PRM101	RESEARCH METHODOLOGY	L	T	P	C
	Total contact Hours-45	3	0	0	3
	Prerequisite- M.Sc Physics				
	Course Designed by – Department of Physics				

COURSE OBJECTIVES:-

This course aims to give exposure to the students on research methodology

COURSE OUTCOMES (COs)

CO1	To understand the basics of research methodology
CO2	To understand the different types of research design and know the concepts on experimental design
CO3	To learn the fundamentals of optical and thermal property related instrumentation techniques.
CO4	To understand the working principles of magnetic property and compositional analysis related instrumentation techniques
CO5	To learn about the structure of solid materials
CO6	To solve the numerical problems through numerical problems.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS O1	PSO2	PSO3
2	CO1	H	M	L	L	L	L	M	H		
	CO2	M	H	L	M	M	L	M			
	CO3	H	M	M	H	M	M	H			
	CO4	H	H	H	M	M	M	H			
	CO5	M	H	M	L	H	M	M			
	CO6	H	H	H	L	H	M	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					✓					
4	Approval	Academic Council Meeting								

Unit – I **Concepts and Types of Research & Research Problem** **9**

Meaning – Objectives – Motivation – Types – Approaches – Significance – Research Methods versus Methodology – Research and Scientific Method – Importance of Research – Research Process – Criteria of Good Research – Problem Encountered by Researchers.

Sources – Formulation – Criteria – Research Questions – Importance – Survey – Use of Library and Journals – Internet – Reprints of Research Articles Research Design – Meaning – Need – Features – Important Concepts – Different Research Designs – Ex-Post Facto Research – Explanatory Research – Exploratory Research.

Unit - II **Sampling Techniques & Data Collection** **9**

Census and Sample Survey – Implications of a Sample Design – Steps in Sampling Design – Criteria of Sampling – Characteristics of Good Sample Design – Randomisation – Simple Random – Stratified Random Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling – Convenience Sampling – Purposive Sampling – Quota Sampling – Advantages and Disadvantages of Sampling.

Primary and Secondary Data – Meaning – Importance - Characteristics – Quantitative and Qualitative Data – Interview – Questionnaire – Schedules – Survey – Experimentation.

Unit – III **Hypothesis Testing** **9**

Meaning – Importance – Sources – Types – Characteristics – Formulation – Generalization – Hypothesis Testing of Means – Hypothesis Testing for Differences between means - – Hypothesis Testing for comparing Two Related Samples – Hypothesis Testing of proportions - – Hypothesis Testing for Differences between Proportions - – Hypothesis Testing for Comparing Variance - – Hypothesis Testing for Correlations – Limitation of Hypothesis Testing.

Unit – IV **Analysis of Data & Interpretation and Report Writing** **9**

Measures of Central Tendency – Measures of Dispersion – Correlations – Chi – Square – Test Analysis of Variance – Regression – Multivariate Analysis – Sign Test – Wilcoxons Signed Rank Test – Wald Wolfowits runs Test – Freedman Test – Mann Whiteny U Test.

Meaning – Techniques – Precautions of Interpretation – Report writing – Structure of Report – Contents – Steps in Drafting – Layout – Types – Styles – Editing – Final Report – Evaluation.

Unit – V **Computer Applications** **9**

Computer and Computer Technology – Computer System – Important Characteristics – The Primary Number System – Computer Applications – Computers and Researchers – Tables – Graphs Languages.

Text Books:

1. John W. Best and James V. Kahn – 'Research in Education'. – Prentice Hall f India Private Limited, New Delhi – 2006.
2. C.R. Kothari – 'Research Methodology – Methods and Techniques ' – New Age International Publishers, New Delhi, 2004.

References:

1. Donald H. Mc. Burney – 'Research Methods' – Thomson Asia Pvt. Ltd., Singapore 2002.
2. Ranjit Kumar – 'Research Methodology '- Sage Publication, New Delhi 1999.
3. Meenakshi Raman and Sangeeta Sharma – 'Technical Communications – Principles & Practice' – Oxford University Press, London.
4. Uma Sekaran - 'Research Methods for Business' – John Wiley and Sons Inc., New York 2002.

PPS101	ADVANCE CONCEPTS IN PHYSICS	L	T	P	C
	Total contact Hours-45	3	0	0	3
	Prerequisite- M.Sc Physics				
	Course Designed by – Department of Physics				

COURSE OBJECTIVES:-

To introduce the basic crystal physics and technology of semiconductor and systems for solar energy harnessing

COURSE OUTCOMES (COs)

CO1	Gain knowledge about solar energy and its solar radiation, design of solar cells
CO2	Learn about semiconductor based solar cells
CO3	Understand the Characterization and Analysis
CO4	Demonstrate knowledge on the physics, chemistry, biology, quantum confinement and photonics of Nanomaterials
CO5	Gain knowledge about one, Two- and three-dimensional photonic crystals and optical devices and its properties
CO6	To learn about the structure of solid materials

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PS O1	PSO2	PSO3
2	CO1	H	M	L	L	L	L	M	H		
	CO2	M	H	L	M	M	L	M			
	CO3	H	M	M	H	M	M	H			
	CO4	H	H	H	M	M	M	H			
	CO5	M	H	M	L	H	M	M			
	CO6	H	H	H	L	H	M	H			
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)	
					✓						
4	Approval	Academic Council Meeting									

UNIT 1 Solar energy **9**

Energy sources and their availability – Prospects of renewable energy sources. Solar cells; Solar cells for direct conversion of solar energy to electric powers- solar cell parameters – solar cell electrical characteristics – Efficiency – Single crystal silicon solar cells- Polycrystalline silicon solar cells- cadmium sulphide solar cells- Applications of solar energy: Solar water heating- space heating and space cooling- solar photo voltaic- agricultural and industrial process heat- solar distribution- solar pumping – solar furnace solar cooking – solar green house.

UNIT 2 X-ray diffraction **9**

X-rays- X-ray sources- conventional generators – construction and geometry – rotating anode generators – choice of radiation – Synchrotron radiation – X-ray optics: filters – monochromators – collimators – mirrors – safety. Crystals – Lattice planes – Miller indices – Space lattice – X-ray diffraction reciprocal lattice – relation between direct and reciprocal space – Bragg's law in reciprocal lattice – X-ray powder diffraction method.

UNIT 3 Quantum mechanics **9**

Inadequacy of classical theory – de-Broglie hypothesis of matter waves - Heisenberg's uncertainty relation – Schrodinger's waves equation – physical interpretation and condition on wave function – eigen values and eigen functions – particle in a square–well potential – potential barrier - tunneling

UNIT 4 Non-Linear Optics **9**

Harmonic generation- Second and higher order harmonics generation- Phase Matching – Optical mixing - Optical parametric oscillations – Multi-photon processing.

UNIT 5 Vibrational spectroscopy **9**

Infrared spectroscopy – Vibrational study of diatomic molecules – IR rotation – Vibrational spectra of gaseous diatomic molecules – simple gaseous polyatomic molecules – Correlations of Infra Red Spectra with Molecular Structure - Instrumentation - Sample handling - quantitative Analysis - Raman Spectroscopy - Theory - Instrumentation - Sample Handling and Analysis – SERS – CARS - FT technique in Raman spectroscopy – Application of vibrational spectroscopy in structural elucidations.

Books For Reference

1. Kreith and Kreider, Principles of solar Engineering, Tata McGraw Hill Publication.
2. A.B. Meinel and A.P. Meinel, Applied Solar Energy.
3. M.P. Agarwal, Solar Energy, S. Chand & co.
4. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Edition.
5. G.D. Rai, Non-Conventional Energy sources, Khauna publications, New Delhi.
6. X-ray Structure Determination (2nd Edition) – Stout and Jensen – John Wiley (1989).
7. Fundamentals of Crystallography - (2nd Edition)- C. Giacovazzo- Oxford press.
8. Structure determination of X-ray Crystallography (2nd Edition)- Ladd and Palmer.
9. B.B. Laud, Lasers and Non Linear optics –New age international P (Ltd) (2nd Edition), New Delhi (1991).
10. Ajoy Ghatak, Optics -(2nd Edition)- Tata Mcgraw Hill Publications.
11. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill (1972).
12. D.N. Sathyanarayana, Vibrational spectroscopy, New Age international (2004).
13. M. Lakshmanan and S. Rajasekhar, Non Linear Dynamics: Intergrability Chaos and Patterns, Springer Verlag, Berlin (2003).

PPS151 / PPS1E1	**ELECTRONICS**	L	T	P	C
	Total contact Hours-45	3	0	0	3
	Prerequisite- M.Sc Physics				
	Course Designed by – Department of Physics				

COURSE OBJECTIVES:-

Understand the basic concepts of current electricity, electronics and digital electronics

COURSE OUTCOMES (COs)

CO1	To understand the basic concepts of construction and working of electronic devices and optical fibers
CO2	To Learn about the principles of electronics circuits
CO3	Apply the knowledge to understand the working of special types of diodes
CO4	Understand the principles of modulation and demodulation
CO5	To design and construct the electronic circuit and solve the mathematical equations.
CO6	Apply the knowledge to understand the working of amplifiers, oscillators and multivibrators

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	**COs/Pos**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PS O1**	**PSO2**	**PSO3**
2	CO1	H	M	L	L	L	L	M	H		
	CO2	M	H	L	M	M	L	M			
	CO3	H	M	M	H	M	M	H			
	CO4	H	H	H	M	M	M	H			
	CO5	M	H	M	L	H	M	M			
	CO6	H	H	H	L	H	M	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
						✓				

4	Approval	Academic Council Meeting

Unit – I: 9

Circuit Theorems and Special Diodes Kirchoff's laws for current and voltage – Thevenin's and Norton's theorems, superposition and reciprocity theorems with examples –
p-n junction diodes – Zener diode – tunnel diode – Schottky barrier diode – varactor diode-photodiode – solar cell – photodiodes and transistors – light emitting diode – semiconductor laser – UJT – opto-couplers.

Unit – II: 9

Bipolar Transistor Amplifiers and FETs Biasing characteristics of junction transistors – analysis using re model-fixed bias-voltage divider bias-emitter bias – direct coupled transistor amplifiers – single stage transistor amplifier – frequency response – feed back in amplifiers – effect of negative feedback in amplifiers – FETs – different types-low and high frequency FETs, frequency response of FET – applications

Unit-III: 9

Oscillators Oscillator principle – oscillator types – frequency stability, RC oscillators – phase shift oscillator – Wein bridge oscillator – LC tunable oscillators – limitations – multivibrators – monostable and astable – 555 IC timer – sine wave and triangular wave generation – crystal oscillators and their applications.

Unit – IV: 9

Operational Amplifiers Basis of operational amplifier – characteristics – CMRR – inverting and non-inverting modes- sum and difference amplifiers – integrating and differentiating circuits – feedback types – current to voltage (ICVS) and voltage to current (VCIS) conversion — op-amp application – instrumentation amplifiers – low pass and high pass active filters.

Unit – V: 9

Digital Circuits Logic gates: De Morgan's law, binary adder, comparators, decoders, multiplexers. Flip-flops: RS flip-flop, JK flip- flop, JK master-slave flip-flops, T flip-flop, D flip-flop. Shift registers – synchronous and asynchronous counters – registers – A/D and D/A conversion.

Text Books

1. J. Milman and C.C. Halkias, Electronic Devices and Circuits, McGraw-Hill (1981).
2. Albert Malvino, David J Bates, Electronics Principles, Tata McGraw-Hill (2007).
3. R.J. Higgins, Electronics with Digital and Analogue Integrated Circuits, Prentice Hall (1983).

