A Textbook of Advanced Practical Physics - S. K. Ghosh, New Central Publishers, 2000.
3.	Practical Electronics (Microprocessor) – T. Veeramanikandasamy and A. Balamurugan, Technical Publications, Pune, 2011.
REFERENCE BOOKS	
1.	Advanced Practical Physics Volume I – Dr. S.P. Sing, Pragati Prakasan Educational publishers, 2011.
2.	Practical Physics and Electronics – C.C. Ouseph, U.J. Rao, V. Vijayendran, Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	**3**	**3**	**1**	**1**	**3**	**2**	**2**	**3**	**0**	**0**
CO2	**2**	**3**	**1**	**1**	**3**	**2**	**2**	**3**	**0**	**0**
CO3	**3**	**3**	**1**	**1**	**1**	**2**	**2**	**3**	**0**	**0**
CO4	**3**	**2**	**1**	**1**	**1**	**2**	**2**	**3**	**0**	**0**
CO5	**2**	**3**	**1**	**1**	**2**	**2**	**2**	**3**	**0**	**0**

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH301			**SOLID STATE PHYSICS**	**L**	**T**	**P**	**C**
				4	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0.75**	**0.25**		**4**	**1**	**0**	**5**

PREREQUISITE: Basic knowledge in Materials Science.

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

	Course Outcome	Domain	Level
CO1	***Understand*** the basics of crystal structure and chemical bonding.	**Cognitive**	Knowledge
CO2	***Obtain*** the knowledge of dynamic nature of the crystalline materials.	**Cognitive**	Knowledge
CO3	***Understand*** the propagation characteristics of electron in solid state materials.	**Cognitive**	Knowledge
CO4	***Acquire*** knowledge about various kind of magnetism in electron models.	**Cognitive**	Knowledge, Comprehension
CO5	***Comprehend*** basic theories of superconductivity and its applications.	**Cognitive**	Knowledge, Apply

UNIT - I	Crystal Structure	12+3
Elementary concepts of crystals - Bonding of solids - Reciprocal lattice - Laue equations -Miller indices - Brillouin zones - Point groups and Space groups - Bravais lattice - Crystal symmetry - Structure factor - Atomic scattering factor- Crystal diffraction- Bragg's law - Ewald's sphere construction- Laue, Powder, Rotation methods.		
UNIT - II	**Lattice Dynamics and Thermal Properties**	**12+3**
Vibrations of monoatomic and diatomic basis - harmonic approximation - acoustical, optical, transverse and longitudinal modes - Phonon quantization - Thermal conductivity - Umklapp process - Specific heat capacity of solids - Einstein, Debye model-Drude model of thermal conductivity - Density of states in one and three dimensional - specific heat response and relaxation phenomena.		
UNIT - III	**Metals and Semiconductors**	**12+3**
Metals-Heat capacity of electron gas - Fermi- Dirac distribution - Electron gas in three dimensions - Nearly free electron model - review of electron in a periodic potential - Kronig Penny model - Limitations. Semiconductors - Band theory of pure and doped semiconductors- Carrier concentrations - intrinsic carrier - Hall effect.		
UNIT - IV	**Electric and Magnetic Properties**	**12+3**
Classification of polarization- macroscopic electric field - local electric field at an atom - Lorentz field - Dielectric constant and polarizability - Clausius-Mossotti relation - Ferro electric crystals - Ferro electric domains - Polarization catastrophe- Landau theory of phase transition. Langevin theory of Diamagnetism-paramagnetism - Quantum theory of paramagnetism - Curie law - Ferromagnetism - Weiss molecular field theory- Domain theory - Neel temperature - Ferrimagnetism - Ferrites - Spin waves.		
UNIT - V	**Superconductivity**	**12+3**
Occurrence of superconductivity- destruction of superconductivity by magnetic fields - Meissner effects - Type I and Type II superconductors - Heat capacity electron-phonon interaction - Cooper pairs and BCS theory - London equation - Coherence length -penetration depth - Flux quantization in superconducting ring - duration of persistent currents - Quantum interference - Josephson effect and applications SQUIDS - High temperature superconductivity.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	15	0	75

TEXT BOOKS

1. Introduction to Solid State Physics - C. Kittel, Wiley Eastern, New Delhi, 2014.
2. Solid State Physics - S.O. Pillai, A.J. Dekker, New Age International Publishers, New Delhi, 2015.

REFERENCE BOOKS :

1. Solid State Physics - A.J. Dekker, Macmillan, 2000.

2.	Solid State Physics - Rita John, McGraw Hill, New Delhi, 2014.
3.	Solid State Physics - B.S.Saxena, R.C. Gupta and P.N. Saxena, Pragati Prakashan, Uttar Pradesh, 2015.
4.	Crystallography for Solid State Physics - A.R.Verma and O.N.Srivastava, Wiley, Marshall, 1991.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	1	1	3	1	3	2	0	3
CO2	3	3	2	1	3	1	3	2	0	3
CO3	3	3	3	1	3	1	3	2	0	3
CO4	3	3	1	1	3	1	3	2	0	3
CO5	3	3	2	1	3	1	3	2	0	3

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH302			QUANTUM MECHANICS - II	L	T	P	C
				4	1	0	5
C	P	A		L	T	P	H
3	0.75	0.25		4	1	0	5

PREREQUISITE: Basic knowledge in principles of quantum mechanics and calculus.

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

	Course Outcome	Domain	Level
CO1	***Apply*** perturbation theory in Non-degenerate and degenerate problems in systems under magnetic and electric fields.	**Cognitive**	Apply
CO2	***Solve*** problems in time dependent perturbation and semi-classical theory of radiation.	**Cognitive**	Apply
CO3	***Understand*** Born approximation and ***explore*** scattering with screened potential and different scattering cross sections at various potentials.	**Cognitive**	Knowledge, Synthesis
CO4	***Solve*** the relativistic problems using Klein-Gordan and Dirac equations. Also ***understand*** the theory of field quantization.	**Cognitive**	Knowledge, Apply
CO5	***Explore*** the theory of Central field approximation and molecular orbital theory.	**Cognitive**	Knowledge, Comprehension

UNIT - I	Approximation Methods for Time Independent Problems	12+3

Time independent perturbation theory – stationary theory- Non-degenerate case: first and second order-Normal Helium atom– Zeeman effect without electron spin –Degenerate case: Energy correction- stark effect in hydrogen atom. Variation method: Variation Principle – upper bound states-ground state of Helium atom –Hydrogen molecule-WKB approximation - Schrodinger equation-Asymptotic solution-validity of WKB approximation-solution near a turning point – connection formula for penetration barrier – Bohr-Summer field quantization condition tunneling through a potential barrier.		
UNIT - II	**Approximation Methods for Time Dependant Perturbation**	**12+3**
Time dependent Perturbation theory - first order transitions – constant perturbation- transition probability: Fermi Golden Rule – Periodic perturbation –harmonic perturbation – adiabatic and sudden approximation. Semi-classical theory of radiation: Application of the time dependent perturbation theory to semi-classical theory of radiation – Einstein's coefficients – absorption - induced emission - spontaneous emission – Einsteim's transition probabilities- dipole transition - selection rules – forbidden transitions.		
UNIT - III	**Scattering Theory**	**12+3**
Kinematics of scattering process - wave mechanical picture- Green's functions – Born approximation and its validity –Born series – screened coulombic potential scattering from Born approximation. Partial wave analysis: asymptotic behavior – phase shift – scattering amplitude in terms of phase shifts – differential and total cross sections – optical theorem – low energy scattering – resonant scattering – non-resonant scattering-scattering length and effective range– Ramsauer-Townsend effect – scattering by square well potential.		
UNIT - IV	**Relativistic Quantum Mechanics and Quantisation of Field**	**12+3**
Schrodinger relativistic equation- Klein-Gordan equation-charge and current densities – interaction with electromagnetic field- Hydrogen like atom – nonrelativistic limit- Dirac relativistic equation: Dirac relativistic Hamiltonian – probability density- Dirac matrices-plane wave solution – eigen spectrum – spin of Dirac particle – significance of negative eigen states – electron in a magnetic field – spin magnetic moment. Quantisation of the Field Electromagnetic wave as harmonic oscillators – quantisation: classical e.m.wave quantisation of fields oscillators- Photons- number operator – creation and annihilation operators of photons.		
UNIT - V	**Quantum Theory of Atomic and Molecular Structure**	**12+3**
Central field approximation: residual electrostatic interaction - spin orbit interaction- Determination of central field: Thomas Fermi statistical method-Hartree and Hartree-Fock approximations (self consistent fields) – Atomic structure and Huns's rule. Molecules: Born-Oppenheimer approximation – An application: the hydrogen molecule Ion (H_2+) – Molecular orbital theory: LCAO- Hydrogen molecule.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	**15**	**0**	**75**

TEXT BOOKS

1.	A Text book of Quantum Mechanics - P. M. Mathews and K. Venkatesan , Tata McGraw –Hill Publications, 2010.
2.	Quantum Mechanics - SatyaPrakash, KedarNath Ram Nath and Co. Publications, 2018.
3.	Qantum Mechanics: Theory and applications -A. K. Ghatak and Lokanathan, Macmillan India Ltd Publication, 2015.
REFERENCE BOOKS	
1.	Quantum Mechanics - V. K. Thankappan, New Age International Publication,2003.
2.	Principle of Quantum Mechanics - R. Shankar, Plenum US Publication, 1994.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	0	1	3	1	2	1	3	1
CO2	3	3	0	1	3	1	2	1	3	1
CO3	2	2	0	2	3	1	2	1	3	1
CO4	3	3	0	1	3	1	2	1	3	1
CO5	2	2	0	3	3	1	2	1	3	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH303			ELECTROMAGNETIC THEORY	L	T	P	C
				4	1	0	5
C	P	A		L	T	P	H
3	0.75	0.25		4	1	0	5

PREREQUISITE: Fundamental Physics knowledge related to electrical energy, power and forces on electric and magnetic fields.