Reference Books

1. R. L. Boylsted and L. Nashelsky, Electronic Device and Circuits, Pearson Education (2003).
2. C.L Wadhwa, Network Analysis and Synthesis, New Age International Publishers, (2007).
3. G.B. Calyton, Operation Amplifiers, ELBS (1980).

PPS152 / PPS1E1	**CRYSTAL GROWTH AND CHARACTERIZATION**	L	T	P	C
	Total contact Hours-45	3	0	0	3
	Prerequisite- M.Sc Physics				
	Course Designed by – Department of Physics				

COURSE OBJECTIVES:-

The aim of this course is to introduce the students to different types of crystals and their properties

COURSE OUTCOMES (COs)

CO1	Understand the basic concepts crystals
CO2	Kinds of nucleation-nucleation.
CO3	Understand the basic laws of Crytallography.
CO4	Analyze and solve the problems based on electron theory of solids and for different materials
CO5	To design and construct particle equation in the free and bound states as well as to analyze and interpret the results.
CO6	To execute the applications of the superconductor

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	**COs/Pos**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PS O1**	**PSO2**	**PSO3**
2	CO1	H	M	L	L	L	L	M	H		
	CO2	M	H	L	M	M	L	M			
	CO3	H	M	M	H	M	M	H			
	CO4	H	H	H	M	M	M	H			
	CO5	M	H	M	L	H	M	M			
	CO6	H	H	H	L	H	M	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
						✓				

4	Approval	Academic Council Meeting

UNIT I - Crystallization from Solution Introduction **9**

Main categories of crystal growth methods – The chemical Physics of Crystal growth – Solid growth techniques – Melt growth techniques – Solution growth methods – Vapour phase growth Choosing a crystal growth methods. Solution Method: Basic requirements – Crystallization apparatus – Saluration and seeding – Factors that influence the perfection of the final crystal – Control of crystal morphology.

UNIT II - Crystal Growth in Gel media **9**

Various methods of gel growth – Growth mechanism – Morphologies of various gel grown crystals.

UNIT III - Crystal Pulling Material considerations **9**

Crystal growth – Solid solutions and impurities – Growth control – Special techniques.

UNIT IV - Structural Characterization of Crystals **9**

Different probes for structure analysis – Principles of X-ray diffraction – Experimental methods in structure analysis – Steps in crystal structure analysis – Structure determination – Structure refinement.

UNIT V – Electrical characterization **9**

Crystalline perfection and electrical Characterization Volume, Area, Line and point defects – Threshold concentration of defects in crystals – Methods of detecting imperfections. Two probe method to determine dielectric constant, electrical conductivity and thermo electric power.

Books for Study :

1. Crystal Growth Edited by Brain R. Pamplin (2nd Edn. Pergamon Press, Oxford, 1980)
2. Crystal in Gels and Liecegand Rings by Heinz K. Henisch (Cambridge University Press, Cambridge, 1988).
3. Crystal Structure Analysis by C.Mahadevan in Horizons of physics (Vol. II) edited by Narendra Nath and A.W.Joshi. (New Age International Publishers, New Delhi, 1996)

Articles for Study :

1. Crystal Growth in Gel media by C.Mahadevan (Bulletin of IAPI, 5(9), 1988, 243-245).
2. Crystal Growth in Gel media by A.R.Patel and A.Venkateswara Rao (Bulletin of Materials Science, 4(5), 1982, 527 – 528).
3. A Versatile setup for determination of Dielectric Constant, Electrical Conductivity and Thermo electric power by A.T.Seshadri, V.K.Vijayaraghavan and G.Balakrishnan (Bulletin of IPAT, 10(5), 1993, 146 – 148).

PPS153 / PPS1E1	**NANO PHYSICS**	L	T	P	C
	Total contact Hours-45	3	0	0	3
	Prerequisite- M.Sc Physics				
	Course Designed by – Department of Physics				

COURSE OBJECTIVES:-

To introduce the basic nanophysics imply to nanomaterials and their advantages in device fabrication

COURSE OUTCOMES (COs)

CO1	Gain basic knowledge about nanomaterials
CO2	Learn about nanmaterials based device
CO3	Understand the Characterization and Analysis
CO4	Demonstrate knowledge on the physics, chemistry, biology, quantum confinement and photonics of Nanomaterials
CO5	Gain knowledge about one, Two- and three-dimensional photonic crystals and optical devices and its properties
CO6	To learn about the structure of solid materials

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	**COs/Pos**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PS O1**	**PSO2**	**PSO3**
2	CO1	H	M	L	L	L	L	M	H		
	CO2	M	H	L	M	M	L	M			
	CO3	H	M	M	H	M	M	H			
	CO4	H	H	H	M	M	M	H			
	CO5	M	H	M	L	H	M	M			
	CO6	H	H	H	L	H	M	H			
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)	
					✓						
4	Approval	Academic Council Meeting									

UNIT – I : Introduction to Nanomaterials **9**

Historical perspective of Nanomaterials – Classification of Nanomaterials – Reason for the development of Nanomaterials – Challenges in Nanoscience and Technology – Surface energy – Chemical Potential as a function surface temperature – Electrostatic stabilization – Surface charge density – Electric potential at the proximity of solid surface – Vander walls attraction potential – DLVO theory – Steric stabilization.

UNIT – II : Basic properties of Nanoparticles **9**

Size effect and properties of Nanoparticles – Particle size – Particle shape – Particle density – Melting point, Surface tension, wettability – Specific surface area and pore – Composite structure – Crystal structure – Surface Characteristics – Mechanical property – Electrical properties – Magnetic properties – Optical property of Nanoparticle.

UNIT – III Synthesis and Processing of Nanoparticles **9**

Top-down and Bottom-up approaches – Synthesis of metallic and semiconductor Nanoparticles – Physical and chemical techniques – Ball milling laser ablation – Photo, Ebeam, X-ray lithography – Molecular beam epitaxy (MBE) – Inert gas condensation – Physical vapour deposition (PVD) – Plasma arching – Chemical vapour deposition (CVD) – Sol-gel techniques.

UNIT – IV : Fabrication and Characterization of Nanostructured Materials **9**

Zero-D, One-D and Two-D structures: Nanoparticles in dispersed in various matrixes – Nanowires – Nanorods – Different growth techniques – VLS and SLS growth – Sol-gel – PVD, CVD, etc. – Nanotubes – Formation and growth techniques – Carbon Nanotubes – Types and Structures – Nanomanipulation: Nanolithography – Soft lithography – Microprinting – Nanoimprint – Dip-pin lithography.

UNIT – V : Properties and Applications of Nanomaterials **9**

Melting point and lattice constant – Estimation of Particles size – XRD, SEM, AFM and TEM – Quantum size effect – Surface Plasmon resonance – Electrical conductivity – Excitons – Scattering – Quantum transport – Magnetic behaviors of Nanoparticles – Dilute magnetic semiconductor – Super Para magnetism – Application in molecular and nano devices: Nanodots – Molecular recognition – Quantum dot wells – Photonic crystal and Plasmon wave guides – Nano DNA devices – Drug delivery system.

BOOKS FOR REFERENCE

1. Nano – The essentials, T.Praddetp, Mc Graw Hill Education, Chennai.
2. Nanosacle magterials in chemistry, Kenneth, J.Klabunde, 2001, Wiley & Sons, Inc. Publications.
3. Physics and Chemistry of Metal cluster Components, De Jongh.J, 1994, Kulwer academic Publishers, Dordrecht.
4. Nanosystems, Dexler E, John Wiley, CNY.
5. Nanotechnology, AIP Press, Springer – Verlag, Gregory Timp, Editor, 1999, New York, (ISBN 0 – 387 – 98334 – 1).
6. Nanoscale charterization of surfaces & Interfaces, N.JohnDinardo, Weinheim Cambridge: Wiley – VCH, 2000 2nd Ed.
7. Semiconductors for Micro and Nanotechnology – An introduction for engineers, Jan Korvink & Andreas Greiner, Weinheim Cambridge: Wiley – VCH, 2001.
8. Hand book of Nanoscience, Engineering and Technology – The Electrical Engineering hand Book series.

PMR101	RESEARCH METHODOLOGY	L	T	P	C
	Total Contact Hours– 60	4	0	0	4
	Prerequisite course – UG Level				
	CourseCoordinator Name& Department:-**Ms. S ANU PRIYA/CS**				

COURSE OBJECTIVES:-

Research is a careful and detailed study of a particular problem or concern, using scientific methods. An in-depth analysis of information creates space for generating new questions, concepts and understandings. The main objective of research is to explore the unknown and unlock new possibilities.

COURSE OUTCOMES(COs)

CO1	Describe the concept of Research Meaning ,Objectives, Types, Approaches, Research and Scientific Method
CO2	Explain Research Questions Research Articles and Sampling Techniques
CO3	Demonstrate the purpose of Data Collection and Hypothesis Testing concepts
CO4	Analyze the types of Hypothesis Testing, and Correlations Analysis of Data
CO5	Evaluate the concept of Interpretation and Report Writing and Introduction to Computer Technology
CO6	Generalize Computer System, Characteristics, Number System, Applications, methods to draw Tables and Graphs Languages.

Mapping of CourseOutcomes with Program outcomes (POs)
(1/2/3 indicates strengthof correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L								
	CO2	H	L							H	
	CO3	H	H								
	CO4	L	L								
	CO5	H	L								
	CO6	H	L								

3	Category	Humanities &Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core(PC)	CoreElective (CE)	Non-Major Elective(NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
						✓				

4	Approval	AcademicCouncilMeeting

Unit – I Concepts and Types of Research & Research Problem 12

Meaning – Objectives – Motivation – Types – Approaches – Significance – Research Methods versus Methodology – Research and Scientific Method – Importance of Research – Research Process – Criteria of Good Research – Problem Encountered by Researchers.

Sources – Formulation – Criteria – Research Questions – Importance – Survey – Use of Library and Journals – Internet – Reprints of Research Articles Research Design – Meaning – Need – Features – Important Concepts – Different Research Designs – Ex-Post Facto Research – Explanatory Research – Exploratory Research.

Unit – II Sampling Techniques & Data Collection 12

Census and Sample Survey – Implications of a Sample Design – Steps in Sampling Design – Criteria of Sampling – Characteristics of Good Sample Design – Randomisation – Simple Random – Stratified Random Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling – Convenience Sampling – Purposive Sampling – Quota Sampling – Advantages and Disadvantages of Sampling.

Primary and Secondary Data – Meaning – Importance - Characteristics – Quantitative and Qualitative Data – Interview – Questionnaire – Schedules – Survey – Experimentation.

Unit – III Hypothesis Testing 12

Meaning – Importance – Sources – Types – Characteristics – Formulation – Generalization – Hypothesis Testing of Means – Hypothesis Testing for Differences between means - – Hypothesis Testing for comparing Two Related Samples – Hypothesis Testing of proportions - – Hypothesis Testing for Differences between Proportions - – Hypothesis Testing for Comparing Variance - – Hypothesis Testing for Correlations – Limitation of Hypothesis Testing.

Unit – IV Analysis of Data & Interpretation and Report Writing 12

Measures of Central Tendency – Measures of Dispersion – Correlations – Chi – Square – Test Analysis of Variance – Regression – Multivariate Analysis – Sign Test – Wilcoxons Signed Rank Test – Wald Wolfowits runs Test – Freedman Test – Mann Whiteny U Test.

Meaning – Techniques – Precautions of Interpretation – Report writing – Structure of Report – Contents – Steps in Drafting – Layout – Types – Styles – Editing – Final Report – Evaluation.

Unit – V Computer Applications 12

Computer and Computer Technology – Computer System – Important Characteristics – The Primary Number System – Computer Applications – Computers and Researchers – Tables – Graphs Languages.