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

Course Outcome		Domain	Level
CO1	***Apply*** vector calculus operations and ***develop*** knowledge of vector fields and scalar fields in electrostatics.	Cognitive	Apply, Synthesis
CO2	***Describe*** the fundamental nature of static fields, including steady current, static electric and magnetic fields.	Cognitive	Knowledge
CO3	***Formulate*** potential problems within electrostatics, magnetostatics and stationary current distributions in linear isotropic media. Also, ***solve*** and ***analyze*** such problems in simple geometries using separation of variables and the method of images.	Cognitive	Synthesis, Apply, Analyse
CO4	***Apply*** Maxwell's equations and their application to time-harmonic fields, boundary conditions, wave	Cognitive	Apply

	equations, and Poynting's power-balance theorem evaluation.		
CO5	***Describe*** the properties of plane waves in unbounded space and ***understand*** such concepts as wavelength, phase velocity and attenuation.	**Cognitive**	Knowledge, Apply

UNIT - I	**Electrostatics**	**12+3**
Coulomb's law – surface, line and volume charge distributions - Gauss' Law and its applications; Electrostatic potential - Laplace and Poisson equations – Potential of a localized charged distributions – Laplace equation in one, two and three dimensions – Boundary conditions and Uniqueness theorems- Work and Energy in electrostatics – Conductors.		
UNIT - II	**Magnetostatics**	**12+3**
Lorentz force law- Biot-Savart law – condition for steady electric current - Ampere's law – Application of Ampere's law – comparison of Magnetostatics and Electrostatics – Magnetic vector and Scalar potential – Magneto static boundary conditions – Magnetic fields in matter- Magnetization – The field of a magnetized object.		
UNIT - III	**Electrodynamics**	**12+3**
Electromotive force – ohms law – Faradays law – Induced electric field – Energy in magnetic fields – Maxwell's equation in free space – Magnetic charge - Maxwell's equation in matter – Boundary conditions - Conservation laws – Conservation of energy – Poynting's theorem - conservation of momentum.		
UNIT - IV	**Electromagnetic Waves and Interaction with Matter**	**12+3**
Electromagnetic waves in vacuum – Energy and momentum of EMW – EMW in matter – Propagation in linear media – Reflection and transmission at Normal incidence – Reflection and Transmission at Oblique incidence – Implications: Laws of incidence and reflectance, Snell's law, Brewster law – Fresnel's equations – wave guides- rectangular waveguide.		
UNIT - V	**Plasma Physics & Applications**	**12+3**
Plasma – Plasma criteria – Debye shielding (DC current) – Plasma frequency (AC shielding) – Motion charge particles in uniform E and B field - non uniform B field – non uniform E field – time varying E field – time varying B field – guiding centre drifts – plasma confinement – Introduction to plasma diagnostics -Applications.		

LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
60	**15**	**0**	**75**

TEXT BOOKS

1.	Introduction to Electrodynamics - David J. Griffiths, Prentice Hall of India Pvt. Ltd, 2000.
2.	Classical Electrodynamics, J.D. Jackson, John Wiley-India, 2011.
3.	Introduction to Plasma Physics and Controlled Fusion, F. F. Chen, Springer (India) Pvt. Ltd, New Delhi, 2006.

REFERENCE BOOKS	
1.	Electromagnetic theory, P. K. Basu and H. Dhasmana, Ane Books Pvt. Ltd., New Delhi, 2010.
2.	Classical Electrodynamics, Hans Ohanian, Firewall media, 2nd Edition, 2009.
3.	Foundations of Electromagnetic theory, J.R. Reity, F.J. Milford and R.W. Christy, Pearson, 2010.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	2	2	1	1	3	1	3	2	0	0
CO2	2	2	1	1	3	1	3	2	0	0
CO3	2	2	1	1	3	1	3	2	0	0
CO4	2	2	1	1	3	1	3	2	0	0
CO5	2	2	1	1	3	1	3	2	0	0

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH304A			MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Basic knowledge on electronics

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

Course Outcome		Domain	Level
CO1	***Acquire*** knowledge and ***get*** introduced to the field of Microsystems.	**Cognitive**	Knowledge
CO2	***Learn*** new materials, science and technology for Microsystems and its applications	**Cognitive**	Knowledge
CO3	***Describe*** MEMS fabrication technologies	**Cognitive**	Comprehension
CO4	***Analyse*** Microsystems technology for technical feasibility as well as practicality.	**Cognitive**	Apply
CO5	***Acquire*** knowledge and ***understand*** the state-of-art micromachining and packaging technologies.	**Cognitive**	Apply

UNIT - I	Overview of MEMS and Microsystems	12

Emergence – devices and application, MEMS and Microsystems - typical MEMS and Microsystem Products-Evolution of micro fabrication - Microsystem and microelectronics - Microsystem and Miniaturization. MEMS with micro actuator - Microgrippers - Micromotors - Microvalves - Micro pumps - Micro accelerometers.

UNIT - II	Scaling laws and materials for MEMS	12
Scaling: Introduction to scaling - Scaling in geometry - rigid body dynamics - Electrostatic Forces, Electromagnetic, Electricity, Fluid mechanics - Scaling in Heat transfer – Materials: Substrates and Wafers - Active substrate materials - Silicon as a substrate material - Silicon Compounds - Silicon piezo resistor - Gallium Arsenide - Quartz - piezoelectric crystals - polymers - Packing materials.		
UNIT - III	**Microsystem Fabrication Process**	**12**
X-ray Introduction - Photolithography - Ion implantation - Oxidation - Diffusion - Chemical Vapour Deposition - Physical Vapour Deposition (sputtering) - Deposition by epitaxy – Etching - Microstereo lithography.		
UNIT - IV	**Micro Manufacturing**	**12**
Bulk micro manufacturing – isotropic and Anisotropic etching - wet etching - Etch stop - dry etching - comparison, Surface micro machining -general description - process - mechanical problems associated with surface micromachining, The LIGA process - general description-substrate and photoresists-electroplating-SLIGA.		
UNIT - V	**Microsystem Design and Packaging**	**12**
Microsystem Design: Introduction - Design consideration - Mechanical Design Using Finite Elements Method - design, simulation and layout of MEMS devices using CAD tools. Microsystem Packaging: Microsystem Packaging - Interfaces in Microsystem packaging - Essential Packaging Technologies.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	0	0	60

TEXT BOOKS

1. MEMS and Microsystems Design and Manufacture - Hsu & Tai Ran, Tata McGraw Hill, 2000.
2. MEMS and MOEMS Technology and Applications - Ri-Choudhury & Prosenjit, SPIE, 2000.

REFERENCE BOOKS

1. MEMS: Introduction and Fundamentals - Mohamed Goad-el-Hak, CRC Press, 2005.
2. Smart Material Systems and MEMS: Design and Development Methodologies - Vijay K. Vardan, K. J. Vinoy, S. Gopalakrishnan, John Wiley & Sons, 2011.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	1	2	2	2	3	2	3	2	0	1
CO2	1	2	2	2	3	2	3	2	0	1
CO3	1	2	3	2	3	2	3	2	0	1
CO4	1	2	3	2	3	2	3	2	0	1
CO5	1	2	3	2	3	2	3	2	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH304B			SOLAR THERMAL AND PHOTOVOLTAIC TECHNOLOGY	L	T	P	C
				4	0	0	4
C	P	A		L	T	P	H
3	0.75	0.25		4	0	0	4

PREREQUISITE: Basic knowledge on energy sources.

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

	Course Outcome	Domain	Level
CO1	***Explain*** the principles that underlie the ability to various natural phenomena to deliver solar energy.	**Cognitive**	Knowledge
CO2	***Outline*** the technologies that are used to harness the power of solar energy for various applications.	**Cognitive**	Knowledge, Apply
CO3	***Evaluate*** the choice of solar collector for a given application.	**Cognitive**	Knowledge, Apply
CO4	***Understand*** the potential impact of solar thermal systems and ***apply*** knowledge for design of solar thermal systems.	**Cognitive**	Knowledge, Apply
CO5	***Understand*** the working principle of solar photovoltaic cell and ***analyse*** the performance of the device.	**Cognitive**	Knowledge, Analyse

UNIT - I	**Energy Resources and Solar Spectrum**	**12**

World energy resources - Indian energy scenario - Environmental aspects of energy utilization. Renewable energy resources and their importance - Global solar resources. Solar spectrum – Electromagnetic spectrum, basic laws of radiation. Physics of the Sun - Energy balance of the earth, energy flux, solar constant for earth.

UNIT - II	**Solar Applications**	**12**

Solar water heaters - solar space conditioning systems - Solar Cooking – Distillation - Desalination - Solar Ponds – Solar Passive Architecture – Solar Drying – Solar Chimney - Solar electricity - solar lighting.

UNIT - III	**Solar Collectors**	**12**

Concentrating and non-concentrating solar collectors - design, structure, operation and performance - parabolic trough collectors - flat plate collectors - evacuated tube collectors - Application of non-concentrating collectors (low temperature solar thermal plants for space heating and cooling, drying, seawater desalination) and concentrating collectors (process heat production and power generation).