Text Books:

1. John W. Best and James V. Kahn – 'Research in Education'. – Prentice Hall f India Private Limited, New Delhi – 2006.
2. C.R. Kothari – 'Research Methodology – Methods and Techniques ' – New Age International Publishers, New Delhi, 2004.

References:

1. Donald H. Mc. Burney – 'Research Methods' – Thomson Asia Pvt. Ltd., Singapore 2002.
2. Ranjit Kumar – 'Research Methodology '- Sage Publication, New Delhi 1999.
3. Meenakshi Raman and Sangeeta Sharma – 'Technical Communications – Principles & Practice' – Oxford University Press, London.
4. Uma Sekaran - 'Research Methods for Business' – John Wiley and Sons Inc., New York 2002.

Course Coordinator HOD

PCI101	ADVANCED CONCEPTS IN CHEMISTRY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite course – PG level				
	Course Coordinator Name & Department:- – Dr A. Manikandan / Chemistry				

COURSE OBJECTIVES:-

To enable students know about the molecular spectroscopy for qualitative and quantitative analysis and also advanced spectroscopy.

COURSE OUTCOMES (COs)

CO1	Remember the knowledge about the Infrared and Raman spectroscopy
CO2	Understand about the principles and methods of NMR spectroscopy
CO3	Understand about the methods of evaluation of thermodynamic parameters
CO4	Apply the detail about the Applications of EPR and mass spectroscopy to some simple systems
CO5	Apply the importance of concepts involved in the Mossbauer emission and AE spectroscopy
CO6	Analyze the real time applications of various diffraction methods in day to day life.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L				M		H		
	CO2	H	L				H				
	CO3	H	L				H				
	CO4	H	L				M				
	CO5	H	L				M				
	CO6	H	L				H				

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR
						√				

4	Approval		Academic Council Meeting

UNIT – I: INFRARED AND RAMAN SPECTROSCOPY 9

Vibrations in simple molecules (H_2O, CO_2) and their symmetry notation - Group vibrations and the limitations – Applications of Raman Spectroscopy – combined uses of IR and Raman Spectroscopy in the structural elucidation of simple molecules like N_2O, ClF_3, NO_3^-, ClO_4^- – effect of coordination on ligand vibrations – uses of group vibrations in the structural elucidation of metal complexes of urea, thiourea, cyanide, thiocyanate, nitrate, sulphate and dimethyl sulphoxide.

UNIT – II: NMR SPECTROSCOPY: PRINCIPLES AND METHODS 9

Definition of nuclear angular momentum and the nuclear magnetic moment: Idea about the rotating axis system, Bloch equations, the quantum mechanical description of the NMR experiment, transition probabilities, Relaxation effects, Fourier transform NMR – measurement of T_1 and T_2Spectral simplification and determination of signs of coupling constants.Examples for different spin systems – chemical shifts and coupling constants (Spin-spin coupling) involving different nuclei (^{1}H, ^{19}F, ^{31}P, ^{13}C) interpretation and applications to inorganic compounds – Effect of quadrupolar nuclei (^{2}H, ^{10}B, ^{11}B) on the ^{1}H NMR spectra satellite spectra.

UNIT – III: EPR SPECTROSCOPY **9**

Factors affecting the magnitudes of g and A tensors in metal species – Zero field splitting and Kramers degeneracy – spectra of VO(II), Mn(II), Fe(II), Co(II), Ni(II) and Cu(II) complexes – Applications of EPR to some simple systems such as benzo semiquinone, Xe^{2+}. Mass Spectrometry – instrumentation – resolution, EI and CI methods – base peak, isotopic peaks, metastable peak, parent peak, determination and use of molecular formula, recognition of molecular ion peak – FAB. Fragmentation – general rules – pattern of fragmentation for various classes of compounds, McLafferty rearrangement.

UNIT – IV: MOSSBAUER SPECTROSCOPY **9**

Isomer shifts – Magnetic interactions – Mossbauer emission spectroscopy – applications to iron and tin compounds. **PHOTOELECTRON SPECTROSCOPY:** Principles – Auger electron spectroscopy – electron spectra in chemical analysis.

UNIT – V: DIFFRACTION METHODS **9**

Crystal symmetry – combination of symmetry elements – crystal classes – screw axis and glide planes – space group – crystal axes – crystal systems, unit cell, Bravais lattices, asymmetric unit – space group – Equivalent positions –X-ray diffraction by single crystals – structure factor – determination of space group by symmetric – phase problem in structure analysis – heavy atom method – Fourier synthesis – refinement of structure - Neutron diffraction – magnetic scattering – applications and comparison with X-ray diffraction. Electron diffraction – basic principles and applications to simple molecules - XeF_6, $Be(BH_4)_2$, ferrocene, Cr(II) acetate.

References:

1. R.S. Drago, "Physical Methods in Chemistry", W.B. Sanders Company, Philadelphia, London.
2. C.N. Banwell, "Fundamentals of Molecular Spectroscopy", 3rd ed., McGraw Hill, 1983, New Delhi.
3. F.W. Fifield and D. Kealey, "Principles and Practice of Analytical Chemistry, Springer US, Reprint (2013)
4. T.C. Gibbs, "Principles of Mossbauer Spectroscopy", Chapman and Hall, London, 1976.

Textbooks :

1. Robert D. Braun, "Introduction to Instrumental analysis", Pharma Book Syndicate, Indian reprint (2006).
2. S. Ahuja, N. Jespersen, Modern Instrumental Analysis, 1st Edition, Volume 47, Elsevier Science, (2006).
3. G.H. Stout and L.H. Jenson, "X-ray Structure Determination – a Practical Guide".
4. Skoog, D.A., Holler, F.J. and Crouch, S.R., "Instrumental analysis, 11 edition Cengage publishers (2012).

Course Coordinator **HOD**

PCI151	INDUSTRIAL CHEMISTRY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite course – PG level				
	Course Coordinator Name &Department:- – Dr A. Manikandan / Chemistry				

COURSE OBJECTIVES:-

To make the students learn about the chemistry from the basic and understood all theoretical background with all concepts understands thoroughly.

COURSE OUTCOMES (COs)

CO1	Remember the knowledge about the generation of energy from various types of fuels
CO2	Understand about the chemicals in improvement of agricultural crops
CO3	Understand about the methods employed for purification of water for industry and home
CO4	Apply the detail about the Pollution occurring from various sources and resulting toxic effects
CO5	Apply the importance of concepts involved in the pollutant technology
CO6	Analyze the real time applications of Chemistry in day today life.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L				M		H		
	CO2	H	L				H				
	CO3	H	L				H				
	CO4	H	L				M				
	CO5	H	L				M				
	CO6	H	L				H				
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR	
						√					
4	Approval		Academic Council Meeting								

UNIT-1: INDUSTRIAL FUELS **9**

Energy: Sources: non-renewable, classification of fuels: solid, liquid and gaseous. Calorific value of fuels and its determination - **Solid fuels:** Coal: types – properties and uses – lignite, sub-bituminous coal, bituminous coal and anthracite. Coking and non-coking coal - **Liquid fuels:** Refining of crude petroleum and uses of fractions. Hydrodesulphurisation. Cracking: thermal and catalytic (fixed bed and fluidised bed cataylsis). Octane number. Production and uses of tetraethyl lead, ETBE and MTBE

UNIT-2: CHEMISTRY AND AGRICULTURE **9**

Fertilizers: NPK, representation,superphosphate, triple superphosphate, uses of mixed fertilizers - Micronutrients and their role, biofertilizers, plant growth harmones – **Pesticides:**

Classification of pesticides with examples - Insectides; stomach poisons, contact insecticides, fumigants. Manufacture and uses of insecticides. DDT, BHC (gammaxane: Conformation of gamma isomer) pyrethrin - Mention of aldrin, dieldrin,endrin and pentachlorophenel (and its Na salts) and Biopesticides - Herbicides: Manufacture of 2,4-D and 2,4,5-T - Fungicides: Preparation of Bordeaux mixture. **Sugar industry:** Double sulphitation process. Refining and grading of sugar. Saccharin: synthesis and use as a sugar substitute - aspartame. Ethanol: manufacture from molasses by fermentation.

UNIT-3: WATER TREATMENT **9**

Introduction: Sources of water. Hardness of water-temporary or carbonate hardness, permanent hardness or non-carbonate hardness. Units of hardness, disadvantages of hard water – In domestic, in industry and in steam generation in boilers. Effect of iron and manganese in water - Estimation of hardness – EDTA method – Estimation of total hardness – O. Hehner's method or alkali titration method - **Water softening methods:** Industrial purpose Lime – soda process, Zeolite process; Ion-exchange - Demineralisation – deionization process. Mixed – bed deionization - Domestic purpose - Removal of suspended impurities. Removal of microorganism – Chlorination – Break point chlorination. Reverse osmosis. Desalination - Waste water treatment

UNIT-4: POLLUTION AND CHEMICAL TOXICOLOGY **9**

Pollution: Air pollution - Acid rain. Green house effect (global warming), ozone layer depletion - photochemical oxidants. Control of air pollution. Water pollution – organic pollutants, Chemical oxygen demand (COD), Biological oxygen demand (BOD), total organic carbon. International standards for water and air quality and regulations - **Chemical toxicology:** Effect of toxic chemicals on enzymes. Lead, mercury and cyanide pollution and their biochemical effects. Carbon monoxide, sulfur dioxide, oxides of nitrogen, ozone – biochemical effects.

UNIT-5: SEMINAR TOPICS **9**

Glass, Cement, Dyes, Paints, Special paints, Lubricants and greases, Refractories, Abrasives, Plastics, Perfumes and flavoring industries, Fermentation industries, Explosives, Pulp and paper industries, Rubber industries, Pharmaceutical industries, Food and food products industries, Photographic product industries, Ceramic industries, Petrochemicals.

REFERENCES

1. Norris Shreve, R. and Joseph a. Brink, Jr. Chemical Process Industries, 4th Ed.;Mc Graw Hill Kogakusha, Ltd: 1977.
2. George t. Austin. Shreve's Chemical Process Industries, 5th Ed.; Mc Graw Hill: 1984.
3. Subba rao, n. S. Biofertilizers in Agriculture; Oxford and IBH Publishing Co.: New Delhi, 1982.

TEXTBOOKS

1. Jain, P. C. And Jain, M. Engineering Chemistry, 10th Ed.; Dhanpat Rai And Sons:Delhi, 1993
2. Kuriakose, j. C. And rajaram, j. Chemistry in Engineering and Technology. Vol 2.; Tata Mc Graw Hill: New Delhi, 1988.
3. Stanley E. Mahanen, Jugal, Kishore, Agrawal,Practicals in Engineering Chemistry; Oxford and IBH Publishing Co., New Delhi, 1976.

Course Coordinator **HOD**

PCI152	NANO CHEMISTRY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite course – PG level				
	Course Coordinator Name & Department:- – Dr A. Manikandan / Chemistry				

COURSE OBJECTIVES:-

To enable students know about Nano Chemistry, synthesis and characterization of nanomaterials

COURSE OUTCOMES (COs)

CO1	Remember the knowledge about the energy at Nanoscale
CO2	Understand about the principles and methods of Nanomaterials synthesis
CO3	Understand about the methods of evaluation for structural characterization
CO4	Apply the detail about the applications of advanced nanomaterials and properties
CO5	Apply the importance of concepts involved in the optical and electrical properties of Nano samples
CO6	Analyze the real time applications of various Nano biosensors in day to day life.