UNIT - IV	**Solar Thermal Energy Conversion**	**12**

Green house effect - Fundamentals of solar collectors as devices to convert solar energy to heat - Thermal design of receivers - Thermal Energy Storage Systems - Solar heating systems with and without heat storage - solar thermal power generation.

UNIT - V	**Solar Photovoltaic Energy Conversion**	**12**

Solar photovoltaic energy conversion - Principles - Physics and operation of solar cells. Classification

of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants.			
LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
60	**0**	**0**	**60**

TEXT BOOKS	
1.	Solar Energy: Principles of Thermal Collection and Storage - Sukhatme, Tata McGraw Hill, New York, 2008.
2.	Thin Film Phenomena - K. L. Chopra, Tata McGraw Hill Book Company, New York, 1969.
REFERENCE BOOKS	
1.	Hand Book of Thin Films - Hari Singh Nalwa, Academic Press, 2002.
2.	Physics of Thin Films - L. Eckertova. Plenum Press, New York , 1977.
3.	Material Science of Thin Films - Milton Ohring, Academic Press, 2002.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**0**	**0**
CO2	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**0**	**0**
CO3	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**0**	**0**
CO4	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**0**	**0**
CO5	**1**	**2**	**3**	**1**	**3**	**3**	**3**	**3**	**0**	**0**

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH304C			**INDUSTRIAL ELECTRONICS**	**L**	**T**	**P**	**C**
				4	**0**	**0**	**4**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0.75**	**0.25**		**4**	**0**	**0**	**4**

PREREQUISITE: Basic knowledge on electronics.

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

Course Outcome		**Domain**	**Level**
CO1	***Understand*** different types of power electronic devices and their switching.	**Cognitive**	Knowledge
CO2	***Study*** the operation of circuits used in power electronic devices.	**Cognitive**	Knowledge

CO3	***Know*** the industrial applications of power electronic devices.	**Cognitive**	Knowledge, Apply
CO4	***Know*** the basics of transducers and sensors and types of sensors used for Robotics.	**Cognitive**	Knowledge
CO5	***Understand*** the working principle of ECG, EEG & EMG and general biomedical imaging techniques.	**Cognitive**	Knowledge

UNIT - I	**Power Electronic Devices**	**12**

Study of switching devices: Silicon controlled rectifiers (SCR) – Unijunction transistors (UJT) Bipolar junction transistor (BJT) – Diode for alternating current (DIAC) – Triode for alternating current (TRIAC) - Insulated gate bipolar junction transistor (IGBT) - triggering and commutation circuit for SCR - introduction to driver and snuber circuit.

UNIT - II	**Power Electronic Circuits and Controls**	**12**

Converters: Chopper – Cyclo converters – Matrix converters; Rectifiers: Single-phase half-wave rectifiers – Single-phase full-wave rectifiers; Inverters: Single-phase inverters – Three-phase inverters – Multilevel inverters – Line-commutated inverters.

UNIT - III	**Applications of Power Electronic Devices**	**12**

SCR DC drives – Power electronic converter – Position sensing – Types and operation of Step Motors: Variable reluctance step motor – Drive circuits for variable reluctance step motors – Permanent magnet step motor – Control of step motor; Uninterruptible power supplies (UPS): UPS functions – Static UPS topologies – Rotary UPS.

UNIT - IV	**Sensors in Robotics**	**12**

Introduction of transducers and sensors – Types of sensors in robotics: Tactile sensors–Proximity and range sensors – Miscellaneous sensors and sensor based systems – Uses of sensors in robotics – Machine vision: Introduction to machine vision – Sensing and digitizing function.

UNIT - V	**Concepts of Medical Electronics**	**12**

Bioelectric signals and electrodes: Electrocardiogram (ECG) – Electroencephalogram (EEG) – Electromyogram (EMG); Electrode-tissue interface; Electrodes for ECG – Electrodes for EEG – Electrodes for EMG – Electrical conductivity of electrode jellies and creams; Biomedical imaging system: Principle and Working of – X-ray machine, Computed tomography (CT) and Magnetic resonance imaging (MRI).

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	**0**	**0**	**60**

TEXT BOOKS

1. Industrial Electronics – Circuits, Instruments, and Control Techniques - Terry Bartelt, Cengage Learning India Pvt. Ltd, New Delhi, 2009.
2. Handbook of Biomedical Instrumentation, R.S. Khandpur, Tata McGraw-Hill Publishing Company Ltd, New Delhi, Second edition: 2003.