Mapping of Course Outcomes with Program outcomes (POs)

(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L				M		H		
	CO2	H	L				H				
	CO3	H	L				H				
	CO4	H	L				M				
	CO5	H	L				M				
	CO6	H	L				H				
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR	
						√					
4	Approval		Academic Council Meeting								

UNIT I INTRODUCTION TO NANOCHEMISTRY **9**

Importance of surface – particle shape and surface – surface and volume – atomic structure and particle orientation – energy at nanoscale – the material continuum (zero, one and two dimensional materials) – nanothermodynamics – chemical interactions at the nanoscale – supermolecular chemistry

UNIT II NANOMATERIALS SYNTHESIS **9**

Top–down approach (physical vapor deposition, chemical vapor deposition, lithographic method and high energy method) – bottom–up approach (sol–gel, co–precipitation, microemulsions, hydrothermal and solvothermal methods, template synthesis) – growth mechanism (vapor– liquid–solid, solid–liquid–solid).

UNIT III NANOMATERIALS CHARACTERIZATIONS **9**

Structural characterization (XRD, SAXS, SEM, TEM, SPM) – chemical characterization (optical spectroscopy, electron spectroscopy, ionic spectrometry) – surface characterization (XPS, AES, SIMS).

UNIT IV ADVANCED NANOMATERIALS AND PROPERTIES 9

Nanotubes - carbon nanotubes – synthetic methods (CVD and MOCVD) for single walled and multi walled nanotubes; graphene- synthesis, properties and application.Chemical properties- hybridization, solubility, stability and functionalization; physical properties- optical, mechanical, magnetic and electrical properties, quantum size effects, Inorganic nanotubes – synthesis and properties.Nanoporous Materials – Silicon - Zeolites, mesoporous materials – nanosponges and its Applications.

UNIT V APPLICATIONS OF NANOMATERIALS 9

Nanocatalysis (transition metal nanoparticles in catalysis, aerogel supported nanoparticle in catalysis, multi metallic nanoparticles in catalysis) – organic/polymeric field–effect–transistors (FET) – polymer based nanocomposites – nano biosensors and energy materials.

REFERENCES

1. B.S. Murthy, P.Shankar, Baldev Raj, B.B.Rath, James Murday, Text book of Nanoscience and Nanotechnology, Springer, Universities Press (India) Pvt Ltd, (2013).
2. Wei-Hong Zhong, Bin Li, Russell G Maguire, Vivian T Dang, Jo Anne Shatkin, Gwen M.Gross, Michael.C.Richey, Nanoscience and Nanomaterials: Synthesis, manufacturing and Industry Impacts, DEStech Publications, Inc. (2012).
3. Zhen Gao, Li Tan, Fundamentals and application of nanomaterials, Artech house, Bostan (2009).

TEXTBOOKS

1. Duncan W. Bruce, DermofO"Hare, Richard I. Walton, Porous materials, John Wiley and sons, Ltd (2011).
2. Didier Astruc, Nanoparticles and catalysis, Wiley–VCH Verlag, (2008).
3. P. M. Ajayan, Linda S. Schadler, Paul V. Braun, Nanocomposite science and technology, Wiley–VCH Verlag (2003).
4. GuoZhongGao, Nanostructures and nanomaterials: synthesis, properties and applications, Imperial college press (2004)

Course Coordinator **HOD**

PCI153	POLYMER CHEMISTRY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite: PG level				
	Course Coordinator Name & Department:- – Dr. A. Manikandan / Chemistry				

COURSE OBJECTIVES:-

To make the students learn about the basic concepts of polymer science and Copolymerization and to familiarize with the processing of polymers.

COURSE OUTCOMES (COs)

CO1	Gain the knowledge about the introduction of polymer
CO2	Understand about the method of polymerization
CO3	Apply its properties and uses of polymer degradation
CO4	Analyze the detail about the Industrial polymers
CO5	Evaluate the importance of polymer processing
CO6	Create the real time applications of Chemistry in day today life.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L						H		
	CO2	H	L								
	CO3	H	L								
	CO4	H	L								
	CO5	H	L								
	CO6	H	L								
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR	
						✓					
4	Approval		Academic Council Meeting								

UNIT 1 : INTRODUCTION TO POLYMER **9**

Monomers, Oligomers, Polymers and their characteristics - Classification of polymers : Natural synthetic, linear, cross linked and network; plastics, elastomers, fibres, Homopolymers and Co-polymers - Bonding in polymers : Primary and secondary bond forces in polymers ; cohesive energy and decomposition of polymers - Determination of Molecular mass of polymers: Number Average molecular mass (Mn) and Weight average molecular mass (Mw) of polymers and determination by (i) viscosity (ii) Light scattering method (iii) Gel Permeation Chromatography (iv) osmometry and ultracentrifuging.

UNIT 2 : KINETICS AND MECHANISM FOR POLYMERIZATION **9**

Chain growth polymerization : Cationic, anionic, free radical polymerization, Stereo regular polymers : Ziegler Natta polymers - Polycondensation-non catalysed, acid catalysed polymerization, molecular weight – distribution - Step growth polymers

UNIT 3 : TECHNIQUES OF POLYMERIZATION **9**

Bulk, Solution, Emulsion, Suspension, Melt polycondensation, solution polycondensation interfacial and gas phase polymerization - Types of Polymer Degradation, Thermal degradation, mechanical degradation, photodegradation, Photo stabilizers.

UNIT 4 : INDUSTRIAL POLYMERS: **9**

Raw material, preparation, fibre forming polymers, elastomeric material - Thermoplastics : Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester - Thermosetting Plastics : Phenol formaldehyde and expoxide resin - Elastomers : Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene - Conducting Polymers : Elementary ideas ; examples : poly sulphur nitriles, poly phenylene, polypyrrole and poly acetylene.

UNIT 5 : INTRODUCTION TO POLYMER PROCESSING : **9**

Compounding: Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants - Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding, extrusion moulding and reinforcing.

TEXT BOOKS :

1. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995.
2. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996.
3. Krzysztof Matyjaszenski, "Hand Book of Radical Polymerisation",-Wiley, John & Sons. (2003)

REFERENCE BOOKS:

1. F. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.
2. Kumar and S. K. Gupta, Fundamentals and Polymer Science and Engineering, Tata McGraw-Hill, 1978.
3. George Odian "Principles of polymerization", 4th Edition – John Wiley & sons, Inc., New York (2004).
4. J.A. Brydson, "Plastic Materials" ,Heinemenn / Elsevier Publisher,7th edition,2005).

Course Coordinator **HOD**

PCI154	NANOMATERIAL CHEMISTRY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite course – PG level				
	Course Coordinator Name & Department:- – Dr A. Manikandan / Chemistry				

COURSE OBJECTIVES:-

To enable students know about the importance of nanomaterials and get clear knowledge of Nano composites.

COURSE OUTCOMES (COs)

CO1	Remember the knowledge about the preparation of nano structures
CO2	Understand about the principles and methods of characterization techniques
CO3	Understand about the methods of evaluation for nanotube formation
CO4	Apply the detail about the Applications of Optical and electrical properties of nanoparticles
CO5	Apply the importance of concepts involved in the Metallodendrimers and Nanocatalysis
CO6	Analyze the real time applications of Nanostructures in Biology Technology in day to day life.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L				M		H		
	CO2	H	L				H				
	CO3	H	L				H				
	CO4	H	L				M				
	CO5	H	L				M				
	CO6	H	L				H				
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR	
						√					
4	Approval		Academic Council Meeting								

Unit 1: Fabrication and Patterning Nanostructures **9**

Preparation of nanostructures: Nucleation and particle growth-sol process, sol-gel process, chemical co-precipitation, hydrothermal/solvothermal synthesis, pyrolysis, vapor deposition - Techniques of nanofabrication- Nanofabrication by molding, embossing, and printing: hard pattern transfer elements-step-and-flash imprint lithography, nanoimprint lithography; soft pattern transfer elements-Self-assembly for nanofabrication: Surface modification of nanoparticles, characterization techniques-SEM, TEM, HRTEM, AFM, SAXS, LDI-MS, STM.

Unit 2: Nanoarchitectures **9**

Nanotubes based on amphiphilic molecules: methods for nanotube formation-chiral self-assembly,

packing-directed self-assembly, amphiphilic polymer assembly, molecular sculpting, template processes; synthesis of hybrid tubular structures- template-directed synthesis - Carbon nanotubes: assembly in carbon soot, molecular structure, nanotube morphology - Control of dimensions: outer diameter, inner diameter, length, wall thickness - Nanorods: axial rods-modules and rods, singly- and doubly-linked axial rods; zig-zag rods.

Unit 3: Devices Based on Nanostructures **9**

Molecular scale machines-interlocked macromolecules, polyrotaxanes - Chemically-, electrochemically-, and photochemically controllable supramolecular complexes, molecular shuttles, and catenates - Optical and electrical properties of nanoparticles: semiconductor quantum dots, quantum size effects and electron transition, NLO properties, photon upconversion and anti Stokes processes, electron-phonon relaxation - Lanthanide-containing supramolecular devices.

Unit 4: Metallodendrimers and Nanocatalysis **9**

Dendrimers and metallodendrimers: evolution of dendrimers, synthetic methodology-divergent and convergent methodologies, types of metallodendrimers, characterization techniques - Light harvesting dendrimers and photoactive metallodendrimers - Dendrimer encapsulated metal nanoclusters: silver and gold nanoclusters and their chemical and photochemical properties - Nanocatalysis: homogeneous catalysis-cross-coupling reactions, electron-transfer reactions, hydrogenation reactions, oxidation reactions; heterogeneous catalysis-reactions catalyzed by supported transition metal nanocatalysts.

Unit 5: Nanostructures in Biology and Medical Technology **9**

Biomacromolecular nanoreactors: protein cages, viruses-rod-shaped and cage-structured viruses - Nanostructure-based detection methods: optical detection of nucleic acids, proteins, biologically relevant small molecules, metal ions - Biological molecular machines: Myosin-structural aspects and chemomechanical properties; Fluorescence imaging: single-molecule fluorescence spectroscopy, confocal and two photon microscopy, fluorescent proteins, imaging studies of protein localization, imaging of cell signaling - Targeted cancer nanotherapy: magnetic nanoparticles and cancer therapy; gold nanoparticles-tunable optical properties and in vivo cancer detection and therapy.

REFERENCES

1. B.S.Murthy,P.Shankar, Baldev Raj, B.B.Rath, James Murday, Text book of Nanoscience and Nanotechnology, Springer, Universities Press (India) Pvt Ltd, (2013).
2. Wei-Hong Zhong, Bin Li, Russell G Maguire, Gwen M.Gross, Michael.C.Richey, Nanoscience and Nanomaterials: Synthesis, manufacturing and Industry Impacts, DEStech Publications, Inc. (2012).
3. Zhen Gao, Li Tan, Fundamentals and application of nanomaterials, Artech house, Bostan (2009).

TEXTBOOKS

1. Duncan W. Bruce, DermofO"Hare, Richard I. Walton, Porous materials, John Wiley and sons.
2. Didier Astruc, Nanoparticles and catalysis, Wiley–VCH Verlag, (2008).
3. P. M. Ajayan, Linda S. Schadler, Paul V. Braun, Nanocomposite science and technology, Wiley–VCH Verlag (2003).
4. GuoZhongGao, Nanostructures and nanomaterials: synthesis, properties and applications, Imperial college press (2004)

Course Coordinator **HOD**

M18PRHS111	Research Methodology	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course – Mathematics Studied in Under Graduate				
	Course Coordinator Name & Department:- Dr.P.Sumathi/Mathematics				

COURSE OBJECTIVES:-

Learners will be familiar with basic and algorithm analysis. Learners will able to apply the problem solving techniques using theorem.