REFERENCE BOOKS

1.	Modern Industrial Electronics - Timothy J. Maloney, Prentice Hall, New Jersy, 1996.
2.	Electronic Devices and Circuits - Anil K. Maini, Varsha Agrawal, Wiley India Pvt. Ltd., New Delhi, 2009.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	1	2	3	2	3	3	3	3	0	1
CO2	1	2	3	2	3	3	3	3	0	1
CO3	1	2	3	2	3	3	3	3	0	1
CO4	1	2	3	2	3	3	3	3	0	1
CO5	1	2	3	2	3	3	3	3	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH305			ADVANCED GENERAL AND ELECTRONICS LABORATORY	L	T	P	C
				0	0	3	3
C	P	A		L	T	P	H
0.5	2	0.5		0	0	6	6

PREREQUISITE: Know the basic laws and have practical experience to use measuring tools.

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

Course Outcome		Domain	Level
CO1	***Understand*** the concepts behind various physics experiments.	**Cognitive, Psychomotor**	Knowledge
CO2	***Measure*** different physical parameters with maximum accuracy.	**Cognitive, Psychomotor**	Apply
CO3	***Determine*** various physical constants through different physics experiments.	**Cognitive, Psychomotor**	Apply
CO4	***Construct*** simple electronic circuits and make out the characteristics of transistors, amplifiers, oscillators and filters.	**Cognitive, Psychomotor**	Synthesis
CO5	***Know*** the conceptual difference between analog and digital circuits.	**Cognitive, Psychomotor**	Knowledge

S. No.	Experiments
A. General Experiments (Any eight experiments)	
1.	Determination of thermal conductivity using thermocouples by Forbe's method
2.	Measurement of Electrical Conductivity– Four Probe Method
3.	Determination of carrier concentration and Hall coefficients in semiconductors.

4.	Determination of magnetic susceptibility of liquid by Guoy method.
5.	Determination of magnetic susceptibility of liquids by Quincke's method.
6.	Determination of wavelength and thickness of a film by using Michelson's interferometer.
7.	Determination of polarizability of liquids by finding the refractive indices at different wavelengths.
8.	Determination of wavelength of monochromatic source using biprism.
9.	Determination of specific rotatory power of a liquid using polarimeter.
10.	Determination of charge of an Electron by spectrometer
11.	Determination of Dielectric loss using CRO
B. Electronics Experiments (Any eight experiments)	
1.	Op-Amp Arithmetic Operations
2.	Op-Amp Square, Ramp Generator and Wien Bridge Oscillator
3.	Op-Amp Precision Full Wave Rectifier
4.	IC 555 timer – Schmitt Trigger
5.	Characteristics of Photo Diode, Photo Transistor, LDR, LED
6.	Push-pull amplifier using complementary – symmetry transistors power gain and frequency response.
7.	Active filters – low pass and high pass-first and second order frequency response and roll off rate.
8.	Astable and bistable and monostable multivibrator using IC 555 / IC741
9.	Digital to analog converter - R-2R method and Weighted method
10.	Analog to digital converter
11.	RC Coupled CE amplifier
12.	Relaxation oscillator using UJT

LECTURE	TUTORIAL	PRACTICAL	TOTAL
0	**0**	**90**	**90**

TEXT BOOKS

1.	An Advanced Course in Practical Physics - D. Chattopadhyay, P. C. Rakshit, New Central Book Agency (P) Ltd., 2007.
2.	A Textbook of Advanced Practical Physics - S. K. Ghosh, New Central Publishers, 2000.

REFERENCE BOOKS

1.	Advanced Practical Physics Volume I – Dr. S.P. Sing, Pragati Prakasan Educational publishers, 2011.
2.	Practical Physics and Electronics – C.C. Ouseph, U.J. Rao, V. Vijayendran, Viswanathan Printers & Publishers Pvt. Ltd., 2007.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	1	1	3	3	2	3	0	1
CO2	2	3	1	1	3	3	2	3	0	1
CO3	3	3	1	1	1	3	2	3	0	1
CO4	3	2	1	1	1	3	2	3	0	1
CO5	2	3	1	1	2	3	2	3	0	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH401			ATOMIC AND MOLECULAR SPECTROSCOPY	L	T	P	C
				4	1	0	5
C	P	A		L	T	P	H
3	0.75	0.25		4	1	0	5

PREREQUISITE: Basic knowledge on physics of atoms and molecules and light.

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

	Course Outcome	Domain	Level
CO1	***Understand*** the principles and concepts of atomic and molecular spectroscopy.	**Cognitive**	Knowledge
CO2	***Understand*** the electronic structure of atoms and molecules, and transition and selection rules of rotational, vibrational, electronic spectroscopies.	**Cognitive**	Knowledge
CO3	***Identify*** the spectroscopic tools to ***investigate*** rotational, vibrational, electronic and structural characteristics of materials.	**Cognitive**	Knowledge, Comprehension
CO4	***Observe*** the spectra, extract spectral signatures, ***interpret*** them and ***associate*** to the structural and chemical properties of materials.	**Cognitive**	Knowledge, Apply
CO5	***Develop*** models to extract detailed information from the spectra.	**Cognitive**	Synthesis

UNIT - I	**Electronic Spectroscopy of Atoms**	**12+3**

Electronic wave function – atomic quantum numbers – hydrogen atom spectrum – Electronic angular momentum – Fine structure of hydrogen atom – Many-electron atoms – Lithium atom spectrum – angular momentum of many electron atoms – Term symbols – LS and JJ coupling – Spectrum of helium and alkaline earths – Equivalent and non-equivalent electrons – Zeeman effect – Paschen-Back effect – Stark effect – X-ray photoelectron spectroscopy.