COURSE OUTCOMES (COs)

CO1	Gain knowledge in research methodology.
CO2	Understand the concept of sampling techniques and data collection.
CO3	Apply for developing a Primary and Secondary data.
CO4	Analyze the Data & Interpretation and Report Writing
CO5	Evaluate data structures for final report.
CO6	Create a computer application.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PSO 1	PSO 2
2	CO1	1	1	3			3			
	CO2	3	3	2			2			
	CO3	2	2	3			3			
	CO4	3	3	2			3	3		
	CO5	3	2	2			1			
	CO6	3	3	3			3			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					□					
4	Approval	Academic Council Meeting								

Unit – I **Concepts and Types of Research & Research Problem** **12**

Meaning – Objectives – Motivation – Types – Approaches – Significance – Research Methods versus Methodology – Research and Scientific Method – Importance of Research – Research Process – Criteria of Good Research – Problem Encountered by Researchers.

Sources – Formulation – Criteria – Research Questions – Importance – Survey – Use of Library and Journals – Internet – Reprints of Research Articles Research Design – Meaning – Need – Features – Important Concepts – Different Research Designs – Ex-Post Facto Research – Explanatory Research – Exploratory Research.

Unit - II **Sampling Techniques & Data Collection** **12**

Census and Sample Survey – Implications of a Sample Design – Steps in Sampling Design – Criteria of Sampling – Characteristics of Good Sample Design – Randomisation – Simple Random – Stratified Random Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling – Convenience Sampling – Purposive Sampling – Quota Sampling – Advantages and Disadvantages of Sampling.

Primary and Secondary Data – Meaning – Importance - Characteristics – Quantitative and Qualitative Data – Interview – Questionnaire – Schedules – Survey – Experimentation.

Unit – III **Hypothesis Testing** **12**

Meaning – Importance – Sources – Types – Characteristics – Formulation – Generalization – Hypothesis Testing of Means – Hypothesis Testing for Differences between means - – Hypothesis Testing for comparing Two Related Samples – Hypothesis Testing of proportions - – Hypothesis Testing for Differences between Proportions - – Hypothesis Testing for Comparing Variance - – Hypothesis Testing for Correlations – Limitation of Hypothesis Testing.

Unit – IV **Analysis of Data & Interpretation and Report Writing** **12**

Measures of Central Tendency – Measures of Dispersion – Correlations – Chi – Square – Test Analysis of Variance – Regression – Multivariate Analysis – Sign Test – Wilcoxons Signed Rank Test – Wald Wolfowits runs Test – Freedman Test – Mann-Whiteny U Test.

Meaning – Techniques – Precautions of Interpretation – Report writing – Structure of Report – Contents – Steps in Drafting – Layout – Types – Styles – Editing – Final Report – Evaluation.

Unit – V **Computer Applications** **12**

Computer and Computer Technology – Computer System – Important Characteristics – The Primary Number System – Computer Applications – Computers and Researchers – Tables – Graphs Languages.

References:

1. John W. Best and James V. Kahn – 'Research in Education'. – Prentice Hall f India Private Limited, New Delhi – 2006.
2. Kothari.C.R – 'Research Methodology – Methods and Techniques ' – New Age International Publishers, New Delhi, 2004.
3. Donald H. Mc. Burney – 'Research Methods' – Thomson Asia Pvt. Ltd., Singapore 2002.
4. Ranjit Kumar – 'Research Methodology '- Sage Publication, New Delhi 1999.
5. Meenakshi Raman and Sangeeta Sharma – 'Technical Communications – Principles & Practice' – Oxford University Press, London.
6. Uma Sekaran - 'Research Methods for Business' – John Wiley and Sons Inc., New York 2002.

M18PCMA111	Advanced Concepts in Mathematics	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course – Mathematics Studied in Under Graduate				
	Course Coordinator Name & Department: - Dr.P.Sumathi/Mathematics				

COURSE OBJECTIVES: -

Learners will be familiar with basic and algorithm analysis. Learners will able to apply the problem-solving techniques using theorem.

COURSE OUTCOMES (COs)

CO1	Gain knowledge in various concepts of mathematics.
CO2	Understand the concept of algebra, stochastic, queuing and transforms.
CO3	Applying Stochastic Processes for Markov chains.
CO4	Analyze the free modules for vector space, dual space.
CO5	Evaluate Holomorphic Fourier Transforms.
CO6	Create descriptive for queuing theory with finite and infinite capacities.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PS O 1	PS O 2
2	CO1	1	1	3			3			
	CO2	3	3	2			2			
	CO3	2	2	3			2			
	CO4	3	3	2			3	3		
	CO5	2	2	2			1			
	CO6	3	3	3			3			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					□					
4	Approval	Academic Council Meeting								

UNIT I: MODULES

Basic definitions – Group of homomorphisms – Direct products and sums of modules-structure of semi simple algebras- Radical - indecomposable modules, Free modules – Vector spaces – The dual space and dual module.

UNIT II: ALGEBRA

Tensor Products, Simple Algebras.

UNIT III: STOCHASTIC PROCESSES

Elements of Stochastic Processes – Notion of a Stochastic Process – Specification of Stochastic processes – Stationary Processes, Markov chains.

UNIT IV: QUEING THEORY

Queue descriptive – Characteristics of queues M/M/1 and M/M/S queues with finite and infinite capacities.

UNIT V: FOURIER TRANSFORMS

Formal properties–Inversion theorem–The Plancherel theorem – Banach Algebra L^1, Holomorphic Fourier Transforms.

TEXT BOOK

1. Treatment as in Associative Algebras (R.S. Pierce, Springer – Verlag GTM 88 (1982))
2. Treatment as in W. RUDIN: Real and Complex Analysis second edition (TMH Edition) reprinted (1980)

REFERENCES

1. C. Goffman and G. Pedrick, A First Course in Functional Analysis, Prentice-Hall, 1974.
2. A first course in Stochastic processes – Samuel Karlin and Howard M. Taylor – Second edition – Academic press.
3. H. Taha – Operations Research – An introduction – Collier Macmillan 1976.
4. W. Rudin, Real and Complex Analysis, 3rd edition, McGraw Hill International, 1986.

M18PCMA112	**COMPLEX ANALYSIS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course –Mathematics / Mathematics Studied in Under Graduate.				
	Course Coordinator Name & Department: - Ms.S.Kavitha /Mathematics				

COURSE OBJECTIVES: -

Learners will be familiar with methods appropriate for solving problems. Apply methods to specific problems.

COURSE OUTCOMES (COs)

CO1	Gain knowledge in basic of Cauchy's Integral Formula
CO2	Understand the concept of the general form of Cauchy's Theorem
CO3	Evaluation of definite integrals and harmonic functions
CO4	Analyze the concept of harmonic functions and power series expansions
CO5	Evaluate partial fractions and entire functions
CO6	Analyze the concepts of canonical products

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PSO 1	PSO 2
2	CO1	3	3	1			3			
	CO2	2	3	1			2			
	CO3	3	2	3			3			
	CO4	2	2	3			2	3		
	CO5	2	2	2			1			
	CO6	3	3	3			3			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					□					
4	Approval	Academic Council Meeting								

UNIT-I

CAUCHY'S INTEGRAL FORMULA

The index of a point with respect to a closed curve- The integral formula- Higher derivatives.

LOCAL PROPERTIES OF ANALYTIC FUNCTIONS:

Removable singularities- Taylor's Theorem- zeros and poles – The Local Mapping- The Maximum Principle. Chapter 4 : Section 2 : 2.1 – 2.3, Section 3 : 3.1 – 3.4.

UNIT-II

THE GENERAL FORM OF CAUCHY'S THEOREM

Chains and cycles - simple connectivity Homology- The general statement of Cauchy's Theorem - Proof of Cauchy's Theorem –Locally exact differentials - Multiple connected regions- Residue Theorem- The argument principle. Chapter 4 : Section 4 : 4.1 – 4.7, Section 5 : 5.1 – 5.2.

UNIT-III

RIEMANN MAPPING THEOREM:

Statement and proof – Boundary behaviour – Use of reflection principle.

CONFORMAL MAPPINGS OF POLYGONS:

Behaviour at an angle Schwarz –Christoffel formula – Mapping of a rectangle.

HARMONIC FUNCTIONS:

Functions with mean value property – Harnack's Principle.

Chapter 6: Section 1: 1.1 – 1.3, Section 2 \: 2.1 – 2.3, Section 3: 3.1 – 3.2.

UNIT IV:

ELEMENTARY THEORY OF UNIVALENT FUNCTIONS:

Area theorem –Growth and distortion theorem-Coefficient estimates - Convex and Starlike Functions –Close to Convex Functions – Starlike Functions.

UNIT V

GENERAL EXTREMAL PROBLEMS:

Functionals on linear spaces- Representation of linear functional – Extreme points and support points –Properties of extremal functions –Extreme points of S- Extreme points of Σ

Chapter 9: Section 9.1 – 9.6.

Reference Book:

UNIT I, II & III :

Lars V.Ahlfors, Complex Analysis (Edition III) MC Graw Hill Co. New York 1979.

UNIT IV&V:

Univalent Functions by Goodman.

M18PCMA113	**GRAPH THEORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course – Mathematics Studied in Under Graduate				
	Course Coordinator Name & Department:- Dr.P.Sumathi/Mathematics				

COURSE OBJECTIVES:-

Learners will be familiar with basic and algorithm analysis. Learners will able to apply the problem-solving techniques using theorem.

COURSE OUTCOMES (COs)

CO1	Gain knowledge in graphs, subgraphs and trees
CO2	Understand the concept of algorithmic design and connectivity, Euler tours and Hamilton cycles
CO3	Apply for developing a real time application in matchings, edge colourings
CO4	Analyze the algorithm for independent sets and cliques, vertex colourings
CO5	Evaluate data structures for planar graphs
CO6	Create a real time application from algorithms.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
2	CO1	1	1	3			2			
	CO2	3	3	2			2			
	CO3	2	2	3			3			
	CO4	3	3	2			3	3		
	CO5	3	2	2			1			
	CO6	3	3	3			2			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					☐					
4	Approval	Academic Council Meeting								

Unit-1

Matchings and covers Maximum matchings, Hall's Matching condition, Min-Max theorems, Independent sets, and covers.

Unit-2

Connectivity - Edge -connectivity, Blocks, 2-connected graphs, connectivity of Di-graphs, k-connected and k-edge connected graphs, Applications of Menger's Theorem.

Unit-3

Coloring of graphs Vertex colorings, upper bounds, Brooks Theorem, Graphs with Large chromatic number, Turan's Theorem.

Unit-4

Planar graphs Drawings in the plane, dual graphs, Euler's formula, Kuratowski's Theorem, Convex Embedings.

Unit-5

Edges and cycles Edge colorings, Hamiltonian cycles- Necessary conditions, Sufficient conditions, Cycles in Directed graphs.

Text Book:

1. Graph Theory with Applications to Engineering and Computer Science Narsingh Deo, Printice Hall of India,New Delhi, Latest Edition.

Reference Books:

1. Douglas B.west, "Introduction to Graph theory" PHI Learning, Private limited, NewDelhi.
2. Bondy and Murty, "Graph theory with Applications", Elsevier, 1976.
3. Bollobas .B, "Modern Graph Theory" Texts math, Springer-Verlag, 1998.

M18PCMA114	**OPERATIONS RESEARCH**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course –Mathematics/ Mathematics Studied in Higher Secondary Studies				
	Course Coordinator Name & Department: - Mrs. L.Radhika /Mathematics				

COURSE OBJECTIVES: -

To learn the methods of appropriate for solving problems. Apply methods to specific problems.

COURSE OUTCOMES (COs)

CO1	Gain the basic knowledge in decision theory
CO2	Understand the concept of network models
CO3	Todeterministic inventory control models
CO4	Understanding basic knowledge and solving ability in Queueing theory
CO5	Evaluate data in replacement and maintenance models
CO6	Evaluate probabilistic inventory control models

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PSO 1	PSO 2
2	CO1	3	2	1			1			
	CO2	3	3	1			3			
	CO3	2	2	3			3			
	CO4	3	2	3			2			
	CO5	1	2	2			1	3		
	CO6	3	3	3			3			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					□					
4	Approval	Academic Council Meeting								

UNIT I ADVANCED LINEAR PROGRAMMING

Linear Programming Models - The Simplex Algorithm – Optimality and Feasibility Criteria - Product Criterion – Transportation and Assignment Model - Revised Simplex Method. Integer Linear Programming – Branch and Bound Algorithm – Cutting Plane Algorithm – Bounded Variable Algorithms.

UNIT II SENSITIVITY IN LINEAR PROGRAMMING

Generic Activities Versus Resources Perspective – Quantifying Sensitivity to Changes in Linear Programming Model Parameters – Primal - Dual Models Properties – Dual Simplex Method – Post Optimality or Sensitivity Analysis.

UNIT III REDUNDANCY ANALYSIS

Heuristics Algorithm – A Priori Identification of Redundancies of constraints and Variables – Application of Primal – Dual Properties to Identify Redundancies – Model Reduction – Comparison of Computational of Efficiencies.

UNIT IV NON – LINEAR PROGRAMMING

Non – Linear Programming Models – Kuhn Tucker Conditions – Wolfe's Modified Simplex Method. Unconstrained optimization in one-dimension, unconstrained optimization in higher dimension, constrained optimization and Lagrange multipliers.

UNIT V DECISION ANALYSIS AND GAMES

Decision Making - Decision Making Under Risk - Decision Making Under Uncertainty – Queueing Theory – Queueing System – Kendall's Notation for representing Queueing models – Classification of Queueing models.

REFERENCES

1. Hamdy A Taha, "Operations Research an Introduction", PHI, 8th Edition, 2007.
2. Ronald L Rardin, "Optimization in Operations Research", Pearson Education, Asia, 2002.
3. Tulsian, "Quantitative Techniques – Theory and Problems", Pearson Education, Asia, 2002.
4. Jit. S. Chandran, Mahendran P. Kawatra, Ki Ho Kim, "Essentials of Linear Programming", Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
5. Hiller F.S, Liberman G.J, "Introduction to Operations Research", Sixth Edition, McGraw Hill, Inc., 1995.

M18PCMA115	STATISTICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course –Mathematics / Mathematics Studied in Undergraduate.				
	Course Coordinator Name & Department:- Mrs.P.S.Sharmila /Mathematics				

COURSE OBJECTIVES: -

Learners will be familiar with basic random events and random variables, parameters of the distribution, characteristic functions, some probability distributions, limit theorems

COURSE OUTCOMES (COs)

CO1	Gain knowledge in random events and random variables
CO2	Understand the concept in parameters of the distribution
CO3	Apply suitable formulae for developing a real time application
CO4	Analyze the algorithms in some probability distributions
CO5	Evaluate the solution of limit theorems
CO6	Create a real time application using algorithms.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PSO 1	PSO 2
2	CO1	2	3	1			1			
	CO2	2	3	3			3			
	CO3	2	1	3			3			
	CO4	1	2	2			2	3		
	CO5	2	3	3			1			
	CO6	3	3	3			3			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					□					
4	Approval	Academic Council Meeting								

Unit - I

Meaning and definition of Statistics, importance and scope of Statistics, functions of Statistics and limitations of Statistics. Diagrammatic representations of data - Bar diagrams - simple, component, multiple and percentage, Pie diagram.

Unit - II

Graphical representations - Histogram, Frequency curve, frequency polygon and Ogives (Construction and uses). Measures of Central Tendency – Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean - derivation of their properties, Merits and Demerits and problems.

Unit –III

Measures of Dispersion - Range, Quartile deviation, Mean Deviation, Standard Deviation and Coefficient of variation. Skewness - concept, measures of Skewness – Karl Pearson's and Bowley's coefficient of skewness. Moments – Raw and Central. Kurtosis - Concept and measures. Problems.

Unit - IV

Correlation - Definitions, Types and Properties of correlation coefficient (statement and proof). Scatter diagrams, Karl Pearson's co-efficient of correlation and Spearman's Rank Correlation. Regression lines and its properties, uses and problems.

Unit – V

Statistical Hypotheses- Types of errors. Test of Significance- small sample and large sample tests based on normal, t, F and Chi-square for mean, S.D. correlation and proportion

Text Book:

1. Gupta S.C., and V.K.Kapoor, "Fundamental of Mathematical Statistics". - Sultan Chand & Sons, New Delhi. (2013).

Book for Reference:

1. Gupta S.P, "Statistical Methods", Sultan Chand & Sons, New Delhi. (1995)
2. Hogg, RV and Craig, AT "An Int to Mathematical Statistics" 6th Edn. Pearson Education Pub. New Delhi. (2009)

M18PCMA121	NUMERICAL METHODS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course – Mathematics Studied in Under Graduate				
	Course Coordinator Name & Department:- Ms.E.Vanishree /Mathematics				

COURSE OBJECTIVES:-

Learners will be familiar with basic and algorithm analysis. Learners will able to apply the problem solving techniques using theorem.

COURSE OUTCOMES (COs)

CO1	Gain knowledge in solution algebraic and transcendental equation
CO2	Understand the concept of method of factorization
CO3	Apply the concept of linear simultaneous equations
CO4	Analyze the usage of differential equation
CO5	Evaluate numerical solution of partial differential equations
CO6	Understanding iterative methods for the solution

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PSO 1	PSO 2
2	CO1	3	3	2						
	CO2	2	3	1						
	CO3	3	2	3						
	CO4	3	2	2			3			
	CO5	2	2	2						
	CO6	3	3	3						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
						□				
4	Approval	Academic Council Meeting								

UNIT I: SYSTEMS OF LINEAR EQUATIONS

Solving System of Homogeneous and Non-homogeneous linear equations. Iterative methods- Jacobi, Gauss-Seidel and Successive Over Relaxation(S.O.R) methods - Conditions for

convergence, conjugate gradient methods. Solving linear non-homogeneous equations with more equations than unknowns and less number of equations than unknowns.

UNIT II: INTERPOLATION

Review of Lagrange interpolation techniques, piecewise linear and cubic splines, error estimates,

uniform approximation by polynomials, data fitting and least squares approximation, Numerical Integration- integration by interpolation, adaptive quadratures and Gauss methods.

UNIT III: IVP FOR ORDINARY DIFFERENTIAL EQUATIONS

Single step methods-Taylor's series, Runge-Kutta methods, multi-step methods-predictor and corrector scheme, stability and convergence analysis.

UNIT IV: ONE DIMENSIONAL PARABOLIC EQUATIONS

Explicit and Crank-Nicolson Schemes for $u_t = u_{xx}$, Weighted average approximation , Derivative boundary conditions, Truncation errors - Consistency, Stability and convergence, Lax quivalence theorem.

UNIT V: HYPERBOLIC EUATIONS AND ELLIPTIC EQUATIONS

First order quasi-linear equations and characteristics, Numerical integration along a characteristic, Lax-Wendroff explicit method, Solution of Laplace and Poisson equations in a rectangular region, Finite difference in Polar coordinate Formulas for derivatives near a curved boundary when using a square mesh.

REFERENCES

1. Smith G.D., "Numerical Solution of P.D.E.", Oxford University Press, New York, 1995.
2. Mitchel A.R. and Griffiths S.D.F., "The Finite Difference Methods in Partial Differential Equations", John Wiley and Sons, New York, 1980.
3. Morton K.W., Mayers, D.F., "Numerical Solutions of Partial Differential Equations", Cambridge University Press, Cambridge, 2002.
4. Iserles A., "A first course in the Numerical Analysis of Differential Equations", Cambridge University press, New Delhi, 2010.
5. G.H. Golub and J.M. Ortega, Scientific Computing and Differential Equations: An Introduction to Numerical Methods, Academic Press, 1992.

M18PCMA122	FUNCTIONAL ANALYSIS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course –Mathematics / Mathematics Studied in Under Graduate				
	Course Coordinator Name & Department: - Dr.P.Sumathi /Mathematics				

COURSE OBJECTIVES: -

Learners will be familiar with basic algorithm and analysis. Learners will understand the theorems and its applications

COURSE OUTCOMES (COs)

CO1	Gain knowledge in Banach spaces
CO2	Understand the concept of boundedness principle
CO3	Understand the concepts of duals and transposes
CO4	Analyze the concepts of product spaces
CO5	Gain knowledge about the operators and adjoints
CO6	Understanding theorems in Spectrum and Numerical range

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO 2	PO 3	PO4	PO 5	PO6	PO7	PSO 1	PSO 2
2	CO1	3	3	3			1			
	CO2	3	3	1			2			
	CO3	3	2	3			3			
	CO4	3	2	2			2			
	CO5	2	2	2			1	3		
	CO6	3	3	3			3			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
					□					
4	Approval	Academic Council Meeting								

Unit I

Normed spaces – continuity of linear maps – Hahn-Banach theorems.

Unit II

Uniform Boundedness Principle – Closed graph and Open Mapping theorems – Spectrum of a Bounded Operator

Unit III

Duals of Transposes – Duals of L^p ([a, b]) and C ([a, b])- Weak and Weak* Convergence – Reflexivity

Unit IV

Inner Product Spaces – Orthonormal Sets – Approximation and Optimization – Projection and Riesz Representation theorems

Unit V

Bounded Operators and Adjoints – Normal, Unitary and Self – Adjoint Operators

References

1. J.B. Conway, A Course in Functional Analysis, 2nd ed., Springer, Berlin, 1990.
2. C. Goffman and G. Pedrick, A First Course in Functional Analysis, Prentice-Hall, 1974.
3. E. Kreyzig, Introduction to Functional Analysis with Applications, John Wiley & Sons, New York, 1978.
4. B.V. Limaye, Functional Analysis, 2nd ed., New Age International, New Delhi, 1996.
5. A. Taylor and D. Lay, Introduction to Functional Analysis, Wiley, New York, 1980.

CURRICULUM

(R2015)

CHOICE BASED CREDIT SYSTEM

(Applicable to the batches admitted from July 2015)

M.Phil. MICROBIOLOGY

I-II SEMESTERS

SEMESTER I

Part	Category	Sub Code	Sub Name	No. of periods per week			Credit
				L	T	P	
THEORY							
Part I	PC	M15PCMI111	Advanced Concepts in Microbiology	3	1	0	4
	PC	M15PCMI120	Environmental Microbiology	3	1	0	4
	PC	M15PRHS111	Research Methodology	3	1	0	4
Total Contact Hours: 60						**Total Credits: 12**	

SEMESTER II

Part	Category	Sub Code	Sub Name	No. of periods per week			Credit
				L	T	P	
THEORY							
Part I	PC	M15PRHS2P1	Project	10	0	0	10
Total Contact Hours: 60						**Total Credits: 10**	

M15PCMI111	Advanced Concepts in Microbiology	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course – M.Sc., Biotechnology, Microbiology and other related Life Science Subject.				
	Course Coordinator Name & Department: - Dr. Jayanthi Rebecca & Microbiology				

COURSE OBJECTIVES: -

Learners will be familiar with the basics of microbiology concepts. Learners will understand the classification, characteristics, techniques, importance of microbes and their applications.

COURSE OUTCOMES (COs)

CO1	Recall the history, basics of microbiology and microscopy.
CO2	Recognize the classification of microbes based on physiological characteristics.
CO3	Apply various techniques in microbiology lab maintenance.
CO4	Apply the microbes based morphological studies using staining techniques.
CO5	Analyze the pathogenicity of microorganisms.
CO6	Analyze the microbial diseases and their treatments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	M						H		
	CO2	H	M								
	CO3	H	M								
	CO4	H	M								
	CO5	H	M								
	CO6	H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR)
					✓					
4	Approval	Academic Council Meeting								

Unit – I Soil Microbiology **12**

Broad significance of soil Microorganisms - Characteristic of soil Microorganisms – Enzymes ofsoil microorganisms – Microbial Biochemistry – Plant – Soil Microorganisms interactions – Factors affecting the activities of soil microorganisms – Microbial degrdation of pesticidal compounds in soil.

Unit – II Environmental Microbiology **12**

Concept & Scope of Environmental Microbiology – soil pollution – water pollution – Air pollution – Oil pollution- Biomining of metals – solid wastes Management. Microbial control of environmental pollution. and Bio remediation– Microbial degradation of Xenobiotis. Environmental laws, Biological warfare.

Unit – III Food Microbiology **12**

Food microflora – spoilage organisms – Food poisoning – Intoxication and infection – Qualitymanagement in food industries – Fermented foods – SCP . Microbial enzymes – Genetically modified foods.

Unit – IV Industrial Microbiology **12**

Concept and scope of industrial Microbiology – strain improvement ;Bioreactors – types, designand functional characteristics. scale up of fermentations. Production of organic solvents , organicacids and amino acids. Third generation antibiotics , Bioassay techniques of antibiotics. Production of microbial inoculants, Principles of immobilization – different kinds of immobilization techniques and their uses in industries. Intellectual property rights (IPR) Patents, Trademark, copyright, Design registration and know- how – patent system India – patenting microorganisms and microbial products.

Unit – V Medical Microbiology **12**

Diagnostic Microbiology – General methods for isolation and identification of bacteria – typing of bacterial isolates – Sero diagnosis Antimicrobials – General characters and drug resistance – antiviral and anti- parasitic drugs.

TEXT BOOKS

1.Coyne, M.S 2000. Soil Microbiology CBS publications New Delhi.
2. Subba Rao. N.S 2001. Soil Microbiology Oxford and IBH Publ. House. India.
3. Wolf. Cruzer and Annalise , Cruzer, 2000. *Biotechnology Text Book of Industrial Microbiology*, panima Publishing House, New Delhi.
4. Patel, A.H.2001. Industrial Microbiology , MacMillian India Ltd.,

REFERENCES

1. Banwari , G.J . 1998. Basic Food Microbiology , CBS Publishers and Distributors New Delhi . India.
2. Jay, J.M. Modern +Food Microbiology. 7th Edition CBS Publishers and Distributors , New York.
3. Murray Moo- Young 2004. Comprehensive Biotechnology Vil. I to Vol 4. Panima Book Publication , New Delhi.

	Environmental Microbiology	L	T	P	C
M15PCMI120	Total Contact Hours – 60	3	1	0	4
	Prerequisite course – B.Sc. Biochemistry, Biotechnology, Microbiology and other related Life Science Subject				
	Course Coordinator Name & Department: - Dr. V. Padmapriya & Microbiology				

COURSE OBJECTIVES: -

Learners will be familiar with the basic knowledge of soil microorganisms. Learners will understand the importance of biofertilizers in soil microbiology **.**

COURSE OUTCOMES (COs)

CO1	Recall the basic of soil microbes, types and their significance
CO2	Recognize the biogeochemical cycles
CO3	Apply the biofertilizers used in the modern agriculture
CO4	Analyze the lifecycle of the soil microbes
CO5	Evaluate the diseases of soil microbes and its treatments
CO6	Analyze the new biopesticides in microbiology

Mapping of Course Outcomes with Program outcomes (POs) (H/M/Lindicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	M						H		
	CO2	H	M								
	CO3	H	M								
	CO4	H	M								
	CO5	H	M								
	CO6	H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR)
					✓					
4	Approval	Academic Council Meeting								

UNIT I **12**

Properties of soil cultivation, types and signification of soil microbes - bacteria, fungi Actinomycetes, Algae, protozoa, nematode and virus – Factors affecting microbial population.

UNIT II **12**

Biochemical cycle – carbon, phosphorus, nitrogen, biological - nitrogen fixation-nitrogen fixers, root nodules formation – Nitrogenase, Hydrogenase.

UNIT III **12**

Microbial interaction between microbes – Neutralism, Commensalism, synergism, Mutualism, Amensalism, Symbiosis, competition, Parasitism and predators – interaction of microbes with plants - Rhizosphere and mycorrhiza - interaction of microbes-insects and rumen.

UNIT IV **12**

Plant pathology – Bacterial disease - blight of rice, citrus canker - Fungal disease - red rot of sugarcane, wilt of cotton, Tikka leaf, root of groundnut

UNIT V **12**

Biofertilizers - Rhizobium and Azotobacter, cyanobacteria, Azolla - mass multiplication and crop response, Biopesticides- Bacterial, fungal and viral.

TEXT BOOKS:

1. Subba Rao NS. Soil Microbiology, 4th Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1994
2. Mishra RR. Soil Microbiology, 1stEdition, CBS Publishers and Distributors, New Delhi, 2001.

REFERENCE BOOKS:

1. Rangaswami G and Mahadevan A, Diseases of crop plants in India, 4th Edition, Printice-Hall of India Pvt. Ltd., New Delhi, 2002.
2. Robert L Tate. Soil Microbiology, 1st Edition, John Wiley & Sons, Inc. New York, 2005.

M15PRHS111	Research Methodology	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite course – B.Sc. Biochemistry, Biotechnology, Microbiology and other related Life Science Subject.				
	Course Coordinator Name & Department: - Dr. V. JanakiDevi & Microbiology				

COURSE OBJECTIVES: -

Learners will be familiar with the research in life sciences. Learners will understand the data collection, analysis and interpretation.

COURSE OUTCOMES (COs)

CO1	Remember the basic research concepts and its types.
CO2	Understand the research topics related to society welfare and design a research using references.
CO3	Apply appropriate methods for data/ sample collection with ethical clearance.
CO4	Apply the data/samples using various methods.
CO5	Analyze the results with previous related research studies.
CO6	Analyze the results and interpret the value and predict the results.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	M						H		
	CO2	H	M								
	CO3	H	M								
	CO4	H	M								
	CO5	H	M								
	CO6	H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship (PR)
					✓					
4	Approval	Academic Council Meeting								

UNIT I **12**

Research- Meaning, Objectives and Motivation, Types of researches, Research process-steps. Criteria of good research. Data collection method- Primary data-observation method, Interview method, Secondary data.

UNIT II **12**

Need for Research Design, Features of good design, Important concepts relating to research designs, Types of Research Design, Basic Principles of Experimenting design, Developing a research plan.

UNIT III **12**

Interpretation-Technique and precaution in interpreting, Significance of report writing, Different steps in writing report, Layout of the research report. Writing research report. Case study.

UNIT IV **12**

Sampling Concepts for statistical analysis-Mean, median, standard deviation-standard error-ANNOVA, SPSS, R-program, Graph pad prism, origin software, sigma statistics, sigma plot.

UNIT V **12**

Legal and socio-economic impacts of biotech research-biosafety regulation-rDNA guidelines-issues involved in experimenting with animals-Experimental protocol approvals-contaminant level and environmental effects-impact of GM organisms and GM foods-IPR and patents.

TEXT BOOKS:

1. Gurumani N. Research Methodology for biological sciences, MJP publishers, Chennai, 2006
2. Kothari CR. Research Methodology-Methods and techniques, New Age publications, New Delhi, 2009.

REFERENCE BOOKS:

1. Paneerselvam R. Research Methodology, Prentice-Hall of India, New Delhi, 2004.
2. Ranjit Kumar. Research Methodology a step by step guide for beginners, 3rd edition, Sage publications, New Delhi 2011.

PMR101	RESEARCH METHODOLOGY	L	T	P	C
	Total Contact Hours– 60	4	0	0	4
	Prerequisite course – UG Level				
	CourseCoordinator Name& Department:-**Ms. S ANU PRIYA/CS**				

COURSE OBJECTIVES:-

Research is a careful and detailed study of a particular problem or concern, using scientific methods. An in-depth analysis of information creates space for generating new questions, concepts and understandings. The main objective of research is to explore the unknown and unlock new possibilities.

COURSE OUTCOMES(COs)

CO1	Describe the concept of Research Meaning ,Objectives, Types, Approaches, Research and Scientific Method
CO2	Explain Research Questions Research Articles and Sampling Techniques
CO3	Demonstrate the purpose of Data Collection and Hypothesis Testing concepts
CO4	Analyze the types of Hypothesis Testing, and Correlations Analysis of Data
CO5	Evaluate the concept of Interpretation and Report Writing and Introduction to Computer Technology
CO6	Generalize Computer System, Characteristics, Number System, Applications, methods to draw Tables and Graphs Languages.

Mapping of CourseOutcomes with Program outcomes (POs)
(1/2/3 indicates strengthof correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L								
	CO2	H	L							H	
	CO3	H	H								
	CO4	L	L								
	CO5	H	L								
	CO6	H	L								

3	Category	Humanities &Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core(PC)	CoreElective (CE)	Non-Major Elective(NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
						✓				

4	Approval	AcademicCouncilMeeting

Unit – I Concepts and Types of Research & Research Problem 12

Meaning – Objectives – Motivation – Types – Approaches – Significance – Research Methods versus Methodology – Research and Scientific Method – Importance of Research – Research Process – Criteria of Good Research – Problem Encountered by Researchers.

Sources – Formulation – Criteria – Research Questions – Importance – Survey – Use of Library and Journals – Internet – Reprints of Research Articles Research Design – Meaning – Need – Features – Important Concepts – Different Research Designs – Ex-Post Facto Research – Explanatory Research – Exploratory Research.

Unit - II Sampling Techniques & Data Collection 12

Census and Sample Survey – Implications of a Sample Design – Steps in Sampling Design – Criteria of Sampling – Characteristics of Good Sample Design – Randomisation – Simple Random – Stratified Random Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling – Convenience Sampling – Purposive Sampling – Quota Sampling – Advantages and Disadvantages of Sampling.

Primary and Secondary Data – Meaning – Importance - Characteristics – Quantitative and Qualitative Data – Interview – Questionnaire – Schedules – Survey – Experimentation.

Unit – III Hypothesis Testing 12

Meaning – Importance – Sources – Types – Characteristics – Formulation – Generalization – Hypothesis Testing of Means – Hypothesis Testing for Differences between means - – Hypothesis Testing for comparing Two Related Samples – Hypothesis Testing of proportions - – Hypothesis Testing for Differences between Proportions - – Hypothesis Testing for Comparing Variance - – Hypothesis Testing for Correlations – Limitation of Hypothesis Testing.

Unit – IV Analysis of Data & Interpretation and Report Writing 12

Measures of Central Tendency – Measures of Dispersion – Correlations – Chi – Square – Test Analysis of Variance – Regression – Multivariate Analysis – Sign Test – Wilcoxons Signed Rank Test – Wald Wolfowits runs Test – Freedman Test – Mann Whiteny U Test.

Meaning – Techniques – Precautions of Interpretation – Report writing – Structure of Report – Contents – Steps in Drafting – Layout – Types – Styles – Editing – Final Report – Evaluation.

Unit – V Computer Applications 12

Computer and Computer Technology – Computer System – Important Characteristics – The Primary Number System – Computer Applications – Computers and Researchers – Tables – Graphs Languages.

Text Books:

1. John W. Best and James V. Kahn – 'Research in Education'. – Prentice Hall f India Private Limited, New Delhi – 2006.
2. C.R. Kothari – 'Research Methodology – Methods and Techniques ' – New Age International Publishers, New Delhi, 2004.

References:

1. Donald H. Mc. Burney – 'Research Methods' – Thomson Asia Pvt. Ltd., Singapore 2002.
2. Ranjit Kumar – 'Research Methodology '- Sage Publication, New Delhi 1999.
3. Meenakshi Raman and Sangeeta Sharma – 'Technical Communications – Principles & Practice' – Oxford University Press, London.
4. Uma Sekaran - 'Research Methods for Business' – John Wiley and Sons Inc., New York 2002.

Course Coordinator **HOD**

PSC101	ADVANCED CONCEPTS IN COMPUTER SCIENCE	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite course - UG Level				
	Course Coordinator Name & Department:- **Ms K.Hepzibah/CS**				

COURSE OBJECTIVES:-

Learners will be familiar with world-leading IT technology with high international standard of service. Learners will understand the expertise of service.

COURSE OUTCOMES (COs)

CO1	Understand the Security problems in Computing.
CO2	Identify the Database security in network.
CO3	Computational knowledge in the Distributed Databases
CO4	Design & Development of Distributed Databases & its transactions.
CO5	Evaluate the Distributed theory processing Heterogeneous distributed databases.
CO6	Analyze the Fundamentals of Parallel processing & MIMD computers.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L								
	CO2	H	L							H	
	CO3	H	H								
	CO4	L	L								
	CO5	H	L								
	CO6	H	L								

3	Category									
						✓				
4	Approval	Academic Council Meeting								

Unit I

Security problems in Computing - Cryptography - program security - Database security - Security in Networks

Unit II

Grid Computing organization and their role - Grid computing anatomy - Merging the Gridservice architecture with web services architecture

Unit III

Fundamental - Remote procedure cells - Distributed shared memory - Synchronization

Unit IV

Distributed Databases - Homogeneous and Heterogeneous databases - Distributed data storage - distributed transactions - commit protocols - concurrent control - availability - Distributed theory processing Heterogeneous distributed databases - Directory systems

Unit V

Fundamentals of Parallel processing - MIMD computers or Multiprocessor 4.1 - 4.2, 4.3

Text Books:

1. Chapter 1,2,3,6 & 7 - (Security in Computing, Charles P. Pfleeger, & Shani Lawrence Pfeeger)
2. Joshy Joseph, Graig Felenstern „Grid Computing" - Pearsons 2004
3. Distributed file systems, Chapter 1,4,5,6 & 9 Distributed Operating Systems, Pradeep K.Sinha, PHI, 2004
4. Abraham fiberschatz & Hendry F. Korths "Data base systems concepts" Mc Graw Hill International fifth edition, 2006
5. Distributed memory multiprocessors 5.1, 5.2, 5.3, 5.4, 5.5 Data dependence and parallelism – 7.1 - 7.2, 7.3, 7.4, 7.5 Implementing synchronization and data sharing 8.1, 8.2, 8.3, 8.4 Harry F. Jordan Gita Alaghband

Course Coordinator **HOD**

PSC151	CLOUD COMPUTING	L	T	P	C
	Total Contact Hours– 45	3	0	0	3
	Prerequisite course – UG Level				
	CourseCoordinator Name& Department:- Ms. E.Srimathi/CS				

COURSE OBJECTIVES:-

Learners will be familiar with world-leading IT technology with high international standard of service. Learners will understand the expertise of service.

COURSE OUTCOMES(COs)

CO1	Gain knowledge inidentifying the technicalfoundations of cloud systems architectures.
CO2	Understand the problems and solutions to cloud application problems.
CO3	Apply principles of best practice in cloud application design and management.
CO4	Analyze and definetechnical challenges for cloud applications and assesstheir
CO5	Evaluate the implementation service with a quality control fromproject imitation to production
CO6	Create a real time application using Cloud Computing by using various services.

Mapping of CourseOutcomes with Program outcomes (POs)
(1/2/3 indicates strengthof correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L								
	CO2	H	L							H	
	CO3	H	H								
	CO4	L	L								
	CO5	H	L								
	CO6	H	L								

3	Category	Humanities &Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core(PC)	CoreElective (CE)	Non-Major Elective(NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
						✓				
4	Approval	AcademicCouncilMeeting								

UNIT I FUNDAMENTALS OF GRID ANDCLOUD COMPUTING 12

Fundamentals – Cloud computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why cloud computing Matters – Advantages of Cloud computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services.

UNIT II DEVELOPING CLOUD SERVICES 12

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2- Google App Engine – IBM Clouds.

UNIT III CLOUD COMPUTING FOR EVERY ONE 12

Centralizing Email communications – collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for theCorporation.

UNIT IV USINGCLOUDSERVICES 12

Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing – Collaborating on Databases – Storing and Sharing Files – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

UNIT V GRIDCOMPUTING 12

OGSA – Sample Use Cases – OGSA Platform Components – OGSI – OGSA Basic Services.Globus Toolkit – Architecture – Programming Model – High Level Services – OGSI.Net.Middleware Solutions.

TEXT BOOKS

1. Michael Miller, Cloud Computing : Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August2008.
2. Thomas Erl, Zaighammahmood, Ricardo puttini, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall.
3. Joe weinman, Cloudonomics : The Business Value of Cloud Computing, Weily

REFERENCE BOOKS

1. Haley Bear, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centersinthe Cloud with SLAs
2. Aidan Dalgleish Simon Gallagher, VMware Private Cloud Computing With vCloud
3. Igor Faynberg , Hui-Lan Lu , DorSkuler , Cloud Computing: Business Trends and Technologies.
4. John R Vacca, Cloud Computing Security: Foundations and Challenges.
5. ArshdeepBahga, Vijay Madisetti Cloud Computing Solutions Architect: A Hands-On Approach

Course Coordinator **HOD**

PSC158	DATA MINING	L	T	P	C
	Total Contact Hours– 45	3	0	0	3
	Prerequisite course – Computer Science/ Mathematics Studied in Higher Secondary studies				
	CourseCoordinator Name& Department:-**Ms.S.Anu Priya/ CS**				

Learners will be familiar withthe concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

COURSE OUTCOMES(COs)

CO1	Describe the concept of Data Warehouse roles and structures, characteristics and meta data
CO2	Explain Data Warehouse architecture, Basic Data Mining tasks, KDD Process
CO3	Demonstrate Data Mining Techniques and classification concept on Distance based algorithms
CO4	Analyze Neural networks based algorithms clustering Hierarchical algorithms
CO5	Evaluate Partitioning algorithms, Association RulesWeb Mining
CO6	Formulate Spatial Mining classification clustering and Temporal Mining

Mapping of CourseOutcomes with Program outcomes (POs)
(1/2/3 indicates strengthof correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L								
	CO2	H	L							H	
	CO3	H	H								
	CO4	L	L								
	CO5	H	L								
	CO6	H	L								

3	Category	Humanities &Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core(PC)	CoreElective (CE)	Non-Major Elective(NE)	Open Elective (OE)	Any other	Project/Term Paper/ Seminar/ Internship(PR)
						✓				
4	Approval	AcademicCouncilMeeting								

UNIT I DataWarehouse **12**

Data Warehouse roles and structures – What can a data warehouse do? The Cost of Warehousing data – Data Stores, Warehouses and Marts – The Data Warehouse environment – Data warehouse characteristics – The Data Warehouse architecture – Metadata, Metadata Extraction – Implementing the Data Warehouse – Designing and building the Data Warehouse – The data warehouse project plan – Data warehouse architecture, specification and development- Data Warehouse project successfactors.

UNIT II Introduction to Data Mining **12**

Basic Data Mining tasks – Data mining versus knowledge discovery in data bases – Data Mining issues – Data Mining Metrics – Social implications of data mining - Data Mining from a database perspective – Data Mining Techniques – Introduction – A statistical perspective on Data Mining – Similarity measures – Decision trees – Neural networks – Genetic algorithms.

UNIT III Classification **12**

Introduction – Statistical based algorithms – Distance based algorithms – Decision tree based algorithms – Neural networks based algorithms – Rule based algorithms – Combining Techniques.

UNIT IV Clustering **12**

Introduction – Similarity and distance measures – Outliers – Hierarchical algorithms – Partitional algorithms – Clustering large data bases – Clustering with categorical attributes – Association Rules – Introduction – Large Item – sets – Basic Algorithms.

UNIT VWebMining **12**

Web Mining – Introduction – Web Content Mining – Web Structure Mining – Web Usage Mining- Spatial Mining – Introduction – Spatial Data: Overview – Spatial Data Mining primitives - Generalization and Specialization – Spatial Rules – Spatial Classification algorithm – Spatial Clustering Algorithms. Temporal Mining – Introduction: Modeling temporal events.

TEXT BOOK:

1. Margaret H. Dunham, “Data Mining Introductory and Advanced Topics”, Pearson Education, 2003.

REFERENCE BOOKS:

1. George M. Marakas, “Modern Data Warehousing, Mining and Visualization: Core concepts”, Pearson Education, 2003.
2. Aruj K Pujari, “Data Mining Techniques”, Universities Press,2001.

Course Coordinator **HOD**

PSC159	COMPUTER NETWORKS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite course - UG Level				
	Course Coordinator Name & Department:- **Ms K.Hepzibah/CS**				

COURSE OBJECTIVES:-

Learners will be familiar with world-leading IT technology with high international standard of service. Learners will understand the expertise of service.

COURSE OUTCOMES (COs)

CO1	Understand the layers of OSI and TCP/IP networks.
CO2	Identify the solution for the error control and flow control problems.
CO3	Apply the working principles of IP layer and its routing algorithms.
CO4	Evaluate the functionalities of transport layer protocols and its control mechanism.
CO5	Remember the functionalities of application layer protocols.
CO6	Analyze the different types of network devices and their functions.

Mapping of Course Outcomes with Program outcomes (POs)
(1/2/3 indicates strength of correlation) 3-High, 2-Medium, 1-Low

1	COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
2	CO1	H	L								
	CO2	H	L							H	
	CO3	H	H								
	CO4	L	L								
	CO5	H	L								
	CO6	H	L								
3	Category										
						√					
4	Approval	Academic Council Meeting									

UNIT I: INTRODUCTION

Introduction - Network Hardware - Software - Reference Models - OSI and TCP/IP models - Example networks: Internet, ATM, Ethernet and Wireless LANs - Physical layer - Theoretical basis for data communication - guided transmission media

UNIT II: WIRELESS TRANSMISSION

Wireless transmission - Communication Satellites - Telephones structure -local loop, trunks and multiplexing, switching. Data link layer: Design issues - error detection and correction.

UNIT III: DATA LINK LAYER

Elementary data link protocols - sliding window protocols - Data Link Layer in the Internet - Medium Access Layer - Channel Allocation Problem - Multiple Access Protocols.

UNIT IV: NETWORK LAYER

Network layer - design issues - Routing algorithms - Congestion control algorithms - IP protocol - IP Address - Internet Control Protocol.

UNIT V : TRANSPORT LAYER

Transport layer - design issues - Connection management - Addressing, Establishing & Releasing a connection - Simple Transport Protocol - Internet Transport Protocol (TCP) - Network Security: Cryptography.

1. Recommended Texts

(i)A. S.Tanenbaum,2003, Computer Networks, Fourth Edition,- Pearson Education, Inc, (Prentice hall of India Ltd), Delhi.

2. Reference Books

(i) B. Forouzan, 1998, Introduction to Data Communications in Networking, Tata McGraw Hill, New Delhi.
(ii)F. Halsall, 1995, Data Communications, Computer Networks and Open Systems, Addison Wessley.
(iii)D. Bertsekas and R. Gallagher, 1992, Data Networks, Prentice hall of India, New Delhi.
(iv)Lamarca, 2002, Communication Networks, Tata McGraw Hill, New Delhi.

Course Coordinator **HOD**