UNIT - II	**Molecular Spectroscopy and Rotational Spectroscopy**	**12+3**

Diatomic molecule – Molecular orbital theory (LCAO) – Shape of molecular orbitals (Morse Potential) – Born-Oppenheimer approximation – Regions of the electromagnetic spectrum – Width and intensity of spectral lines – Rotation of molecules – Rigid diatomic molecules – Intensity of line spectra – the effect of isotropic substitution – non-rigid rotator and their spectra – polyatomic

molecules (linear and symmetric top molecules) – Technique and instrumentation of microwave spectroscopy.		
UNIT - III	**Vibrational Spectroscopy**	**12+3**
Energy of diatomic molecules – Simple Harmonic Oscillator – Anharmonic oscillator – Diatomic vibrating rotator – Vibration-Rotation spectrum of carbon monoxide – Breakdown of Born-Oppenheimer approximation –Vibrations and symmetry of polyatomic molecules – Influence of rotation on the spectra of polyatomic molecules (linear and symmetric top molecules) – Quantum and classical theory of Raman effect – pure rotational Raman spectra (linear and symmetric top molecules) – Raman active vibrations – Vibrational Raman spectra – Rotational fine structure – Vibrations of spherical tip molecules – Techniques and instrumentation of Infrared and Raman spectrometers.		
UNIT - IV	**Kinematics of Rigid Body**	**12+3**
Vibrational coarse structure progressions – Franck-Condon principle – Dissociation energy and their products – Rotational fine structure of vibronic transitions – Fortat Diagram – Pre-dissociation – Spectrum of molecular hydrogen – Change of shape on excitation – Chemical analysis by electronic spectroscopy – Re-emission of energy by an excited molecule.		
UNIT - V	**Central Force Problem and Theory of Relativity**	**12+3**
Nature of spinning particles – Spin and magnetic field interaction – Larmor precession – Relaxation time – Spin-spin relaxation – Spin–lattice relaxation - NMR chemical shift – Coupling constants – Coupling between nuclei – Chemical analysis by NMR – Exchange Phenomena - NMR for nuclei other than hydrogen - ESR spectroscopy – g-factor – Electron-Nucleus Coupling – Electron-Electron Coupling.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	15	0	75

TEXT BOOKS

1. Fundamentals of Molecular Spectroscopy - C. N. Banwell and Elaine M. McCash, McGraw-Hill Education (India) Pvt. Ltd, 2013.
2. Spectroscopy (Atomic and molecular) - G. R. Chatwal and S. K. Anand, Himalaya Publishing House, 2016.

REFERENCE BOOKS :

1. Fundamentals of Molecular Spectroscopy - Walter S. Struve, John Wiley & Sons, 1989.
2. Atomic and Molecular Spectroscopy - SuneSvanberg, Springer-Verlag, 2004.
3. Molecular Spectroscopy - Jeanne L. McHale, CRC Press, 2017.
4. Molecular Structure and Spectroscopy - G. Aruldhas, Prentice-Hall of India, 2004.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	2	1	2	1	2	1	3	2	1	1
CO2	2	1	2	1	2	1	3	2	1	1
CO3	2	1	2	1	2	1	3	2	1	1

CO4	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**1**	**1**
CO5	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**1**	**1**

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH402			**NUCLEAR AND PARTICLE PHYSICS**	**L**	**T**	**P**	**C**
				4	**1**	**0**	**5**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0.75**	**0.25**		**4**	**1**	**0**	**5**

PREREQUISITE: Basic knowledge in quantum mechanics and mathematical methods.

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

	Course Outcome	**Domain**	**Level**
CO1	***Understand*** nuclear forces, interactions, models and factors affecting the stability of the nucleus.	**Cognitive**	Knowledge
CO2	***Explain*** the different forms of radioactivity and account for their occurrence. ***Explain*** the interaction of radioactivity with matter and particle detectors.	**Cognitive**	Comprehension
CO3	***Account*** for fission and fusion processes and ***explain*** the basic properties of nuclear reactors. Also, ***assess*** a range of applications of nuclear technology.	**Cognitive**	Knowledge, Comprehension
CO4	***Calculate*** the kinematics of various reactions and decay processes.	**Cognitive**	Apply
CO5	***Understand*** the four fundamental interactions in nature and ***classify*** the elementary particles and nuclear states in terms of their quantum numbers.	**Cognitive**	Knowledge, Comprehension

UNIT - I	**Nuclear Structure and Nuclear Forces**	**12+3**

Nuclear size, shape, charge distribution, spin, parity and magnetic moment – binding energy – semi empirical mass formula – Mass parabolas – Nuclear models – liquid drop model, evidence of shell model, single particle shell model, its validity and limitations, collective model– Nuclear forces – nature of nuclear forces - charge independence – deuteron – forms of nuclear potentials - Charge symmetry - non-central (tensor) forces – ground state of deuteron – exchange forces –Yukawa meson theory.

UNIT - II	**Radioactive Decays**	**12+3**

Alpha decay – Gamow's theory – Geiger Nuttall law – Neutrino hypothesis – Fermi's theory of beta decay – Selection rules – Non conservation of parity in beta decay – Gamma decay - Selection rules – Internal Conversion – Nuclear isomerism - Interaction of nuclear radiation with matter – stopping power, range and straggling - Nuclear radiation detectors – Solid state detectors - Geiger-Muller counter.

UNIT - III	**Nuclear Fission and Fusion**	**12+3**

Nuclear fission – types - Mass and energy distribution of nuclear fragments – Bohr Wheeler's theory of nuclear fission - Fission reactors – Power and breeder type reactors - Nuclear chain reactions – Four factor formula – Nuclear Fusion – Solar fusion – Controlled thermonuclear reactors – Pinched discharge, stellarator, magnetic mirror system, beam injection.		
UNIT - IV	**Nuclear Reactions**	**12+3**
Nuclear reactions – types – conservation laws – Q-equation – Nuclear reaction cross sections – Partial wave analysis – Compound nucleus model – Resonance scattering – Breit Wigner one level formula – Direct reactions – Stripping and pick up reactions. Scattering Process The scattering cross section – scattering amplitude – Expression in terms of Green's function – Born approximation and its validity – Screened Coulomb potential – Alpha particle scattering – Rutherford's formula.		
UNIT - V	**Elementary Particles**	**12+3**
Four types of interactions and classifications of elementary particles – Isospin – Isospin quantum numbers – Strangeness and hyper charge – Hadrons – Baryons – Leptons – Invariance principles and symmetries – Invariance under charge-parity (CP), time (T) and CPT – CP violation in neutral K meson decay – Quark model – SU(3) symmetry – Gell-Mann Nishijma formula – Gauge theory of weak and strong interactions – Charm, bottom and top quarks.		

LECTURE	TUTORIAL	PRACTICAL	TOTAL
60	15	0	75

TEXT BOOKS

1. Nuclear Physics - D.C.Tayal, Himalaya Publishing House, 2017.
2. Concepts of Nuclear Physics - B.L.Cohen, Tata McGraw Hill, New Delhi, 1983.

REFERENCE BOOKS :

1. Nuclear Physics - R.R.Roy and B.P.Nigam, Wiley Eastern Ltd., New Delhi, 1986.
2. Introductory Nuclear Physics - Samuel S. M. Wong, Wiley India Pvt. Ltd., New Delhi, 2014.
3. Nuclear and Particle Physics - S. L. Kakani and Shubhra Kakani, Viva Books, New Delhi, 2011.
4. Nuclear and Particle Physics: An Introduction - B. R. Martin, 2012.

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	3	3	1	1	3	2	3	2	1	1
CO2	2	3	1	1	3	2	3	2	1	1
CO3	3	3	1	1	1	2	3	2	1	1
CO4	3	2	1	1	1	2	3	2	1	1
CO5	2	3	1	1	2	2	3	2	1	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

YPH403			PROJECT WORK AND VIVA VOCE	L	T	P	C
				0	0	10	10
C	P	A		L	T	P	H
2	6	2		0	0	15+5*	15 +5*

Note:* - Directed Study

On the successful completion of this course students would able to

COURSE OUTCOMES		Domain	Level
CO1	**Develop** scientific reasoning abilities, practical skills, divergent thinking and multiple solutions	Cognitive, Psychomotor Affective	Knowledge, Mechanism, Respond
CO2	**Synthesis** knowledge from various areas of learning and apply it critically and creatively to real-life situations.	Cognitive Psychomotor Affective	Synthesis, Mechanism, Respond
CO3	**Provide** opportunities for teamwork, group skills and encourage collaboration.	Cognitive Psychomotor Affective	Comprehension, Mechanism, Receive
CO4	**Test** the comprehension and analysis of the innovative experiment	Cognitive Affective	Apply, Analyze, Receive

Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO9	PSO10
CO1	2	3	3	3	3	2	3	2	1	1
CO2	2	3	3	3	3	2	3	2	1	1
CO3	2	1	2	2	3	2	3	2	1	1
CO4	3	3	3	3	3	2	3	2	1	1

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation