Amrita Vishwa Vidyapeetham

School of Engineering

Department of Electronics and Communication Engineering

Branch: Computer and Communication Engineering

Vision of the Department

To provide a value-based learning environment for producing engineers with a blend of technical skills, moral values and leadership qualities in the field of Electronics, Communication and Computing channelized towards technological advancement to cater to the needs of the industry and the society.

Mission of the Department

M1: Achieving excellence in teaching and learning with an emphasis on fundamental knowledge and hands-on exposure to match the state-of-the-art in technology.

M2: Providing an environment for core competency development and enhancing quality research in emerging areas.

M3: Facilitating professional growth to the students for higher education and career in industry and academia.

M4: Imbibing the essence of human values, ethics and professional skills to sustain socio- economic development.

Course Outcomes (CO)

Statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behavior that students acquire in their progress through the course.

Program Outcomes (POs)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behavior that students acquire through the program. The National Board for Accreditation (NBA) has defined the program outcomes for each discipline.

Program Outcomes for Engineering

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional

engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEOs)

To understand the

PEO1: Principles of Computer Science
PEO2: Principles of Computational Engineering
PEO3: Design of Computing Systems and Software
PEO4: Principles and Techniques of Signal Processing
PEO5: Principles of Communication Engineering
PEO6: Principles of Modern Communication Systems

Program Specific Outcomes (PSO)

PSO1: To design and develop algorithms for Communication Systems

PSO2: To design and develop Embedded and Computing Systems

PSO3: To design, prototype and analyse the performance of Modern Communication Systems

The following specializations will be offered as part of this program:
1. Signal Processing
2. Embedded Systems
3. Software Engineering
4. Computational Engineering
5. Computational Communication

ABBREVIATIONS USED IN THE CURRICULUM

Cat	-	Category
L	-	Lecture
T	-	Tutorial
P	-	Practical
Cr	-	Credits
AES	-	Aerospace Engineering
AIE	-	Computer Science and Engineering - Artificial Intelligence
BIO	-	Biology
CCE	-	Computer and Communication Engineering
CHE	-	Chemical Engineering
CHY	-	Chemistry
CSE	-	Computer Science and Engineering
CVL	-	Civil Engineering
CUL	-	Cultural Education
EAC	-	Electronics for Computer Engineering
ECE	-	Electronics and Communication Engineering
EEE	-	Electrical and Electronics Engineering
ELC	-	Electrical and Computer Engineering
ENGG	-	Engineering Sciences (including General, Core and Electives)
HUM	-	Humanities (including Languages and others)
IC	-	Integrated Circuit
MAT	-	Mathematics
MEE	-	Mechanical Engineering
MAOM	-	Mastery over Mind
MIMO	-	Multiple Input and Multiple Output
PHY	-	Physics
PRJ	-	Project Work (including Seminars)
SCI	-	Basic Sciences (including Mathematics)
VLSI	-	Very Large Scale Integration

B.Tech Computer and Communication Engineering

Curriculum (2023)

Semester I

Cat.	Code	Title	L T P	Credit
SCI	23ECE101	Nature Inspired Engineering	3 0 0	3
SCI	23MAT124	Engineering Mathematics I	3 1 0	4
ENGG	23CCE101	Problem Solving and Algorithmic Thinking	1 0 3	2
ENGG	23CCE102	Fundamentals of Electrical Engineering	3 0 0	3
SCI	23PHY110	Physics of Semiconductors	3 0 0	3
ENGG	23CCE103	Computer Programming	3 0 0	3
ENGG	23CCE181	Electrical Engineering Laboratory	0 0 3	1
ENGG	23CCE182	Computer Programming Laboratory	0 0 3	1
HUM	22ADM101	Foundations of Indian Heritage	2 0 1	2
HUM	22AVP103	Mastery Over Mind (MAOM)	1 0 2	2
		TOTAL	**32**	**24**

Semester II

Cat.	Code	Title	L T P	Credit
SCI	23MAT130	Engineering Mathematics II	3 1 0	4
ENGG	23CCE111	Digital Electronics	3 0 0	3
ENGG	23CCE112	Signal Processing 23MAT132*** - Transforms 23CCE113*** - Signals and Systems	3 1 0	4
ENGG	23CCE114	Electronics Engineering	3 0 0	3
HUM	23ENG101	Technical Communication	2 0 3	3
ENGG	23CCE183	Signal Processing Laboratory	0 0 3	1
ENGG	23CCE184	Internet of Things Lab	0 0 3	1
ENGG	23CCE185	Digital Electronics Laboratory	0 0 3	1
HUM	22ADM111	Glimpses of Glorious India	2 0 1	2
		TOTAL	**31**	**22**

Semester III

Cat.	Code	Title	L T P	Credit
ENGG	23CCE201	Data Structures	3 0 0	3
ENGG	23CCE202	Microcontrollers and Interfacing	3 0 0	3
ENGG	23CCE203	Operating Systems	3 0 0	3
SCI	23CCE204	Foundations of Data Science* 23MAT223*** -Probability and Statistics 23CCE205*** - Data Processing	3 1 0	4
SCI	23MAT210	Numerical Methods	3 1 0	4
ENGG	23CCE281	Microcontrollers and Interfacing Lab	0 0 3	1
ENGG	23CCE282	Data Structures Lab	0 0 3	1
ENGG	23CCE283	Operating Systems Laboratory	0 0 3	1
HUM		Amrita Values Programme – 1	1 0 0	1
SCI	23CHY109	Engineering Chemistry B	3 0 0	3
SCI	23ENV300	Environmental Science		P/F
HUM	23LSE201	Life Skills for Engineers I	1 0 2	P/F
		TOTAL	**33**	**24**

Semester IV

Cat.	Code	Title	L T P	Credit
ENGG	23CCE211	Design and Analysis of Algorithms	3 0 0	3
ENGG	23CCE212	Database Management Systems	3 0 0	3
ENGG	23CCE213	Computer Systems and Architecture	3 0 0	3
ENGG	23CCE214	Communication Theory	3 1 0	4
ENGG	23CCE215	Machine Learning 23MAT218*** - Optimization Techniques 23CCE216*** - Machine Learning Models	3 0 0	3
ENGG	23CCE284	Database Management Systems Laboratory	0 0 3	1
ENGG	23CCE285	Machine Learning Laboratory	0 0 3	1
ENGG	23CCE286	Algorithms Lab	0 0 3	1
HUM	23LSE211	Life Skills for Engineers II	1 0 2	2
HUM		Amrita Values Programme – 2	1 0 0	1
HUM	23LAW300	Indian Constitution		P/F
		TOTAL	**30**	**22**

Semester V

Cat.	Code	Title	L T P	Credit
ENGG	23CCE301	IoT & Cloud Computing	3 0 0	3
ENGG	23CCE302	Software Engineering	3 0 0	3
ENGG	23CCE303	Digital Communication	3 1 0	4
ENGG	23CCE304	Embedded Systems	3 0 0	3
ENGG		Professional Elective I	3 0 0	3
PRJ	23CCE381	Open Lab I	0 0 3	1
ENGG	23CCE384	Embedded Systems Lab	0 0 3	1
ENGG	23CCE382	IoT & Cloud Computing Lab	0 0 3	1
ENGG	23CCE383	Communication Systems Lab	0 0 3	1
HUM	23LSE301	Life Skills for Engineers III	1 0 2	2
ENGG	23LIV390***	Live-in –Labs***		[3]
		TOTAL [+3]	**32**	**22**

Semester VI

Cat.	Code	Title	L T P	Credit
ENGG	23CCE311	Software Defined Radio Architecture	3 0 0	3
ENGG	23CCE312	Wireless Communication and Networks	3 0 0	3
ENGG	23CCE313	Computer Networks and Protocols	3 0 0	3
ENGG		Professional Elective II	3 0 0	3
ENGG		Professional Elective III	3 0 0	3
PRJ	23CCE385	Open Lab II	0 0 6	2
ENGG	23CCE386	Wireless Communication and Networks Laboratory	0 0 3	1
ENGG	23CCE387	Software Defined Radio Laboratory	0 0 3	1
HUM	23LSE311	Life Skills for Engineers IV	1 0 2	2
ENGG	23LIV490***	Live-in –Labs***		[3]
		TOTAL [+3]	**31**	**21**

Semester VII

Cat.	Code	Title	L T P	Credit
ENGG		Professional Elective IV	3 0 0	3
ENGG		Professional Elective V	3 0 0	3
ENGG		Professional Elective VI	3 0 0	3
PRJ	23CCE498	Project Phase I	0 0 16	8
HUM		Free Elective	2 0 0	2
		TOTAL	**24**	**19**

Semester VIII

Cat.	Code	Title	L T P	Credit
PRJ	23CCE499	Project Phase II	0 0 12	6
		TOTAL	**12**	**6**

Cumulative CREDITS   **160**

Evaluation Pattern:

1. All courses offered by the School of Engineering will have the following evaluation pattern:

Exam	Type	Weightage	
		Theory & Lab Integrated Theory Courses	Lab Courses Lab Courses (with LTP as 0-0-X / 1-0-X)
Continuous Assessment	Internal	30	40
Mid Term	Internal	30	20
End Semester / Project	External	40	40

2. All courses offered to B.Tech – Computer and Communication Engineering, by other Schools, will follow the evaluation pattern mandated by the individual Schools offering the course.

List of courses in Amrita Value Programme I & II			
Course Code	Title	L-T-P	Credits
22ADM201	**Strategic Lessons from Mahabharatha**	**1-0-0**	**1**
22ADM211	**Leadership from Ramayana**	**1-0-0**	**1**
22AVP210	**Kerala Mural Art and Painting**	**1-0-0**	**1**
22AVP218	**Yoga Therapy and Lessons**	**1-0-0**	**1**
22AVP212	**Introduction to Traditional Indian Systems of Medicine**	**1-0-0**	**1**
22AVP201	**Amma's Life and Message to the modern world**	**1-0-0**	**1**
22AVP204	**Lessons from the Upanishads**	**1-0-0**	**1**
22AVP205	**Message of the Bhagavad Gita**	**1-0-0**	**1**
22AVP206	**Life and Message of Swami Vivekananda**	**1-0-0**	**1**
22AVP207	**Life and Teachings of Spiritual Masters of India**	**1-0-0**	**1**
22AVP208	**Insights into Indian Arts and Literature**	**1-0-0**	**1**
22AVP213	**Traditional Fine Arts of India**	**1-0-0**	**1**
22AVP214	**Principles of Worship in India**	**1-0-0**	**1**
22AVP215	**Temple Mural Arts in Kerala**	**1-0-0**	**1**
22AVP218	**Insights into Indian Classical Music**	**1-0-0**	**1**
22AVP219	**Insights into Traditional Indian Painting**	**1-0-0**	**1**

22AVP220	Insights into Indian Classical Dance	1-0-0	1
22AVP221	Indian Martial Arts and Self Defense	1-0-0	1
22AVP209	Yoga and Meditation	1-0-0	1

PROFESSIONAL ELECTIVES UNDER SCIENCE STREAM

CHEMISTRY				
Cat.	Course Code	Title	L T P	Credit
SCI	23CHY240	Computational Chemistry and Molecular Modelling	3 0 0	3
SCI	23CHY241	Electrochemical Energy Systems and Processes	3 0 0	3
SCI	23CHY242	Fuels and Combustion	3 0 0	3
SCI	23CHY243	Green Chemistry and Technology	3 0 0	3
SCI	23CHY244	Instrumental Methods of Analysis	3 0 0	3
SCI	23CHY245	Batteries and Fuel Cells	3 0 0	3
SCI	23CHY246	Corrosion Science	3 0 0	3
PHYSICS				
SCI	23PHY240	Advanced Classical Dynamics	3 0 0	3
SCI	23PHY241	Electrical Engineering Materials	3 0 0	3
SCI	23PHY242	Physics of Lasers and Applications	3 0 0	3
SCI	23PHY243	Concepts of Nanophysics and Nanotechnology	3 0 0	3
SCI	23PHY244	Physics of Semiconductor Devices	3 0 0	3
SCI	23PHY245	Astrophysics	3 0 0	3
Mathematics				
SCI	23MAT240	Statistical Inference	3 0 0	3
SCI	23MAT241	Introduction to Game Theory	3 0 0	3
SCI	23MAT242	Numerical Methods and Optimization	3 0 0	3

FREE ELECTIVES OFFERED UNDER MANAGEMENT STREAM				
Cat.	Course Code	Title	L T P	Credit
HUM	23MNG331	Financial Management	3 0 0	3
HUM	23MNG332	Supply Chain Management	3 0 0	3
HUM	23MNG333	Marketing Management	3 0 0	3
HUM	23MNG334	Project Management	3 0 0	3
HUM	23MNG335	Enterprise Management	3 0 0	3
HUM	23MNG336	Operations Research	3 0 0	3
HUM	23MEE321	Industrial Engineering	3 0 0	3
HUM	23MEE322	Managerial Statistics	3 0 0	3
HUM	23MEE323	Total Quality Management	3 0 0	3
HUM	23MEE324	Lean Manufacturing	3 0 0	3
HUM	23CSE321	Software Project Management	3 0 0	3
HUM	23CSE322	Financial Engineering	3 0 0	3
HUM	23CSE323	Engineering Economic Analysis	3 0 0	3
HUM	23CSE324	Information Systems	3 0 0	3

FREE ELECTIVES

FREE ELECTIVES OFFERED UNDER HUMANITIES / SOCIAL SCIENCE STREAMS

Cat.	Course Code	Title	L T P	Credit
HUM	23CUL230	Achieving Excellence in Life - An Indian Perspective	2 0 0	2
HUM	23CUL231	Excellence in Daily Life	2 0 0	2
HUM	23CUL232	Exploring Science and Technology in Ancient India	2 0 0	2
HUM	23CUL233	Yoga Psychology	2 0 0	2
HUM	23ENG230	Business Communication	1 0 3	2
HUM	23ENG231	Indian Thought through English	2 0 0	2
HUM	23ENG232	Insights into Life through English Literature	2 0 0	2
HUM	23ENG233	Technical Communication	2 0 0	2
HUM	23ENG234	Indian Short Stories in English	2 0 0	2
HUM	23FRE230	Proficiency in French Language (Lower)	2 0 0	2
HUM	23FRE231	Proficiency in French Language (Higher)	2 0 0	2
HUM	23GER230	German for Beginners I	2 0 0	2
HUM	23GER231	German for Beginners II	2 0 0	2
HUM	23GER232	Proficiency in German Language (Lower)	2 0 0	2
HUM	23GER233	Proficiency in German Language (Higher)	2 0 0	2
HUM	23HIN230	Hindi I	2 0 0	2
HUM	23HIN231	Hindi II	2 0 0	2
HUM	23HUM230	Emotional Intelligence	2 0 0	2
HUM	23HUM231	Glimpses into the Indian Mind - the Growth of Modern India	2 0 0	2
HUM	23HUM232	Glimpses of Eternal India	2 0 0	2
HUM	23HUM233	Glimpses of Indian Economy and Polity	2 0 0	2
HUM	23HUM234	Health and Lifestyle	2 0 0	2
HUM	23HUM235	Indian Classics for the Twenty-first Century	2 0 0	2
HUM	23HUM236	Introduction to India Studies	2 0 0	2
HUM	23HUM237	Introduction to Sanskrit Language and Literature	2 0 0	2
HUM	23HUM238	National Service Scheme	2 0 0	2
HUM	23HUM239	Psychology for Effective Living	2 0 0	2
HUM	23HUM240	Psychology for Engineers	2 0 0	2
HUM	23HUM241	Science and Society - An Indian Perspective	2 0 0	2
HUM	23HUM242	The Message of Bhagwat Gita	2 0 0	2
HUM	23HUM243	The Message of the Upanishads	2 0 0	2
HUM	23HUM244	Understanding Science of Food and Nutrition	2 0 0	2
HUM	23HUM245	Service Learning	2 0 0	2
HUM	23JAP230	Proficiency in Japanese Language (Lower)	2 0 0	2
HUM	23JAP231	Proficiency in Japanese Language (Higher)	2 0 0	2
HUM	23KAN230	Kannada I	2 0 0	2
HUM	23KAN231	Kannada II	2 0 0	2
HUM	23MAL230	Malayalam I	2 0 0	2
HUM	23MAL231	Malayalam II	2 0 0	2
HUM	23SAN230	Sanskrit I	2 0 0	2
HUM	23SAN231	Sanskrit II	2 0 0	2
HUM	23SWK230	Corporate Social Responsibility	2 0 0	2
HUM	23SWK231	Workplace Mental Health	2 0 0	2
HUM	23TAM230	Tamil I	2 0 0	2
HUM	23TAM231	TAMIL II	2 0 0	2

23ECE101	Nature Inspired Engineering (**Prerequisite:** Nil)	**L-T-P-C: 3-0-0-3**

Course Objectives
- To provide an understanding of nature from an engineering perspective
- To enable the study of engineering systems inspired by nature
- To motivate the development of technological ideas based on nature

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand the principles of systems in nature
CO2: Understand engineering principles that are derived from nature
CO3: Identify and ideate technological concepts inspired by nature
CO4: Apply the concepts learnt to address simple engineering problems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3						1					1			
CO2	3	2					1					1			
CO3	2	3					1					2			
CO4	2	3					1					2			

Syllabus
The course will consist of discussions of case studies, broadly classified into three groups of a minimum of 5 each:
Unit 1: Introduction – Biological inspiration; Common characteristics of natural and engineered systems; Examples - Bullet train shape / Kingfisher's beak (helping to reduce aerodynamic stress); Beehive structure (evaporative cooling and natural ventilation); Whale fin structure / Wind turbine blades (role of tubercules); Velcro tape / Hooks and loops (plants); Golden ratio in nature / Fibonacci numbers (ratio of dimensional properties)
Unit 2: Biomimetics – Mimicking nature; Examples - Gene Therapy / Immunotherapy; Dam / Beavers (structural engineering); Aerodynamics / Flight / Birds (Wings, heavier-than-air flight, Humming Bird); Earthworm / Self-Cleaning by means of small electric currents; Lizards / locomotion (inter-atomic bonding); Lizards – change in direction of hair, with no stickiness / Scotch tape; Bones / Material shaping
Unit 3: Bio-inspired Innovations; Control Theory / Feedback / Biomechanisms; Digital Electronics / Human logic; Echolocation / Dolphins / Bats (echolocation); Artificial Intelligence / Neural Networks

Textbooks:
1. Biomimicry: Innovation Inspired by Nature: Benyus J P, Mariner Books, 2002; ISBN 9780060533229.
2. The Shark's Paintbrush: Biomimicry and How Nature is Inspiring Innovation: Harman J., White Cloud Press, 2013; ISBN 978-1935952848
3. Biomimicry Innovation Inspired by Nature, Matheney B., 2023

References:
1. Engineering Education for the Next Generation – A Nature–Inspired Approach: Stier S C., W W Norton & Co., 2020; ISBN 978-0393713770
2. Biomimicry: When Nature Inspires Amazing Inventions: Menu S, Walker E & Waters A, Triangle Square Publishers, 2020; ISBN 1644210185

Other resources:
1. https://tinyurl.com/Janine-01
2. https://tinyurl.com/Pawlyn-01
3. https://tinyurl.com/Biomimicry-01
4. https://asknature.org/

SEMESTER I

23MAT124	Engineering Mathematics-I (Prerequisite: Nil)	L-T-P-C: 3-1-0-4

Course Objectives
- To strengthen the concepts of single variable calculus and linear ODEs
- To provide the fundamentals of matrix algebra
- To introduce the concepts and importance of Eigen values and Eigen vectors

Course Outcomes: At the end of the course, the student should be able to
CO1: solve problems involving limits, derivatives and ODEs
CO2: model and solve system of linear equations
CO3: characterize systems using Eigen values and vectors
CO4: apply the mathematical concepts learnt, to engineering problems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											1			
CO2	3	2										2			
CO3	3	2										1			
CO4	3	2										2			

Syllabus
Unit 1
Calculus: Limit and Continuity: Limit of Functions, Continuous functions, Discontinuities, Monotonic Functions, Infinite Limits; Derivatives, Integration- Definite Integrals, Mean value theorem for definite integrals, Fundamental Theorem of Calculus, Integration Techniques. Examples of applications of the above in solving real engineering problems.
Unit 2
Differential Equations: Ordinary differential equations (ODE), Linear differential equations, Modelling problems: Electric circuits; Second order Differential Equations, Homogeneous Systems and Non-homogeneous with constant coefficients, System of ODEs, Basic concepts and theory; Examples of applications of the above in solving real engineering problem.
Unit 3
Matrix Algebra: Review - System of linear Equations, linear independence; Properties of Matrices, Symmetric and Skew Symmetric Matrices, Hermitian and Skew Hermitian Matrices and Orthogonal matrices; Eigen values and Eigen vectors; Positive definite, negative definite and indefinite, Diagonalization and Orthogonal Diagonalization; Examples of applications of the above in solving real engineering problem.

Text Books
1. E Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Tenth Edition, 2018.
2. Srimanta Pal and Subhodh C Bhunia 'Engineering Mathematics', John Wiley and Sons, 2012, Ninth Edition.
References
1. Monty J. Strauss, Gerald J. Bradley and Karl J. Smith 'Calculus', 3rd Edition, 2002.
2. Dennis G. Zill and Michael R.Cullen, Advanced Engineering Mathematics by, second edition, CBS Publishers, 2012.

23CCE101	Problem Solving and Algorithmic Thinking (Prerequisite: Nil)	L-T-P-C: 1-0-3-2	Course Objectives • To

provide insight into computational logic
- To introduce the fundamentals of computational thinking
- To introduce computational approach to problem solving

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the concepts of computational logic
CO2: develop algorithmic thinking
CO3: identify algorithms and their suitability
CO4: apply algorithms to solve a problem

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2											3			
CO2	2											2			
CO3	2	2										2			
CO4	3	2										2			

Syllabus

What is computational thinking ? – corner stones of computational thinking – characteristics of algorithms -– problem solving strategies –computational logic–boolean expressions and logic –data organization – variables, list, arrays and strings–Algorithmic thinking – name binding, sequence, selection, repetition and modularization.

Modeling tools-state diagrams, pseudocodes and flowcharts – code tracing - problem solving with algorithms – merging, searching, sorting and recursions- brute force and greedy algorithms- Introduction to analysis of algorithms - Algorithmic complexity – linear, logarithmic and exponential –computational complexity – Introduction to Python programming.

Textbook(s)
1. Riley DD, Hunt KA. Computational Thinking for the Modern Problem Solver. CRC press; 2014 Mar 27.

References(s)
1. Ferragina P, Luccio F. Computational Thinking: First Algorithms, Then Code. Springer; 2018.
2. Beecher K. Computational Thinking: A beginner's guide to Problem-solving and Programming. BCS Learning & Development Limited; 2017.

23CCE102	Fundamentals of Electrical Engineering (Prerequisite: Nil)	L-T-P-C: 3-0-0-3	Course Objectives • To provide an

understanding of fundamental electrical quantities and their measurements
- To help in the use of analytical tools for circuit analysis
- To provide an understanding of electromagnetic machines

Course Outcomes: At the end of the course, the student should be able to
CO1: understand fundamental electrical quantities
CO2: understand the principles of electrical measurements
CO3: analyse ac and dc circuits
CO4: understand the operation of electromagnetic machines

CO-PO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO															
CO1	3														
CO2	3	2								2					
CO3	3	3								2					
CO4	3														

Syllabus
Unit 1
Introduction: ac, dc, Voltage, Current and Power, Current and Voltage sources, Dependent and Independent; Resistance, Inductance (self & Mutual), Capacitance, Series and parallel combination of R, L, C components, Wheatstone's bridge. Power and Energy - Alternating voltage and current, Amplitude, phase, Average and RMS values of waveforms. Complex power, Power factor for purely resistive, RL, RC and RLC circuits.

Unit 2
ac and dc circuit Analysis – Ohm's law, Kirchhoff's voltage and Current law, Voltage divider and Current divider Rule, Mesh and Nodal Analysis, Supernode and Supermesh analysis, Source transformation, Superposition Theorem, Thevenin & Norton's Theorems, and Maximum power transfer theorem.

Unit 3
Electrical Machines – Construction, Principle of operation and applications, DC generator and DC Motors. Significance of back EMF and EMF equation. Types of DC motors, Speed, Torque, Torque-Speed characteristics, Load characteristics, Construction and working principles of three phase induction motor and single phase transformer.

Textbook(s)
1. Charles K,Alexander, Mattew N.O.Saidiku, Fundamentals of Electrical Circuits by Tata McGraw Hill company
2. D.P. Kothari and Nagrath "Electrical Machines", McGraw Hill 2017

References(s)
1. Vincent DelToro, "Electrical engineering Fundamentals", PHI second edition 2011
2. S. K. Bhattcharya, "Basic Electrical and Electronics Engineering", Pearson, 2012.

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SEMESTER I

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23PHY110	Physics of Semiconductors (Prerequisite: Nil)	L-T-P-C: 3-0-0-3

Course Objectives
- To provide an understanding of crystal structure
- To help appreciate the band gap nature of semiconductors
- To introduce the concepts of transport phenomena in semiconductors

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the crystal structure of semiconductors
CO2: understand semiconductors based on energy band gap
CO3: understand current flow in semiconductors
CO4: understand the behaviour of pn junctions & MOSFETs

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											1			
CO2	3											1			
CO3	3											1			
CO4	3											2			

Syllabus
Unit 1
Crystal structures - Crystal lattice, basis, unit cell and lattice parameters, crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic, NaCL; ZnS structures – crystal planes, directions and Miller indices, Imperfections in crystals.
Unit 2
Classical free electron theory - Expression for electrical conductivity, Thermal conductivity, expression - Quantum free electron theory; Tunneling – degenerate states, Fermi- Dirac statistics, Density of energy states, Energy bands in solids; Electron effective mass – concept of hole Intrinsic Semiconductors, Energy band diagram, direct and indirect band gap semiconductors; Carrier concentration in intrinsic and extrinsic semiconductors – Variation of carrier concentration with temperature,; Carrier transport in Semiconductors- Drift, mobility and diffusion, Hall effect.
Unit 3
Basic structure of PN junctions – Built-in-potential, Space Charge region, electric field across junction, Forward and reverse bias, band diagram, minority carrier distribution across junction in forward and reverse bias, boundary conditions; Basics of MOSFET – Structure of MOSFET, band diagram of MOS, Ideal MOS Capacitor, FET operation and their applications.

Textbook(s)
1. R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
2. Donald Neeman, Semiconductor physics and devices, Basic principles, McGraw-Hill International, 3rd Edition.

Reference(s)
1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Education (Indian Edition), 2019.
3. Streetman and Banerjee, Solid State Electronic Devices, PHI, 2014

SEMESTER I

23CCE103	Computer Programming (Prerequisite: Nil)	L-T-P-C: 3-0-0-3	**Course Objectives**

- To provide understanding of basic programming in C
- To provide knowledge on programming constructs
- To enable development of modular programs

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the syntax and semantics of programming
CO2: apply appropriate programming constructs
CO3: analyze programs and debug errors
CO4: develop programs to solve specific problems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2													2	
CO2	2				2									2	
CO3	2				2							2		2	
CO4	3				2							3		2	

Syllabus
Unit 1:
Introduction, structure of C program - data types, storage classes, constants, enumeration constant, keywords, variables, operators, expressions, input/output statements, assignment statement conditional statements; number system: binary, decimal, hexadecimal, conversion between number system types; Introduction to tools – IDE, compilation, linking, debugging.
Unit 2:
Control flow statements - if-else, Looping – for, while, do-while, switch case, break and continue, goto and labels; Functions – function prototype, function definition, function call, built-in functions, recursion; Arrays – declaration, initialization, one-dimensional, matrix, multi-dimensional, array operations; string operations – length, compare, concatenate, copy. Recursion – recursive definition, recursive solution, designing recursive functions, limitations of recursion.
Unit 3:
Pointers – pointer operators, pointer arithmetic, array and pointers, array of pointers, parameters passing – pass by value, pass by reference; Structures – simple structure, nested structure, pointers and structure, array of structures, self-referential structures, dynamic memory allocation, typedef; Input-output – command line arguments; File operations – types, sequential access, random access.

Textbook(s)
1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
3. Forouzan BA, Gilberg RF. Computer Science: A structured programming approach using C. Third Edition, Cengage Learning; 2006.

References(s)
1. Byron Gottfried. Programming With C. Fourth Edition, McGrawHill,; 2018.
2. Greg Perry and Dean Miller, "C Programming Absolute Beginner's Guide", Que Publishing; 3rd edition, 2013.
3. JeriHanly and Elliot Koffman. Problem Solving and Program Design in C. Fifth Edition, Addison Wesley (Pearson); 2007.
4. Eric S. Roberts. Art and Science of C. Addison Wesley; 1995.
5. Peter Van Der Linden, "Expert C Programming: Deep Secrets", Pearson Education India, 1994.

SEMESTER I

23CCE182	Computer Programming Laboratory (Prerequisite: Nil)	L-T-P-C: 0-0-3-1

Course Objectives

- To provide hands-on exposure to programming in C
- To facilitate usage of Integrated Development Environment (IDE)
- To enable develop and debug programs

Course Outcomes: At the end of the course, the student should be able to
CO1: write and execute simple programs
CO2: employ IDE for compiling and debugging
CO3: handle dynamic input-output operations
CO4: develop programs for specific applications

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				3				3	3				2	
CO2	2				3				3	3				2	
CO3	2				3				3	3				2	
CO4	3	2			3				3	3		2		2	

Syllabus
1. Practice of Simple C Programs.
2. Control statements.
3. Array concept.
4. 1D and multi-dimensional arrays.
5. Strings and sorting of strings.
6. Various types of functions and recursive functions.
7. Pointers.
8. Strings and pointers.
9. Structures.
10. File input/output and command line arguments.
11. File handling and Dynamic memory allocation.

Textbook(s)
1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
3. Forouzan BA, Gilberg RF. Computer Science: A structured programming approach using C. Third Edition, Cengage Learning; 2006.

References(s)
1. Byron Gottfried. Programming With C. Fourth Edition, McGrawHill,; 2018.
2. Greg Perry and Dean Miller, "C Programming Absolute Beginner's Guide", Que Publishing; 3rd edition, 2013.
3. Jeri Hanly and Elliot Koffman. Problem Solving and Program Design in C. Fifth Edition, Addison Wesley (Pearson); 2007.
4. Eric S. Roberts. Art and Science of C. Addison Wesley; 1995.
5. Peter Van Der Linden, "Expert C Programming: Deep Secrets", Pearson Education India, 1994.

SEMESTER I

23CCE181	Electrical Engineering Laboratory (**Prerequisite:** Nil)	**L-T-P-C: 0-0-3-1**	**Course Objectives** • To

provide hands-on experience of identifying electrical components and their specifications
- To help understand circuit theorems using practical circuits and measurements
- To demonstrate the principles of electrical machines

Course Outcomes: At the end of the course, the student should be able to
CO1: identify electrical components and their specifications
CO2: measure electrical quantities such as voltage and current
CO3: verify theorems for dc circuits
CO4: understand the operation of electrical machines

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3								2	2		1			
CO2	3								2	2		1			
CO3	3								2	2					
CO4	3								2	2					

Syllabus

1. Identification of electrical components and their specifications.
2. Familiarization of equipments like Multimeter, Function generator, DC Power supply and DSO, etc.
3. Verification of Kirchhoff's laws.
4. Verification of Superposition theorem
5. Verification of Thevenin and Norton theorems
6. Speed control of a D.C motor.
7. Single phase transformers – turns ratio measurement, Step down/up
8. Measurement of unknown resistance using Wheatstone's bridge.

Textbook(s)
1. Hughes, Electrical & Electronic Technology, Pearson Education India, 2010.
2. D. P. Kothari and I. J. Nagrath, Electrical Machines, Tata McGraw-Hill, 2017

Reference(s)
1. Advanced Electrical Technology by H. Cotton, Reem Publication Pvt. Ltd, 2011
2. Electrical Engineering fundamentals by Vincent Deltoro, Pearson Education India, 2015

SEMESTER I

22ADM101	Foundations of Indian Heritage	L-T-P-C: 2-0-1-2

Course Objectives
- To introduce students to the depths and richness of the Indian heritage and knowledge traditions,
- To enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields.
- To equip students with a knowledge of their country and its eternal values.

Course Outcomes: At the end of the course, the student should be able to
CO1: Increase understanding of true essence of India's cultural and spiritual heritage.
CO2: Understand the ethical and political strategic concepts to induce critical approach to various theories about India.
CO3: Realise the multidimensionality of man's interaction with nature, fellow beings and society in general.
CO4: Appreciate the socio-political and strategic innovations based on Indian knowledge systems.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				2				2							
CO2		1				1	1	3							
CO3						1	2	3							
CO4	3					3	3	3	3						

Syllabus
Unit 1
Educational Heritage of Ancient India; Life and Happiness; Impact of Colonialism and Decolonization; A timeline of Early Indian Subcontinent

Unit- 2
Pinnacle of Selflessness and ultimate freedom; Indian approach towards life; Circle of Life; Ocean of love; Indian Mahatmas.
Unit 3
Man's association with Nature; Celebrating life 24/7; Metaphors and Tropes; Become A Strategic Thinker (Games / Indic activity)
Unit 4
India: In the Views of Other Scholars and Travellers; Personality Development Through Yoga; Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness; Conversations on Compassion with Amma

Textbook
1. Foundations of Indian Heritage- In-house publication

References
1. The beautiful tree by Dharampal – Other India Press,Mapusa, 2000
2. Peasants and Monks in British India by William Pinch – University of California Press.1996
3. India, that is Bharat: Coloniality, Civilisation, Constitution by J Sai Deepak -Bloomsbury India, 2021
4. Awaken Children Dialogues with Mata Amritanandamayi, MAM Publications
5. Man, and Nature by Mata Amritanandamayi Devi , MAM Publications
6. What Becomes of the Soul After Death, Sri Swami Shivananda, Divine Life Society,1999

SEMESTER I

22AVP103	**Mastery Over Mind** (**Prerequisite:** Nil)	**L-T-P-C: 1-0-2-2**

Course Objectives
- To enhance health and wellbeing of students
- To introduce the students to the immediate and long-term benefits of MA OM meditation
- To equip every attendee to manage stressful emotions and anxiety, facilitating inner peace and harmony.
- To enhance the understanding of experiential learning based on the University's mission: "Education for Life along with Education for Living"
- To allow learners to realize and rediscover the infinite potential of one's true Being and the fulfilment of life's goals.

Course Outcomes: At the end of the course, the student should be able to
CO1: To be able to describe what meditation is and to understand its health benefits
CO2: To understand the causes of stress and how meditation improves well-being
CO3: To understand the science of meditation
CO4: To learn and practice MAOM meditation in daily life
CO5: To understand the application of meditation to improve communication and relationships
CO6: To be able to understand the power of meditation in compassion-driven action

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								1	2	2		2			
CO2			2		2				2	2		2			
CO3					2			2	2	2		2			
CO4			3		3		2	3	3	3		3			
CO5			2		2			2	2	3		3			
CO6			2					2	2	3		3			

Syllabus
Unit 1
Meditation and Understand its Benefits - A: Importance of meditation. How does meditation help to overcome obstacles in life (Pre-recorded video with Swami Shubhamritananda Puri)
        Reading 1: Why Meditate? (Swami Shubamritananda ji)
Unit 2
Causes of Stress and How Meditation Improves Well-being - A: Learn how to prepare for meditation. Understand the aids that can help in effectively practicing meditation. Understand the role of sleep, physical activity, and a balanced diet in supporting meditation. (Pre-recorded video with Dr. Ram Manohar); B: Causes of Stress. The problem of not being relaxed. Effects of stress on health. How meditation helps to relieve stress. Basics of stress management at home and the workplace. (Pre-recorded video with Prof Udhaykumar)

Reading 1: Mayo Clinic Staff (2022, April 29). Meditation: A Simple, Fast Way to Reduce Stress. Mayo Clinic. https://www.mayoclinic.org/tests-procedures/meditation/in-depth/meditation/art-20045858 (PDF provided)

Reading 2: 'Efficient Action.' Chapter 28 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit 3:

The Science of Meditation - A: A preliminary understanding of the Science of meditation. What can modern science tell us about this tradition-based method? (Pre-recorded video with Dr. Shyam Diwakar); B: How meditation helps humanity according to what we know from scientific research (Pre-recorded video with Dr. Shyam Diwakar)

Reading 1: Does Meditation Aid Brain and Mental Health (Dr Shyam Diwakar)

Reading 2: 'Science and Spirituality.' Chapter 85 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit 4:

Practicing MA OM Meditation in Daily Life - Guided Meditation Sessions following scripts provided (Level One to Level Five)

Reading 1: MA OM and White Flower Meditation: A Brief Note (Swami Atmananda Puri)

Reading 2: 'Live in the Present Moment.' Chapter 71 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit 5

Improving Communication and Relationships - How meditation and mindfulness influence interpersonal communication. The role of meditation in improving relationship quality in the family, at the university and in the workplace. (Pre-recorded video with Dr Shobhana Madhavan)

Reading 1: Seppala E (2022, June 30th) 5 Unexpected Ways Meditation Improves Relationships a Lot. Psychology Today. https://www.psychologytoday.com/intl/blog/feeling-it/202206/5-unexpected-ways-   meditation-improves-relationships-lot

Reading 2: 'Attitude.' Chapter 53 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit 6

Meditation and Compassion-driven Action - Understand how meditation can help to motivate compassion-driven action. (Pre-recorded video with Dr Shobhana Madhavan)

Reading 1: Schindler, S., & Friese, M. (2022). The relation of mindfulness and prosocial behavior: What do we (not) know?. Current Opinion in Psychology, 44, 151-156.

Reading 2: 'Sympathy and Compassion.' Chapter 100 in Amritam Gamaya (2022). Mata Amritanandamyi Mission Trust.

Textbooks / References
1. Meditation and Spiritual Life-Swami Yatiswarananda, Ramakrishna Math
2. The Complete Works of Swami Vivekananda Vol Vii by Advaita Ashram Mayavati Almora Himalayas
3. Dhyana Yoga-Holy Gita Swami Chinmayanda
4. Voice of God, Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
5. Hindu Dharma-Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
6. Mind: It's Mysteries and control-Swami Sivananda Saraswati
7. Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.
8. Books on Amma's teachings like Awaken children, From Amma's Heart etc.
9. The Science of Meditation: How to Change Your Brain, Mind and Body by Daniel Goleman and Richard. J. Davidson.
10. Allen, Cynthia (2020) The Potential Health Benefits of Meditation
11. Seppala E (2022, June 30th Unexpected Ways Meditation Improves Relationships a Lot.Psychology Today
12. Sharma, Hari (2022) Meditation: Process and Effects
13. Mayo Clinic Staff (2022, April 29). Meditation: A Simple, Fast Way to Reduce Stress.
14. Schindler, S., & Friese, M. (2022). The relation of mindfulness and prosocial behavior: Current Opinion in Psychology

SEMESTER II

23MAT130	**Engineering Mathematics –II** (**Prerequisite –** Engineering Mathematics-I)	L-T-P-C: 3-1-0-4

Course Objectives
- To introduce the concepts of multivariable calculus
- To introduce the concepts of vector space and inner products
- To provide the foundations of matrix transformations and decompositions

Course Outcomes: At the end of the course, the student should be able to
CO1: solve problems involving vector differentiation and integration
CO2: understand the concepts of vector spaces and orthonormalisation
CO3: apply matrix transformations to linear system
CO4: apply concepts of vector calculus and linear algebra to engineering problems

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											1			
CO2	3											1			
CO3	3	2										1			
CO4	3	2										2			

Syllabus
Unit 1
Vector Spaces - Vector spaces, subspaces, linear independence, basis, row, column and null spaces and dimension theorem. Inner product space, orthogonally, Gram-Schmidt orthogonalization. Linear Transformation (matrix transformation) and inverse linear transformation; Matrix Decompositions: LU, QR, Jordan, EVD, and SVD decompositions. Examples of applications of the above in solving real engineering problems.
Unit 2
Vector Differentiation- Vector and Scalar Functions, Derivatives, Curves, Tangents, Arc Length, Curves in Mechanics, Velocity and Acceleration, Gradient of a Scalar field, Directional derivative, Divergence of a Vector field, Curl of a Vector field. Examples of applications of the above in solving real engineering problems.
Unit 3
Vector Integration - Line Integral, Line Integrals Independent of Path. Green's Theorem in the Plane, Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke's Theorem. Examples of applications of the above in solving real engineering problems.

Text Books
1. E Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Tenth Edition, 2018.
2. Howard Anton and Chris Rorres, Elementary Linear Algebra, 11th Edition, Wiley, 2015.

Reference Books
1. Dennis G. Zill and Michael R. Cullen, Advanced Engineering Mathematics by, second edition, CBS Publishers, 2012.
2. Srimanta Pal and Subhodh C Bhunia 'Engineering Mathematics', , John Wiley and Sons, 2012, Ninth Edition.

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SEMESTER II

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23CCE111	Digital Electronics (Prerequisite: Nil)	L-T-P-C: 3-0-0-3

Course Objectives
- To provide an understanding of basic building blocks of digital circuits
- To enable the understanding of Boolean algebra and logic function optimization
- To enable design of combinational and sequential circuits

Course Outcomes: At the end of the course, the student should be able to
CO1: realise a given expression in terms of basic building blocks
CO2: minimise a given logic expression
CO3: design combinational circuits
CO4: design Sequential circuits

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2												2	

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO2	3	2												2	
CO3	3	3	2									2		2	
CO4	3	3	2									2		2	

Syllabus
Unit 1
Introduction to logic circuits - Variables and functions, inversion - Truth tables - Logic gates and Networks - Boolean algebra - Synthesis using gates - Design examples - Optimized implementation of logic functions - Karnaugh map - Strategy for minimization - Minimization of product of sums forms - Incompletely specified functions - Multiple output circuits - Tabular method for minimization.

Unit 2
Combinational circuit building blocks - Number representation and arithmetic circuits: Addition of unsigned numbers - Signed numbers - Fast adders - Multiplexers - Decoders - Encoders - Code converters - Arithmetic comparison circuits.

Unit 3
Sequential circuit building blocks - Basic latch - Gated SR latch - Gated D latch - Master slave and edge triggered - D flip-flops - T flip-flop - JK flip-flop, Registers, Asynchronous Counters, Synchronous Counters, Ring Counter and Johnson Counter, Synchronous sequential circuits - Basic design steps - State assignment problem – Design of Mealy and Moore state models.

Textbook(s)
1. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital logic with Verilog Design", Tata McGraw Hill Publishing Company Limited, Special Indian Edition, 2007.
2. R. D. Sudhakar Samuel, "Logic Design: A Simplified Approach", Sanguine Technical Publishers, Edition 1, 2006.

Reference(s)
1. M Morris Mano and Michael D Ciletti, "Digital Design with Introduction to the Verilog HDL", Pearson Education, Fifth Edition, Fifth Edition, 2015.
2. John F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 3rd Ed, 2008.
3. Donald D Givone, "Digital Principles and Design", Tata McGraw Hill Publishing Company Limited, 2003.

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SEMESTER II

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23CCE112	**Signal Processing** (**Prerequisite:** Engineering Mathematics - I)	**L-T-P-C: 3-1-0-4**	**Course Objectives** • To introduce

the concepts of Signals and Systems
- To provide the foundation of transforms
- To enable the design of digital filters

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the concepts of Signals and Systems
CO2: understand transform techniques
CO3: signals and systems using transform techniques
CO4: design simple digital filters for specific applications

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											2			2
CO2	3											2			2
CO3	3	2										2			3

Syllabus
Unit 1
Introduction to Signals- Continuous time and discrete time signals - Classification of Signals: Periodic, Aperiodic, Even, Odd, Energy and Power signals, Deterministic and Random signals, Elementary signals: unit step, unit impulse, unit ramp, sinusoidal and complex exponential signals - Basic operations on signals: Multiplication by a scalar, signal addition, linear combination, signal multiplication, time shifting, time scaling, combination of time shifting and time scaling- Introduction to Systems- Classification of Systems: Continuous time, discrete time, Invertible, non-invertible, Causal, non-causal systems, time-invariant, time-variant systems, Linear and non-linear systems, BIBO stable and unstable systems, Time Domain characterization of continuous time and discrete time LTI system-Convolution Integral-Convolution Sum.

Unit 2
Introduction to Fourier representation of Signals-Continuous time Fourier series: Dirichlet conditions, Gibbs Phenomenon, Properties of Continuous time Fourier series - Linearity, Time shifting, Frequency shifting, Time scaling, Time reversal, multiplication, Convolution and Parseval's theorem. Discrete time Fourier Series: Properties of DTFS -Linearity, Time shifting, Time scaling, Time reversal- Discrete time Fourier Transform: Properties of DTFT -Linearity, Time shifting, Frequency shifting, Time scaling, Time reversal, and Convolution property.

Unit 3
Z-Transform: Definition – ROC - Inverse Z-transforms - Unilateral Z Transform– Introduction to Filters- Types of filters- low pass, band pass, high pass, band reject- Finite Impulse Response (FIR) filters: symmetric and anti-symmetric FIR filters – design of linear phase FIR filter using Windowing method – FIR differentiators – Hilbert transformer – Introduction to IIR filters.

Textbook(s)
1. Alan V. Oppenheim, Alan S. Wilsky, S. Hamid Nawab, "Signals and Systems". Prentice Hall India private Limited, Second Edition, 1997.
2. John G Proakis, G. Manolakis, "Digital Signals Processing Principles, Algorithms, Applications", Prentice Hall India Private Limited, Fourth Edition, 2007.

References(s)
1. Simon Haykin, Barry Van Veen, "Signals and Systems", Second Edition, John Wiley and Sons, 2007.
2. Sanjit K. Mitra, "Digital Signal Processing, A computer based approach", Tata McGraw Hill Publishing Company Limited, Fourth Edition, 2010.

SEMESTER II

23CCE114	**Electronics Engineering** (**Prerequisite:** Physics of Semiconductors)	**L-T-P-C: 3-0-0-3**	**Course Objectives** • To

provide an understanding of diodes and diode-based circuits
- To provide a working knowledge of transistor-based amplifiers
- To provide an overview of opamp-based circuits

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand diode operation
CO2: Understand the operation of simple diode-based circuits
CO3: Understand the operation of transistor amplifiers
CO4: Obtain an overview of opamp-based circuits

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3														
CO2	3														
CO3	3														
CO4	3														

Syllabus
Unit 1
R, L & C circuits –RC Filters, Resonance -LC, RLC Parallel and Series. Diodes: Forward Bias, Reverse Bias, Diode Equation; VI Characteristics; Diode model (Cut-in voltage; (V_γ) & short-circuit); Simple circuits using diodes; Rectifiers- Half wave, Full wave, Bridge; Basic Clipper and Clamper circuits.

Unit 2

Bipolar Junction Transistors (BJT): Transistor construction and working principle (qualitative); Characteristics; Modes of operation, Input and output characteristics of CB, CE and CC Configurations, Biasing; Fixed bias without and with emitter resistance, collector to base bias, voltage divider bias and emitter bias; Transistor as an amplifier, switch; Amplitude Modulator and Demodulator.

Unit 3

Operational Amplifiers (opamp): Ideal opamp; Inverting & Non-inverting amplifiers; Summing Amplifier; Comparator; Astable & Monostable Multivibrators; Oscillators - concept, Phase Shift Oscillator (without loading); Phase locked loop (PLL).

Textbook(s)

1. A. P. Malvino, "Electronic Principles", 7th Edition, Tata McGraw Hill, 2007.
2. D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education (India) Private Limited, 2014.

Reference(s)

1. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
2. Michael Tooley B. A., "Electronic circuits: Fundamentals and Applications", 3rd Edition, Elsevier Limited, 2006.

23ENG101	Technical Communication (Pre-requisite-Nil)	L-T-P-C: 2-0-3-3	Course Objectives

- To develop techniques of scanning for specific information, comprehension and organization of ideas
- To introduce the fundamentals of mechanics of formal writing, documentation and presentation
- To introduce the art of critical thinking and analysis

Course Outcomes: At the end of the course, the student should be able to

CO1: apply the basic elements of language in formal correspondence by interpreting and analyzing information and to organize ideas in a logical and coherent manner

CO2: understand and summarize technical documents

CO3: understand the mechanics of writing and the elements of formal correspondence

CO4: compose project reports/documents, revise them for language accuracy and make technical presentations

CO-PO Mapping

CO-PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1									2	3		3			
CO2									2	2		3			
CO3									2	3		3			
CO4									2	2		3			

Syllabus

Unit I

Error Analysis**,** Mechanics of Writing: Grammar rules -articles, tenses, auxiliary verbs (primary & modal) prepositions, subject-verb agreement, pronoun-antecedent agreement, discourse markers and sentence linkers, impersonal passive, modifiers, phrasal verbs, General Reading and Listening comprehension - rearrangement & organization of sentences

Unit II

Different kinds of written documents: Definitions- Descriptions- Instructions-Recommendations- User manuals - Reports – Proposals; Formal Correspondence: Writing Formal Letters/Emails; Punctuation; Scientific Reading & Listening Comprehension

Unit III

Technical paper writing: Documentation style - Document editing – Proof reading - Organizing and Formatting; Tone and style; Graphical representation; Reading and listening comprehension of technical documents; Mini Technical project / Term paper (10 - 12 pages); Technical presentations

Reference(s)

1. Hirsh, Herbert. L Essential Communication Strategies for Scientists, Engineers and Technology Professionals. II Edition. New York: IEEE press, 2002

2. Anderson, Paul. V. Technical Communication: A Reader-Centred Approach. V Edition. Harcourt Brace College Publication, 2003
3. Strunk, William Jr. and White. EB. The Elements of Style New York. Alliyan & Bacon, 1999.
4. Riordan, G. Daniel and Pauley E. Steven. Technical Report Writing Today VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.
5. Michael Swan. Practical English Usage Oxford University Press, 2000

SEMESTER II

23CCE183	Signal Processing Laboratory (Prerequisite: Nil)	L-T-P-C: 0-0-3-1

Course Objectives

- To provide a hands-on exposure to signal generation and manipulation
- To enable carry out spectral analysis
- To enable design and apply digital filters for simple applications

Course Outcomes: At the end of the course, the student should be able to
CO1: generate, manipulate and visualize signals
CO2: characterize and analyze LTI systems
CO3: analyze signals and systems through transforms
CO4: design and apply digital filters for specific applications

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				3	3		3		2	3
CO2	3	2			3				3	3		3		2	3
CO3	3	2			3				3	3		3		2	3
CO4	3	2	2		3				3	3		2		2	3

Syllabus
- Generation of Signals
- Basic Operations on Signals
- Properties of Systems
- Convolution
- Sampling of analog signals and study of aliasing
- DTFT
- Computation of DFT using direct /linear transformation method
- Properties of DFT
- Design of FIR filter using different windowing techniques
- Applications of DSP- denoising of sine wave and speech signals

Textbook(s)
1. Li Tan, Jean Jiang , Digital Signal Processing: Fundamentals and Applications, 3rd edition, Academic Press, 2019
2. Sanjit K. Mitra, "Digital Signal Processing, A computer based approach", Tata McGraw Hill Publishing Company Limited, Fourth Edition, 2010.
1. Tarun Kumar Rawat, "Digital Signal Processing", Oxford University Press, 2015.
2. Vinay K. Ingle, John G. Proakis, "Digital Signal Processing Using MATLAB" Third Edition, Cengage Learning, 2012.

SEMESTER II

23CCE184	Internet of Things Lab (Prerequisite: Nil)	L-T-P-C: 0-0-3-1

Course Objectives
- To introduce

hardware platforms for interfacing sensors and actuators
- To introduce mobile application development for IoT
- To help build and prototype IoT based systems

Course Outcomes: At the end of the course, the student should be able to
CO1: interface sensors and actuators to hardware platforms
CO2: transfer data and control remote devices
CO3: develop mobile application for IoT
CO4: build and demonstrate IoT based systems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2				3				3	3				2	
CO2	2				3				3	3				2	
CO3	3				3				3	3		2		2	
CO4	3	2			3				3	3		2		2	

Syllabus
1. GPIO and ADC Programming – LED – Switch – Relay - Proximity Sensor - Seven Segment
2. ADC Programming - Potentiometer - Temperature Sensor – Moisture Sensor - Gas Sensor
3. LCD and Keypad Interfacing
4. Serial Communication – Bluetooth - GPS.
5. SPI and I2C Programming – RFID - RTC
6. Speed and Direction Control of Motors – DC – Stepper/Servo
7. WebServer and IoT Cloud Communication – ESP8266, Thingspeak
8. Basic Mobile Application Development – MIT App Inventor 2
9. Remote Device Control Android App Development - MIT App Inventor 2

Textbook(s)
1. M. Margolis, B. Jepson, N. R. Weldin, "*Arduino Cookbook: Recipes to Begin, Expand and Enhance Your Projects*", Third Edition, Oreilly, 2020
2. N. Cameron, "*Electronics Projects with the ESP8266 and ESP32: Building Webpages, Applications and Wifi Enabled Devices*", Apress, 2021
3. F. Kamriani, K. Roy "*App Inventor 2 Essentials*", Packt Publishing, 2016

References(s)
1. D. Wolber, H. Abelson, E. Spertus, L. Looney, "*App Inventor 2 Create Your Own Android Apps*", Second Edition, Oreilly, 2018
2. M. Schwartz, "*Esp8266 Internet of Things Cookbook*", Packt Publishing, 2017

SEMESTER II

23CCE185	Digital Electronics Laboratory (Prerequisite: Nil)	L-T-P-C: 0-0-3-1

Course Objectives
- To provide hands-on experience in realising simple logic expressions
- To demonstrate the power of logic function optimization
- To enable the implementation of combinational and sequential circuits

Course Outcomes: At the end of the course, the student should be able to
CO1: use datasheets & simulation tools effectively
CO2: realise simple logic circuits
CO3: design & implement combinational circuits
CO4: design & implement sequential circuits

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				2	2		2		2	
CO2	3								2	2				2	

CO3	3	3	2					2	2		2		2		
CO4	3	3	2					2	2		2		2		

Syllabus
1. Logic Gates: Implement logic gates using NAND / NOR.
2. Boolean functions: using logic gates
3. Combinational circuits: Mux, De-Mux, Code Converters, Adders & Subtractors
4. Sequential Circuits: Flip-Flops, Counters, State Machines

Experiments
    1. Verification of Basic Logic Gates.
    2. Realization of Basic Gates using Universal Logic Gates.
    3. Simplification and Realization of a given Boolean Expression
          i) Using basic gates
          ii) SOP Using NAND gates only
          iii) SOP Using NOR gates only
          iv) POS Using NAND gates only
          v) POS Using NOR gates only and
          vi) Compare and analyze the above implementations
    4. Design and verification of Adders and Subtractors.
    5. Design and verification of Parallel Adder / Subtractor.
    6. Design and verification of Binary to Gray code converter and vice versa.
    7. Design and verification of BCD to Excess-3 code converter and vice versa.
    8. Design and verification of 2-bit Magnitude Comparator.
    9. Design and verification of Multiplexers
    10. Implementation and verification of Half adder, full adder, half subtractor and full subtractor using multiplexers.
    11. Design and verification of Flip-flops (D, T and JK flipflop).
    12. Design and verification of shift Registers.
    13. Design and verification of Ring and Johnson Counters.
    14. Design and verification of 4-bit asynchronous Up and Down Counters

Textbook(s)
1. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital logic with Verilog Design", Tata McGraw Hill Publishing Company Limited, Special Indian Edition, 2007.

References(s)
1. John F. Wakerly, "Digital Design Principles and Practices", Pearson Education, Fourth Edition, 2008.
2. K A Navas, "Electronic Lab Manual" – Volume 1, Fifth Edition, Prentice Hall of India, 2015.
3. M Morris Mano and Michael D Ciletti, "Digital Design with Introduction to the Verilog HDL", Pearson Education, Fifth Edition, Fifth Edition, 2015

SEMESTER II

22ADM111	Glimpses of Glorious India (**Prerequisite:** Nil)	L-T-P-C: 2-0-1-2

Course Objectives
- To introduce the sources of Indian thoughts
- To introduce eminent Indian personalities who shaped various disciplines
- To introduce India's significant contribution to mankind
- To introduce the current stature of India in geopolitics
- To introduce the Indian approach to science and ecology.

Course Outcomes: At the end of the course, the student should be able to
    CO1: To recognise the call of Upanishads and outstanding personalities for confronting the wicked in the real world while admiring the valour, pursuit and divinity in both classical and historical female characters of India.
    CO2: Know Acharya Chanakya, his works, and his views on polity and nation to find synchrony between public and personal life, alongside understanding India's cultural nuances and uniqueness concerning the comprehension of God across major global communities.
    CO3: Appreciate Bhagavad Gita as the source of the Indian worldview through the various Yogic lessons enshrined in it, making it one of India's numerous soft powers, and also understand the faith-oriented mechanism of preserving nature.
    CO4: Understand the enormous contribution of Indian civilisation over two and a half millennia to humanity and develop awareness about India's approach toward science, devoid of dogmas and rooted in humanism.

CO-PO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO															
CO1			1	2			2								
CO2	2	1				1	3								
CO3	2		1	2	1	1	3								
CO4	2			3			3								

Syllabus
Unit 1
Face the Brutes; Role of Women in India; Acharya Chanakya; God and Iswara
Unit 2
Bhagavad Gita: From Soldier to Samsarin to Sadhaka; Lessons of Yoga from Bhagavad Gita; Indian Soft powers; Preserving Nature through Faith
Unit 3
Ancient Indian Cultures (Class Activity); Practical Vedanta; To the World from India; Indian Approach to Science

Text Book:
  1. Glimpses of Glorious India **-** (In-house publication)

References:
  1. Fear Not: Be Strong (Swami Tathagatananda)
  2. Essays on Gita (Sri Aurobindo) - Aurobindo Ashram
  3. Indian Contribution to Science (Vijana Bharati Publication)
  4. The Culture And Civilisation Of Ancient India In Historical Outline (D. D. Kosambi)
  5. The Kautilya Arthashastra by Chankaya – Translation with critical and explanatory note by R P Kangle – Motilal Banarasidass Publishers- 1972
  6. Chanakya Neeti – Strategies for success – Radhakrishnan Pillai – Jaico Publishing house - 2020.
  7. Universal Message of the Bhagavad Gita: An exposition of the Gita in the Light of Modern Thought and Modern Needs. - Swami Ranganathananda, Advaita Ashrama Belur Math, 2000.
  8. A Concise History Of Science In India – D M Bose, S N Sen, B V Subbarayappa, The Indian National Science Academy 1971.
  9. Indian Culture and India's Future – Michel Danino - D.K. Printworld (P) Ltd -2011.

SEMESTER III

22ADM211	Leadership from Ramayana (Prerequisite: Nil)	L-T-P-C: 1-0-0-1

Course Objectives
  • To gain a deeper understanding of the ethical grandeur of Indian culture, through a study of the Rāmāyaṇa
  • To be inspired to follow the ideals of the characters depicted therein.

Course Outcomes: At the end of the course, the student should be able to
  CO1: Appreciate the significance of Rāmāyaṇa as an itihāsa, and important aspects of Bālakāṇḍa.
  CO2: Understand the family values and ideal human relationships portrayed in the Ayodhyakāṇḍa and Aranyakāṇḍa of Rāmāyaṇa.
  CO3: Understand dharma and its nuances, emphasizing its applicability in an individual's life through Kishkindhakāṇḍa and Sundarakāṇḍa of Ramayana.
  CO4: Appreciate the triumph of dharma over adharma through Yuddhakāṇḍa of Rāmāyaṇa
  CO5: Appreciate the spiritual values from Rāmāyaṇa in resolving personal and social conflicts through varied effective presentations of important episodes of the Rāmāyaṇa.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2	2	3	3	3		3			
CO2						3	3	3	3	2		3			
CO3						3	2	3	3	3		3			
CO4						3	-	3	3	3		3			
						3	-	3	3	2		3			

Syllabus

Unit 1
An overview of Valmiki's epic - Introdcution to the content and structure of the epic text and it's principal characters; Bala-Kāṇḍa: Preparing for the renowned mission.
Unit 2
Ayodhya-Kāṇḍa: Harbinger of an Entire Tradition of Nobleness.; Araṇya-Kāṇḍa: Tale of the forest life.
Unit 3
Kishkindha-Kāṇḍa: The Empire of Holy Monkeys; Sundara-Kāṇḍa: Heart of the Ramayana
Unit 4
Yuddha-Kāṇḍa:The most popular part of the Ramayana; Uttara-Kāṇḍa: An attempt to explain the untold stories.
Unit 5
Ramayana and Modern-day learning; Ecological Awareness in the Ramayana; Different Ramayana: Epic that connects the world.

Textbook / References
1. Leadership Lessons from the Ramayana, ASCSS
2. Rajagopalachari. C, The Ramayana
3. Valmiki, The Ramayana, Gita Press

SEMESTER III

23CHY109	Engineering Chemistry B (Prerequisite: Nil)	L-T-P-C: 2-1-0-3

Course Objective:
- To impart knowledge on the concepts of chemistry involved in the application of engineering materials that are used in the industry/day-to day life.

Course Outcomes: At the end of the course, the student should be able to
CO1: Characterize the solids using X-ray diffraction technique
CO2: Analyse the materials using computational tools.
CO3: Apply the fundamental principles of electrochemistry to illustrate the functioning of electrochemical energy systems.
CO4: understand the application of polymers in fabricating integrated electronic devices.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											1			
CO2	3											1			
CO3	3											1			
CO4	3											2			

Syllabus
Unit 1
Recap of fundamentals of crystalline structures – unit cell, lattice parameters, Bravais lattices and types of crystals; X-ray diffraction - Bragg's equation and experimental methods (powder method and rotating crystal technique); Elements of symmetry in crystal systems, defects in crystals – stoichiometric, non-stoichiometric, extrinsic and intrinsic defects. Vesta – for visualization of crystal structures.
Solar energy - introduction, utilization and conversion, photovoltaic cells - design, construction and working, panels and arrays. Advantages and disadvantages of PV cells. DSSC (elementary treatment).
Unit 2
Faradays laws, origin of potential, electrochemical series, reference electrodes, Nernst equation, introduction to batteries - classification - primary, secondary and reserve (thermal) batteries. Kinetics of electrochemical reaction – Tafel equations. Characteristics - cell potential, current, capacity and storage density, energy efficiency. Construction, working and application of Leclanche cell-Duracell, lead acid batteries. Ni-Cd battery, Lithium ion batteries. Fuel cell - construction and working of PEMFC and biofuel cell.

Unit 3

Conducting polymers: Conducting mechanisms - Electron transport and bipolar polymers. Photoconductive polymers: Charge carriers, charge injectors, charge transport, charge trapping. Liquid crystalline polymers: Fundamentals and process, liquid crystalline displays –applications. Polymers for light emitting diodes – introduction, polymer structures, Organic LEDs-their functioning-advantages and disadvantages over conventional LEDs – their commercial uses. Piezoelectric materials – working principle and applications.

Textbooks / References:
1. Chemistry: A Molecular Approach, 4th Edition Nivaldo J. Tro, Santa Barbara City College
2. Patrick M. Woodward, Pavel Karen, John S. O. Evans, Solid State Materials Chemistry, Cambridge University Press, 2021
3. Vladimir S. Bagotsky, Alexander M. Skundin, Yurij M. Volfkovich, Electrochemical Power Sources
4. Batteries, Fuel Cells, and Supercapacitors, John Wiley and Sons, 2015.
5. Bansi D. Malhotra, Handbook of Polymers in Electronics, Rapra Technology Limited, 2002
6. Ye Zhou, Guanglong Ding, Polymer Nanocomposite Materials: Applications in Integrated Electronic Devices, Wiley-VCH, 2021.
7. Jain and Jain, "Engineering Chemistry", Dhanpat Rai Publishing company, 2015.

SEMESTER III

| 23CCE201 | Data Structures | L-T-P-C: 3-0-0-3 | **Course Objectives** • To provide an |

understanding of data structures
- • To enable implementation of data structures
- • To enable application of data structures in standard algorithms for computational problems

Course Outcomes: At the end of the course, the student should be able to

CO1: understand elementary data structures
CO2: implement data structures
CO3: select appropriate data structures for computational problems
CO4: apply simple algorithms using data structures for specific applications

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											3	3	2	2
CO2	3											2	3	2	2
CO3	3	2										3	3	2	2
CO4	3	2	2									3	3	2	2

Syllabus
Unit 1
Introduction – fundamental data structures . Arrays – operations - Lists: list ADT – doubly linked list – circular list - implementation – Stacks – Queues - Skip list – implementation through Array and List. Dictionaries: Sets – Dictionaries – Hash tables – Hashing functions. Applications.
Unit 2
Binary trees: Traversals – binary search trees – implementation - operations - splay trees – application to Huffman coding . Balanced Trees: AVL Trees – Red-Black Trees – '2-3' Trees – B-Trees – operations. Applications.
Unit 3
Directed Graphs: Representation - Shortest path problem – Dijkstra's algorithm – Dynamic programming - Floyd's algorithm – Warshall's algorithm – Directed Acrylic graphs. Undirected graphs - Depth and breadth first search - Minimum spanning trees – Prim's – Kruskal's algorithm.

Textbook(s)
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2009.

Reference(s)
1. Robert Sedgewick and Kevin Wayne, "Algorithms", Addison-Wesley Professional; 4th edition, 2011.
2. Narasimha Karumanchi , "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Career Monk Publications; 5th ed. Edition, 2016.

3. Peter Brass, "Advanced Data Structures", Cambridge University Press, Illustrated Edition, 2008.

23CCE202	Microcontrollers and Interfacing (Prerequisite: Digital Electronics)	L-T-P-C: 3-0-0-3

Course Objectives
- To provide understanding of Microcontrollers and its Applications
- To enable the understanding of Microcontroller Peripherals and their configuration
- To provide insight on the design of a simple Embedded System for specific Applications

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the fundamentals of Microcontroller and its Peripherals
CO2: configure the Internal Peripherals of a Microcontroller
CO3: interface External Peripherals with an Embedded Platform
CO4: design a Microcontroller based System for real world applications

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											2		2	
CO2	3	2	2									2		2	
CO3	3	2	2									2		3	
CO4	3	3	3									2		3	

Syllabus
Unit 1
Introduction to Embedded Systems - Introduction to ARM Architecture - ARM Programmer's Model - ARM Processor Modes and States - Addressing Modes - ARM Instruction Set - Types - Data Processing Instructions - Assembly Language Programming - Binary Encoding of Data Processing Instructions - Data Transfer Instructions - Binary Encoding of Data Transfer Instructions
Unit 2
Pipeline in Processor - Pipeline Hazards - ARM 3 Stage Pipeline - LPC2148 Microcontroller Architecture – GPIO - PLL - Introduction to serial communication - Serial Transmission and Reception using UART
Unit 3
ADC - DAC - External Interrupt - Timer - PWM - Seven Segment - Relay - DC Motor - Stepper Motor - LCD - Keypad -Temperature Controller - DC Motor Speed Control - Remote Device Control

Textbook(s)
1. S. Furber, "*ARM system On Chip Architecture*", Second Edition, Pearson, 2015.
2. LPC2148 User manual, NXP Semiconductors, https://www.nxp.com/docs/en/user-guide/UM10139.pdf

References(s)
1. T. Noergaard, "*Embedded Systems Architecture A Comprehensive Guide for Engineers and Programmers*", Newnes, 2013
2. A. Sloss, D. Symes, C. Wright, "*ARM System Developer's Guide: Designing and Optimizing System Software*", First Edition, Elsevier, 2004.

23CCE203	Operating Systems (Prerequisite: Nil)	L-T-P-C: 3-0-0-3

Course Objectives

- To introduce the fundamentals of Operating Systems
- To introduce the concepts of Threading and Scheduling
- To provide the foundations of Operating System's Management Process

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the functionalities and structure of Operating Systems
CO2: understand Threading Processes and Scheduling Algorithms
CO3: understand the operation of Synchronization and Semaphores
CO4: understand various Management concepts of Operating Systems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											3		3	
CO2	3											2		3	
CO3	3											2		3	
CO4	3											2		3	

Syllabus

Unit I

Introduction to Operating systems Services: Overview, Types, Operations, Hardware, Software – hardware protection – operating systems services – system calls - Process and Processor management: Process concepts – process scheduling – operations on process – Threads – multi threading – threading issues – CPU scheduling – scheduling algorithms.

Unit 2

Process synchronization: critical section problem – synchronization hardware – semaphores – classical problems of synchronization – critical regions – monitors – deadlocks – deadlock characterization – methods of handling deadlocks – deadlock prevention – avoidance – detection and recovery. Memory management – swapping – contiguous memory allocation. Paging and segmentation – segmentation with paging – virtual memory – demand paging – process creation – page replacement – thrashing.

Unit 3

Disk scheduling algorithms and policies - File management: file concept - types and structures - directory structure – directory implementation – disk scheduling - Case study: threading concepts in operating systems - kernel structures.

Textbook(s)

1. Silberschatz A, Gagne G, Galvin PB. Operating system concepts. Tenth Edition, John Wiley and Sons; 2018.

References(s)

1. Deitel HM, Deitel PJ, Choffnes DR. Operating systems. Third Edition, Prentice Hall; 2004.
2. Tannenbaum AS. Modern Operating Systems. Fourth Edition, Prentice Hall; 2016.
3. Stevens WR, Rago SA. Advanced programming in the UNIX environment. Second Edition, Addison-Wesley; 2008.
4. Nutt G. Operating systems. Third Edition, Addison Wesley; 2009.

SEMESTER III

23CCE204	Foundations of Data Science (Prerequisite: Engg Mathematics - II)	L-T-P-C: 3-1-0-4

Course Objectives

- To introduce the statistical concepts necessary for exploratory data analysis
- To provide the foundations of data pre-processing, interpretation & visualization
- To introduce the concepts of statistical testing

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand descriptive statistics and data distributions
CO2: Apply pre-processing techniques
CO3: Interpret and visualise data
CO4: Apply statistical tests

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										3			
CO2	3	2										2			
CO3	3	2										3			
CO4	3	2										2			

Syllabus
Unit 1:
Importance of Probability for Data Science, Axioms of Probability, Conditional Probability and Bayes theorem, Random Variables: Discrete- Uniform and Binomial Distribution, Continuous- Normal Distribution, Exponential and Poisson Distribution, Types of Data, Central Tendency Measures, Dispersion Measures, Skewness and Mean, Covariance and Correlation, Central limit theorem.
Unit 2:
Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration, Encoding techniques- Ordinal, One hot and Binary, Data Reduction-PCA, Data Transformation and Discretization, Exploratory data analysis: Visualization Before Analysis, visualizing a Single Variable, Examining Multivariate Data- Heat map.
Unit 3:
Introduction to Hypothesis Testing-Null and alternative hypothesis, Type of Errors, A/B testing, Parametric test: the T-test, Z-test, non-parametric tests- Chi-square tests, P Value, Confidence Intervals, Parametric Confidence Intervals, Bootstrap Confidence Intervals

Textbook(s)
1. Carlos Fernandez-Granda, "Probability and Statistics for Data Science", 2017.
2. Cathy O'Neil and Rachel Schutt, "Doing Data Science", Straight Talk from The Frontline, O'Reilly, 2014.
3. Statistical Methods for Data Science, Elizabeth Purdom, 2023.

References(s)
1. Joel Grus, "Data Science from Scratch" First Edition, April 2015
2. Chirag Shah, "A Hands-On Introduction to Data Science, Cambridge University Press.
3. Data mining methods, 2nd edition, C. Rajan, Narosa (2016).
4. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, "Mining of Massive Datasets. v2.1", Cambridge University Press. 2nd edition, 2014.

SEMESTER III

23MAT210	**Numerical Methods** **(Prerequisite: Engineering Mathematics II)**	**L-T-P-C: 3-1-0-4**

Course Objectives
- To provide foundations of modern numerical techniques
- To introduce the mathematical formulation, discretization and iterative solutions
- To introduce the applications of numerical methods to communication engineering

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand the foundations of numerical techniques
CO2: Perform discretization of differential equations
CO3: Apply iterative techniques to solve problems
CO4: Develop mathematical models for specific problems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

											2	3		
CO1	3										2	3		
CO2	3	2									2	3		
CO3	3	2									2	3		
CO4	3	2									2	3		

Syllabus
Unit 1
Introduction – mathematical preliminaries – Models – Eigen value problem – Fourier analysis – Eigen value expansions. Numerical differentiation: Taylor series - Two-point - three-point. Numerical integration – Lagrange – Trapezoidal Simpsons. Initial value problems – Runge-Gutta type. Properties of numerical methods.
Unit 2
Weighted residuals method: Finite Volume – Galerkin method for first / second order – Finite Volume for second order. Initial boundary value problems: Finite Difference approximation – Algebric system for FDM – solution of linear algebraic systems – Krylov Subspace methods. Applications in Electromagnetics.
Unit 3
Finite Element Methods in Elliptical equations: FEM in 1D space – Hilbert spaces- FEM for Poisson equations. Domain Decomposition Methods: Overlapping Schwarz Alternating Methods – non-overlapping DDM – iterative DDM. Introduction to Mesh Free methods and Multigrids. Case studies.

Textbook(s)
1. George F. Pinder, "Numerical Methods for Solving Partial Differential Equations : A Comprehensive Introduction for Scientists and Engineers", John Wiley and Sons, Inc. 1st Edition, 2018.

References(s)
1. S. Seongjai Kim, "Numerical Methods for Partial Differential Equations", Lectures Notes, Mississippi State University, 2021
2. K.W.Mortan. and D.F.Mayers, "Numerical Solutions of Partial Differential Equations: An Introduction", Cambride University Press, 2012.
3. R. Levecque, *"Numerical Methods for Conservation Laws"*, Lectures in Mathematics, 1992.

SEMESTER III

23CCE281	**Microcontrollers and Interfacing Lab** **(Prerequisite: Digital Electronics)**	**L-T-P-C: 0-0-3-1**

Course Objectives
- To provide hands-on experience of a Microcontroller and its Peripherals
- To provide experience in the interfacing of External Peripherals with a Microcontroller
- To enable the design and implementation of simple Embedded Systems

Course Outcomes: At the end of the course, the student should be able to
  CO1: program in Assembly Language and Embedded C
  CO2: configure the Internal Peripherals of a Microcontroller
  CO3: interface External Peripherals with a Microcontroller
  CO4: prototype a Microcontroller based System

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				3	3		2		3	
CO2	3	2			3				3	3		2		3	
CO3	3	2			3				3	3		2		3	
CO4	3	3	3		3				3	3		2		3	

Syllabus
1. Assembly Language Programs for Addition, Subtraction, Indirect Addressing Modes
2. LED Blinking and Control of LED with Switch using GPIO Peripheral in LPC2148
3. Serial Transmission and Reception using UART
4. Sensor Interfacing using ADC
5. Square Wave Generation using Timer
6. DC Motor Speed Control using PWM
7. LCD Interfacing
8. Term Project

Textbook(s)
1. LPC2148 User manual, NXP Semiconductors, https://www.nxp.com/docs/en/user-guide/UM10139.pdf

References(s)
1. A. Sloss, D. Symes, C. Wright, "ARM System Developer's Guide: Designing and Optimizing System Software", First Edition, Elsevier, 2004.

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SEMESTER III

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23CCE282	**Data Structures Lab** **(Prerequisite: Nil)**	**L-T-P-C: 0-0-3-1**

Course Objectives
- To provide hands-on experience in implementing data structures
- To introduce implementation of simple algorithms
- To enable apply data structures to specific problems

Course Outcomes: At the end of the course, the student should be able to
CO1: implement data structures
CO2: compare complexity of data structures
CO3: implement simple algorithms
CO4: apply appropriate data structures to specific problem

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				3	3		2	2	2	
CO2	3	3			3				3	3		3	2	2	
CO3	3	3			3				3	3		2	2		
CO4	3	3	3		3				3	3		3	2	2	

Syllabus
1. Implement stacks, queues and binary trees using arrays and linked list
2. Implement hash tables and hashing functions to recover the entries.
3. Construct and traverse a binary / binary search tree
4. Check whether a given tree is binary search tree or AVL tree
5. Construct and carry out operations on red-black trees / 2-3 trees / splay trees.
6. Convert a given BST to an AVL tree and vice-versa
7. For a given graph, determine the shortest path – single source / destination / entire network

8. Perform breadth and depth first search on a given graph structure – use coloring.
9. Determine the minimum spanning tree for a given graph

Textbook(s)
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2009.

References(s)
1. Robert Sedgewick and Kevin Wayne, "Algorithms", Addison-Wesley Professional; 4th edition, 2011.
2. Narasimha Karumanchi , "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", Career Monk Publications; 5th ed. Edition, 2016.
3. Peter Brass, "Advanced Data Structures", Cambridge University Press, Illustrated Edition, 2008.

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SEMESTER III

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23CCE283	Operating Systems Laboratory (Prerequisite: Nil)	L-T-P-C: 0-0-3-1

Course Objectives
- To provide hands-on experience on the concepts of Processes and Threads
- To provide experience on Synchronization and Scheduling Algorithms
- To enable the understanding of Resource Management

Course Outcomes: At the end of the course, the student should be able to
CO1: use basic commands to control different Threads and Processes
CO2: carry out performance analysis of different Scheduling Algorithms
CO3: synchronize various Operating System Processes
CO4: effectively manage Operating System Resources

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2				2	2		2		2	
CO2	3	2			2				2	2		2		2	
CO3	3				2				2	2				2	
CO4	3	2			2				2	2				2	

Syllabus
1. Basics of Commands
2. Introduction to Shell Programming
3. System calls implementations using Scripts
4. Knowing to build multi-threaded and multi-process applications and performance analysis
5. Scheduling of different tasks
6. Performance analysis of different scheduling algorithms
7. Implementation of Semaphores, shared memories
8. Implementation of synchronization applications
9. Deadlock and its avoidance
10. Memory Allocation Methods for fixed partition
11. Implementation of Paging Techniques and replacement
12. Implementation of the various File Organization Techniques (Single level directory, two level, Hierarchical, DAG)
13. File Allocation Strategies (eg: Sequential, Indexed, Linked)

Textbook(s)
1. Silberschatz A, Gagne G, Galvin PB. Operating system concepts. Tenth Edition, John Wiley and Sons; 2018.
References(s)
1. Garry. J. Nutt, Operating Systems: A Modern Perspective, Third Edition, AddisonWesley; 2012
2. Andrew S. Tanenbaum and Herbert Bros, Modern Operating Systems, Fourth Edition, Pearson; 2015
3. Russ Cox, Frans Kaashoek, Robert Morris, xv6: a simple, Unix-like teaching operating system; 2020 Sumitabha Das, UNIX Concepts *and Applications, Fourth Edition, Tata McGraw-Hill Education; 2017*

23ENV300	Environmental Science (**Pre-requisite:** Nil)	**P / F**

Course

Objectives

- To study the nature and facts about environment.
- To appreciate the importance of environment by assessing its impact on the human world.
- To study the integrated themes and biodiversity, pollution control and waste management.

Course Outcomes: At the end of the course, the student should be able to

CO1: understand aspects of nature and environment
CO2: analyze impact of environment on human world
CO3: to comprehend pollution control and waste management

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						3	2	3							
CO2						3	2	3							
CO3						3	2	3							

Syllabus

Unit I
Introduction- Overview of the global environment crisis; Biogeochemical cycles; Climate change and related international conventions & treaties and regulations. Ozone hole and related International conventions & treaties and regulations; Over population; Energy crisis; Water crisis; Ground water hydrogeology; Surface water resource development.

Unit II
Ecology, biodiversity loss and related international conventions– treaties and regulations. Deforestation and land degradation; Food crisis; Water pollution and related International and local conventions – treaties and regulations. Sewage - domestic and industrial; Effluent treatment; Air pollution and related international and local conventions, treaties and regulations. Other pollution (land, thermal, noise).

Unit III
Solid waste management (municipal, medical, e-waste, nuclear, household hazardous wastes). Environmental management, Environmental accounting, Green business, Eco-labelling, Environmental Impact Assessment. Constitutional-legal and regulatory provisions; Sustainable development.

Textbook(s)
1. R. Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005, ISBN 0-19-567393-X.

Reference(s)
1. G.T. Miller Jr., "Environmental Science", 11th Edition, Cenage Learning Pvt. Ltd., 2008.

2. Benny Joseph, "Environmental Studies", Tata McGraw-Hill Publishing company Limited, 2008.

23LSE201	**LIFE SKILLS FOR ENGINEERS I**	**L-T-P-C: 1 0 2-P/F**

Pre-requisite(s): An open mind and the urge for self-development, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Assist students in inculcating Soft Skills and developing a strong personality
- Help them improve their presentation skills
- Support them in developing their problem solving and reasoning skills
- Facilitate the enhancement of their communication skills

Course Outcomes

CO1: Soft Skills: To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.

CO2: Soft Skills: To empower students to create a better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.

CO3: Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.

CO4: Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.

CO5: Verbal: To infer the meaning of words and use them in the right context. To have a better understanding of the basics of English grammar and apply them effectively.

CO6: Verbal: To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2	3	3		3
CO2									2	3		3
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Soft Skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. New-age challenges and distractions. Learning to benefit from constructive criticisms and feedback, Need for change in mindset and up-skilling to keep oneself competent in the professional world.

Managing Self: Knowing oneself, Self-perception, Importance of positive attitude, Building and displaying confidence, Avoiding being overconfident, Managing emotions, stress, fear. Developing Resilience and handling failures. Self-motivation, Self-learning, and continuous knowledge up- gradation / Life-long learning. Personal productivity - Goal setting and its importance in career planning, Self-discipline, Importance of values, ethics and integrity, Universal Human Values.

Aptitude

Problem Solving I

Numbers: Types, Power Cycles, Divisibility, Prime, Factors & Multiples, HCF & LCM, Surds, Indices,Square roots, Cube Roots and Simplification.

Percentage: Basics, Profit, Loss & Discount, and Simple & Compound Interest. Ratio, Proportion & Variation: Basics, Alligations, Mixtures, and Partnership. Averages: Basics, and Weighted Average.

Data Interpretation: Tables, Bar Diagrams, Venn Diagrams, Line Graphs, Pie Charts, Caselets, Mixed Varieties, Network Diagrams and other forms of data representation.

Verbal

Vocabulary: Familiarize students with the etymology of words, help them realize the relevance of wordanalysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.

Grammar (**Basic**): Help students learn the usage of structural words and facilitate students to identifyerrors and correct them.

Reasoning: Stress the importance of understanding the relationship between words through analogy questions.

Speaking Skills: Make students conscious of the relevance of effective communication in today's worldthrough various individual speaking activities.

Reference(s):

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita VishwaVidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), "Effective Team Building: How to make * winning team", London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan's – GRE Comprehensive Programme
11. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations,Amrita Vishwa Vidyapeetham.

12. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

Evaluation Pattern: 50:50

Assessment	Internal	External
Continuous Assessment (CA) – Soft Skills	30	-
Continuous Assessment (CA) – Aptitude	10	25
Continuous Assessment (CA) – Verbal	10	25
Total	50	50
Pass / Fail		

*CA - Can be presentations, speaking activities and tests.

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SEMESTER IV

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23CCE211	Design and Analysis of Algorithms (Prerequisite: Data Structures)	L-T-P-C: 3-0-0-3

Course Objectives
- To introduce the concept of asymptotic complexity of algorithms
- To introduce various algorithmic approaches
- To enable design of algorithms for specific applications

Course Outcomes: At the end of the course, the student should be able to
CO1: Analyze the asymptotic performance of algorithms
CO2: Apply algorithmic design paradigms and methods of analysis
CO3: Design efficient algorithms for specific applications
CO4: Understand approaches to reduce time complexity of algorithms

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3									3	3		2
CO2	3	3	3									3	3		2
CO3	3	3	3									3	3		2
CO4	3	3	3	2								3	3		2

Syllabus
Unit 1
Algorithms with Numbers: basic arithmetic – modular arithmetic – universal hashing. Complexity of algorithms: Big Oh notation – examples – worst case, average case, amortized complexity – Big Omega – Big Theta. Sorting algorithms - ordered statistics – lower bound on complexity– asymptotic analysis. Case studies in cryptography.
Unit 2
Divide and Conquer algorithms: Recurrence relations – Merge Sort – Fast Fourier Transform. Decomposition of Graphs – path in graphs. Greedy algorithms – Minimum spanning trees – Fractional Knapsack problem – Job scheduling. Dynamic programming – Bottom-up – Top-down – chain matrix – 0/1 knapsack - subset sum – Travelling salesman problem. Case studies in communications.
Unit 3
Linear Programming and Reductions – portfolio maximization – flow in networks – bipartite matching – duality – simplex algorithms. Introduction to NP completeness – examples of intractable problems - NP-complete Problems – Intelligent exhaustive search – approximation algorithms – local search heuristics. Case studies in communications.

Textbook(s)
1. Dasgupta, Sanjoy, Christos Papadimitriou, and Umesh Vazirani. "*Algorithms",* McGraw-Hill, 2006.

2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2009.
3. Kleinberg, Jon, and Eva Tardos. "*Algorithm Design",* Pearson New International Edition, 1st Edition, 2013.

References(s)
1. Robert Sedgewick and Kevin Wayne, "*Algorithms",* Addison-Wesley Professional; 4th edition, 2011.
2. Steven S. Skiena, "The Algorithm Design Manual", 2nd Edition, Springer, 2008.
3. Narasimha Karumanchi , "*Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles",* Career Monk Publications; 5th ed. Edition, 2016.
4. Peter Brass, "Advanced Data Structures", Cambridge University Press, Illustrated Edition, 2008.

SEMESTER IV

23CCE212	Database Management Systems (Prerequisite: NIL)	L-T-P-C: 3-0-0-3	**Course**

Objectives
- To introduce fundamental concepts of database management systems
- To enable systematic design of relational databases
- To provide the knowledge of SQL programming constructs for building relational databases and querying information

Course Outcomes: At the end of the course, the student should be able to
CO1: understand basic concepts of database systems
CO2: apply programming constructs in SQL effectively
CO3: apply E-R models and formal methods to design relational databases
CO4: understand database management concepts

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											2		2	
CO2	3	2			2							2		2	
CO3	3	2												2	
CO4	3	2										2		2	

Syllabus
Unit 1
Introduction - General introduction to database systems; Database - DBMS distinction, approaches to building a database, data models, three-schema architecture of a database, challenges in building a DBMS, components of a DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attribute types, relationship types, E/R diagram notation. Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators: selection, projection, cross product, joins, division, example queries, tuple relation calculus, domain relational calculus, converting the database specification in E/R notation.
Unit 2
SQL - Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL - basic select-from-where block and its semantics, nested queries - correlated and uncorrelated, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Dependencies and Normal forms - Importance of a good schema design, problems encountered with bad schema designs, motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, multi-valued dependencies and 4NF, join dependencies and definition of 5NF.
Unit 3
Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees. Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.

Textbook(s)
1. Database System Concepts (Sixth Edition) Avi Silberschatz, Henry F. Korth, S. Sudarshan McGraw-Hill 2011 ISBN 978-0071325226/ 0-07-352332-1

2. Database Management Systems, Third Edition Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill ©2003 ISBN: 978-0072465631/ 0-07-246563-8

References(s)
1. Fundamentals of Database Systems, 7th Edition Ramez Elmasri, University of Texas at Arlington Shamkant B. Navathe Pearson India ©2011 ISBN 978-0321369574
2. Database Systems: The Complete Book, (2nd Edition, 2014) Hector Garcia-Molina, Jeffrey D Ullman and Jennifer Widom Pearson India ISBN: 978-9332518674, 9-33-251867-X

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SEMESTER IV

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23CCE213	Computer Systems and Architecture (Prerequisite: Digital Electronics)	L-T-P-C: 3-0-0-3

Course Objectives
- To provide introduction to Computer System Architecture
- To provide foundation on various building blocks of a Computer Architecture
- To introduce the concepts of Pipelining and Parallel Processing

Course Outcomes: At the end of the course, the student should be able to
CO1: understand various functional units and mathematical operations of Computer Systems
CO2: design data-path and control-path operations during execution
CO3: understand Memory Organization and Input Output interfacing
CO4: understand the effect of Pipelining and Parallel Processing

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											3		3	
CO2	3	2	2									3		3	
CO3	3	2	2									3		3	
CO4	3	2										3		3	

Syllabus
Unit 1
Introduction to computer system – Usage of basic digital blocks - Floating point number – IEEE single precision and double precision representation - Floating point arithmetic - Floating point adder/Subtractor - Addressing modes with examples - Data path and controller design – Single bus dataflow unit - Multi bus architecture
Unit 2
Introduction to CPU design - Processor organization - Execution of complete instruction - Design of control unit - Hardwired Control - Microprogrammed Control - Memory and system organization – CPU and memory interaction - Organization of memory modules and interfacing - Cache memory: introduction, related mapping and replacement policies -

Unit 3

Input/output processing - Introduction to Interrupts - Interrupt controlled I/O transfer DMA - Introduction to RISC and CISC approaches - Introduction to pipelining - Pipeline performance - Hazards in pipeline and types – Introduction to Parallel Processing - Parallel Processing Performance – Multithreading - Cache coherence for shared data - Message passing in distributed memory systems - Mathematical modeling of performance.

Textbook(s)

1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", Fifth edition, Indian Edition, McGraw-Hill Education, 2011.
2. Patterson DA, Hennessy JL. Computer Organisation and Design, The Hardware/Software interface (ARM Edition). Fourth Edition, Morgan Kaufmann; 2010.

References(s)

1. Hennessy J L, Patterson DA. Computer architecture: a quantitative approach. Fifth Edition, Morgan Kauffmann; 2011.
2. Behrooz Parhami, "Computer Architecture", Indian Edition, Oxford University Press, 2012.
3. John P. Hayes, "Computer Architecture and Organisation", Indian Edition, McGraw-Hill Education, 2017.
4. Stallings W. Computer Organisation and Architecture.Tenth Edition, PHI; 2016.

SEMESTER IV

23CCE214	Communication Theory (Prerequisite: Signal Processing I)	L-T-P-C: 3-1-0-4

Course Objectives
- To introduce the concepts of analog communication
- To provide the knowledge of time and frequency domain representation of analog modulation techniques
- To introduce the concepts of random processes and noise in analog communication systems

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the principles of analog modulation and demodulation techniques
CO2: analyze the performance of different analog modulation techniques
CO3: understand the concepts of random processes
CO4: analyze the effect of noise in analog communication systems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										2			3
CO2	3	3										2			3
CO3	3	2										3			3
CO4	3	3										2			3

Syllabus

Unit 1

Introduction: Examples of communication systems, Analog vs. Digital, building blocks and their functions, channel types – wired vs. wireless, channel impairments – attenuation, noise, interference, fading, need for modulation, bandwidth and power; Amplitude Modulation (AM): types of AM – DSB-SC, Conventional AM, SSB, VSB, Comparison in terms of bandwidth, power, complexity, etc.; Demodulation: coherent detection, envelop detection; complex low pass representation of narrowband signals, Multiplexing, Super heterodyne receiver; Introduction to AM modulators and demodulators.

Unit 2

Angle Modulation: Introduction and representation; types of angle modulation – FM, PM; modulation index, Generation of narrowband and wideband FM; Spectral characteristics of WBFM, effective bandwidth, Carson's rule; Modulators and demodulators – Armstrong' modulator, PLL-based demodulator; FM radio systems.

Unit 3

Effect of Noise: Review of probability and random variables; Random Processes – auto- and cross-correlation, weak and strong stationarity, power spectral density, Gaussian processes through LTI systems, narrowband noise and filtering; Effect of noise on AM and FM systems, signal to noise ratio (SNR), Performance comparison.

Textbook(s)
1. John. G. Proakis and Masoud Salehi, "Fundamentals of Communication Systems", Pearson Education, First Edition, 2007.
2. Herbert Taub, Donald Schilling, Principles of Communications, Tata McGraw-Hill, 2008.

References(s)
1. Simon Haykin, "Communication Systems", John Wiley and Sons, 4th Edition, 2001.
2. Bruce Carlson, Paul. B. Crilly, Janet. C. Ruteledge, "Communication Systems", McGraw-Hill, 1993, Fourth Edition.

SEMESTER IV

23CCE215	**Machine Learning** **(Prerequisite: Foundations of Data Science)**	**L-T-P-C: 3-0-0-3**

Course Objectives
- To provide the foundations of machine learning
- To introduce supervised and unsupervised learning techniques
- To enable the appreciation of machine learning techniques

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand the mathematical foundations of machine learning
CO2: Understand supervised and unsupervised learning techniques
CO3: Apply machine learning techniques to standard datasets
CO4: Analyze the performance of machine learning models

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	2	-	-	-

Syllabus
Unit 1:

Optimization: Review of partial derivatives, gradient based optimization, Hessian and Jacobian matrices, constrained optimization – challenges, gradient descent algorithm, algorithms with adaptive learning rates

Introduction to Machine Learning: Machine Learning Pipeline - Data Preprocessing: Standardization, Normalization, Missing data problem, Data imbalance problem, Data visualization - Setting up training, development and test sets, Cross validation, Problem of Overfitting, Bias vs Variance, Evaluation measures

Unit 2

Supervised Learning: Linear regression – single and multi-variable cases, regularization, bias and variance, Logistic regression, Classification: K-Nearest Neighbor, Naïve Bayes, Decision Tree, Random Forest, Support Vector Machine, Case study on advanced supervised ML techniques for regression and classification

Unit 3

Unsupervised learning: Clustering - K-means, DBSCAN, Gaussian Mixture Model, Parameter Estimation: MLE and Bayesian Estimate, Expectation Maximization, Case study on advanced unsupervised ML techniques for regression and classification

Artificial Neural Networks: Multi-layer Perceptron, Back Propagation Algorithm, ANN applications to classification and regression

Textbook(s)
1. Goodfellow, I., Bengio, Y. and Courville, A., Deep learning, MIT Press, 2016.
2. Christopher M Bishop. Pattern Recognition and Machine Learning, Springer 2010.
3. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern Classification. Wiley, Second Edition, 2007

Reference
1. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers (Elsevier), 2011.
2. Kevin P. Murphey. Machine Learning, a probabilistic perspective. The MIT Press Cambridge, Massachusetts, 2012.

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SEMESTER IV

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23CCE284	Database Management Systems Laboratory (Prerequisite: NIL)	L-T-P-C: 0-0-3-1	**Course Objectives** • To provide hands-on

experience on the SQL programming language
- To enable efficient query of information from relational databases
- To enable implementation and management of relational databases

Course Outcomes: At the end of the course, the student should be able to
CO1: create and perform basic operations on tables
CO2: apply queries to efficiently retrieve information
CO3: apply SQL features for data and access management
CO4: develop relational databases for specific applications

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				3				3	3		2		2	
CO2	3				3				3	3		2		2	
CO3	3				3				3	3		2		2	
CO4	3	2			3				3	3		2		2	

Syllabus
1. Set up a local database, schema and management console
2. Create and modify SQL tables
3. Basic SQL query structure and variations
4. Set operations, aggregation functions
5. Nested subqueries
6. Joins
7. Indexing
8. Views and authorization
9. Data types, schemas, and integrity constraints
10. PL/SQL Programs using Triggers, Stored Procedures, Functions and Exception Handling.

Textbook(s)
1. Database System Concepts (Sixth Edition) Avi Silberschatz, Henry F. Korth, S. Sudarshan McGraw-Hill 2011 ISBN 978-0071325226/ 0-07-352332-1
2. Database Management Systems, Third Edition Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill ©2003 ISBN: 978-0072465631/ 0-07-246563-8

References(s)
1. Fundamentals of Database Systems, 7th Edition Ramez Elmasri, University of Texas at Arlington Shamkant B. Navathe Pearson India ©2011 ISBN 978-0321369574
2. Database Systems: The Complete Book, (2nd Edition, 2014) Hector Garcia-Molina, Jeffrey D Ullman, and Jennifer Widom Pearson India ISBN: 978-9332518674, 9-33-251867-X

SEMESTER IV

23CCE285	**Machine Learning Laboratory** **(Prerequisite: Foundations of Data Science)**	**L-T-P-C: 0-0-3-1**

Course Objectives
- To provide hands-on experience in the training of ML models
- To enable the performance analysis of Machine Learning algorithms
- To enable the identification of optimal model hyperparameters

Course Outcomes: At the end of the course, the student should be able to
CO1: Preprocess data
CO2: Train ML models
CO3: Analyze the performance of ML algorithms
CO4: Optimize model performance

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	-	-	-	2	2	-	3	-	-	-
CO2	3	-	-	-	3	-	-	-	2	2	-	2	-	-	-
CO3	3	2	-	-	3	-	-	-	2	2	-	3	-	-	-
CO4	3	2	2	-	3	-	-	-	2	2	-	2	-	-	-

Syllabus

Data pre-processing: Data cleaning, scaling, Encoding; Descriptive Statistics - Central tendency and dispersion; Regression- Single and Multivariable, Classification – Logistic regression, kNN, Naïve Bayes classifier, Decision Trees; Clustering - K-means, GMM; Performance evaluation: Confusion matrix, precision, recall, ROC; Hyper-parameter tuning for improving the performance; Artificial Neural Networks; Case Study involving classification including document classification or with applications like recommendation systems, advertising on the web, using ML tools.

Textbook(s)
1. Jiawei Han , Micheline Kamber, Jian Pei, "Data Mining : Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers (Elsevier), 2011.
2. C. M. Bishop. Pattern Recognition and Machine Learning. First Edition. Springer, 2006. (Second Indian Reprint, 2015).
3. P. Flach. Machine Learning: The Art and Science of Algorithms that Make Sense of Data. First Edition, Cambridge University Press, 2012.

23CCE286	**Algorithms Lab** **(Prerequisite: Data Structures Lab)**	**L-T-P-C: 0-0-3-1**

Course Objectives
- To provide hands-on experience in implementing algorithms
- To enable run-time analysis of algorithms
- To enable apply algorithms to specific applications

Course Outcomes: At the end of the course, the student should be able to
- **CO1**: implement algorithms
- **CO2**: analyze run-time performance of algorithms
- **CO3**: understand algorithms applied to engineering problems
- **CO4**: develop algorithms for communication related applications

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		3				3	3		2	3		3
CO2	3	3	2		3				3	3		3	3		3
CO3	3	2	2		3				3	3		3	3		3
CO4	3	3	3	2	3				3	3		3	3		3

Syllabus
1. Asymptotic Analysis of sorting methods on arrays and lists – bubble sort, insertion sort, selection sort, shell sort
2. Asymptotic analysis on advanced sorting methods - merge sort, quick sort, radix sort, heap sort
3. Simple cryptography using hashing functions
4. Huffman encoding
5. Linear programming for portfolio maximization
6. Bandwidth allocation / job scheduling
7. Dynamic programming on graphs
8. Knapsack problem – 0/1 and fractional
9. Shortest paths in the presence of negative edges
10. Intelligent exhaustive search - Branch and bound method
11. Local search heuristics - Graph partitioning

Textbook(s)
1. Dasgupta, Sanjoy, Christos Papadimitriou, and Umesh Vazirani. "*Algorithms*", McGraw-Hill, 2006.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, MIT Press, 2009.
3. Kleinberg, Jon, and Eva Tardos, "*Algorithm Design*", Pearson New International Edition, 1st Edition, 2013.

References(s)
1. Robert Sedgewick and Kevin Wayne, "*Algorithms*", Addison-Wesley Professional; 4th edition, 2011.
2. Steven S. Skiena, "The Algorithm Design Manual", 2nd Edition, Springer, 2008.
3. Narasimha Karumanchi , "*Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles*", Career Monk Publications; 5th ed. Edition, 2016.
4. Peter Brass, "Advanced Data Structures", Cambridge University Press, Illustrated Edition, 2008.

| 22ADM201 | **Strategic Lessons from Mahabaratha** (Prerequisite: Nil) | **L-T-P-C: 1-0-0-1** | **Course Objectives** • To gain a |

deeper understanding of the ethical grandeur of Indian culture, through a study of the Mahabharata
• To be inspired to follow the ideals of the characters depicted therein

Course Outcomes: At the end of the course, the student should be able to

CO1   Understand the impact of itihasas on Indian civilization with a special reference to the Adiparva of Mahabharata.

CO2   Understand the importance of fighting adharma for the welfare of the society through Sabha and Vanaparva.

CO3   Understand the nuances of dharma through the contrast between noble and ignoble characters of the epic as depicted in the Vana, Virata, Udyoga and Bhishma parvas.

CO4   Gain a deeper understanding of the Yuddha Dharma through the subsequent Parvas viz., Drona, Karna, Shalya, Sauptika Parvas.

CO5   Appreciate the spiritual instruction on the ultimate triumph of dharma through the presentations of the important episodes of the MB with special light on Shanti, Anushasana, Ashwamedhika, Ashramavasika, Mausala, Mahaprasthanika and Swargarohana Parvas.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1	-	3	1	-		3			
CO2						2	3	3	3	3		3			
CO3						3	3	3	3	3		3			
CO4						3	-	3	3	2		3			
						3	1	3	1	1		3			

Syllabus
Unit 1
Introduction and Summary of the Mahabharata - A Preamble to the Great Itihasa; Unbroken Legacy
Unit 2
Dharmic Insights of a Butcher; The Vows We Take; Kingship and Polity Acumen
Unit 3
Karna – The Maestro that Went Wide off the Mark; Tactics of Krishna; Yajnaseni
Unit 4
Popular Regional Tales; Maha Prasthanam – The Last Journey.
Unit 5
Mahabharata - An All-Encompassing Text; Mahābhārata- Whats and WhatNots; Nyayas in Mahabharata

Textbook / References
1.   Leadership Lessons from the Mahabharat, ASCSS
2.   Rajagopalachari. C, The Mahabharatha

| 23LAW300 | Indian Constitution (Prerequisite: Nil) | P/F | Course Objectives • To |

know about Indian constitution, Indian society, central and state government functionalities in India

Course Outcomes: At the end of the course, the student should be able to

    CO1: understand the functions of the Indian government

    CO2: understand and abide the rules of the Indian constitution

    CO3: understand and appreciate different culture among the people

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	2	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	2	3	-	-	-	-	-	-	-

Syllabus

Unit I

Historical Background – Constituent Assembly of India – Philosophical Foundations of The Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for Citizens.

Unit II

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

Unit III

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

Textbook(s)

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi, 24th Edition, 2021.
2. R. C. Agarwal, "Indian Political System", S. Chand and Company, New Delhi, 12th Edition, 2019.

Reference(s)

1. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi, 7th Edition, 2019.

| 23LSE211 | LIFE SKILLS FOR ENGINEERS II | L-T-P-C: 1-0-2-2 |

Pre-requisite(s): An inquisitive mind, basic English language skills, knowledge of high schoollevel mathematics.

Course Objectives

• Assist students in inculcating Soft Skills and developing a strong personality.
• Help them improve their presentation skills.
• Aid them in developing their problem solving and reasoning skills.
• Facilitate them in improving the effectiveness of their communication.

Course Outcomes

CO1: Soft Skills: To develop greater morale and positive attitude to face, analyse, and manageemotions in real life situations, like placement process.

CO2: Soft Skills: To empower students to create better impact on a target audience through content creation, effective

delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.

CO3: Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.

CO4: Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.

CO5: Verbal: To learn to use more appropriate words in the given context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.

CO6: Verbal: To be able to read texts critically and arrive at/ predict logical conclusions. To learn to organize speech and incorporate feedback in order to convey ideas with better clarity.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2	3	3		3
CO2									2	3		3
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Communication: Process, Language Fluency, Non-verbal, Active listening. Assertiveness vs. aggressiveness. Barriers in communication. Digital communication

Presentations: Need, importance, preparations, research and content development, structuring and ensuring flow of the presentation. Ways and means of making an effective presentation: Understanding and connecting with the audience – using storytelling technique, managing time, appropriate language, gestures, posture, facial expressions, tones, intonations and grooming. Importance of practice to make an impactful presentation.

Aptitude

Problem Solving II

Equations: Basics, Linear, Quadratic, Equations of Higher Degree and Problems on ages.

Logarithms, Inequalities and Modulus: Basics

Time and Work: Basics, Pipes & Cistern, and Work Equivalence.

Time, Speed and Distance: Basics, Average Speed, Relative Speed, Boats & Streams, Races andCircular tracks.

Logical Reasoning: Arrangements, Sequencing, Scheduling, Venn Diagram, Network Diagrams,Binary Logic, and Logical Connectives.

Verbal

Vocabulary: Aid students learn to use their vocabulary to complete the given sentences with the rightwords. Usage of more appropriate words in different contexts is emphasized.

Grammar (**Basic-intermediate**): Help students master usage of grammatical forms and enablestudents to identify errors and correct them.

Reasoning: Emphasize the importance of avoiding the gap (assumption) in arguments/ statements/ communication.

Reading Comprehension (Basics): Introduce students to smart reading techniques and help themunderstand different

tones in comprehension passages.

Speaking Skills: Make students be aware of the importance of impactful communication throughindividual speaking activities in class.

Writing Skills: Introduce formal written communication and keep the students informed about the etiquette of email writing.

Reference(s)

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita VishwaVidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), *"Effective Team Building: How to make * winning team",* London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan's – GRE Comprehensive Programme
11. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
12. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

Evaluation Pattern: 50:50

Assessment	Internal	External
Continuous Assessment (CA) – Soft Skills	30	-
Continuous Assessment (CA) – Aptitude	10	25
Continuous Assessment (CA) – Verbal	10	25
Total	50	50

*CA - Can be presentations, speaking activities and tests.

SEMESTER V

23CCE301	**IoT and Cloud Computing** **(Prerequisite: Nil)**	**L-T-P-C: 3-0-0-3**

Course Objectives

- To provide understanding of Access Technologies and underlying Protocols
- To provide foundation on Cloud Layers and Deployment Models
- To enable integration of IoT and Cloud Computing

Course Outcomes: At the end of the course, the student should be able to
CO1: understand IoT Technologies and Protocols
CO2: understand IoT based system design
CO3: understand different Cloud Deployment Models and their uses
CO4: understand integration of IoT and Cloud Computing Platforms

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										2		3	
CO2	3	2										2		3	
CO3	3	2										2		3	
CO4	3	2										2		3	

Syllabus
Unit 1
Drivers behind New Network Architectures - IoT Architecture - Core IoT Functional Stack - IoT Data Management and Compute Stack - Sensor and Actuators - Smart Object - Connecting Smart Objects - IoT Access Technology - 802.15.4
Unit 2
LoRaWAN - IP as IoT Network Layer - Need for IP Optimization in IoT - IoT Transport Methods - IoT Application Layer Protocols - CoAP - MQTT - Data Analytics for IoT – Introduction to Big Data Analytics - Basic Hadoob Architecture - IoT Strategies for Smart Cities, Transportation
Unit 3
Introduction to Cloud Computing – Elastic Computing and its Advantages – Types of Cloud and Cloud Providers – Data Center Infrastructure – Virtual Machine – Containers – Virtual Networks – Virtual Storage

Textbook(s)
1. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, J. Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", First Edition, Cisco Press, 2017
2. D. Comer, "The Cloud Computing Book: The Future of Computing Explained", CRC Press, 2021

References(s)
1. S. Manvi, G. Shyam," Cloud Computing: Concepts and Technologies", CRC Press, 2021

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SEMESTER V

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23CCE302	Software Engineering (Prerequisite: Computer Programming)	L-T-P-C: 3-0-0-3

Course Objectives
- To introduce the challenges in software engineering
- To provide exposure to life-cycle models
- To introduce the concepts of specification, design and testing

Course Outcomes: At the end of the course, the student should be able to
CO1: understand concepts of software engineering
CO2: understand the models for software development life-cycle
CO3: understand software specification and design processes
CO4: understand the concepts of software testing

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2											2		2	
CO2	2											2		2	

CO	PO1	PO2										PO12	PSO1	PSO2	PSO3
CO3	2	2										2		2	
CO4	2	2										2		2	

Syllabus
Unit 1
Introduction to software engineering, writing requirements, system analysis, system design, software design, testing, deployment, maintenance, updates, quality attributes and, crisis management. Software development life cycles-water fall model, V-model, evolutionary model, RAD model, concurrent-Agile model, enhancement model, spiral model, prototype model.

Unit 2
Introduction to Agile methodologies, types-scrum, Kanban framework, LEAN, extreme programming; Scrum framework, product owner, scrum master, development team, product backlog, sprint backlog, product increment, daily scrum; Agile sprint planning-creation of user stories, estimation and assignment of story points, building and refining product backlog; Introduction to DevOp tools; Case studies on latest agile frameworks.

Unit 3
Introduction to full stack development-front end development, data base handling, backend development, API, web server, version control; Testing-objectives, unit testing, integration testing, acceptance testing, regression testing, validation testing, system testing, black-box testing, white box testing; Test harness-test drivers, test stubs.

Textbook(s)
1. R. S. Pressman, "Software Engineering: A Practitioners Approach", McGraw Hill, 7th edition, 2010
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Publication, 3rd edition, 2009

References(s)
1. Crowder JA, Friess S, "Agile project management: managing for success", Cham: Springer International Publishing; 2015.
2. Stellman A, Greene J. Learning agil, "Understanding scrum, XP, lean, and kanban", O'Reilly Media, Inc."; 2014.
3. Gregory J, Crispin L., "More agile testing: learning journeys for the whole team", Addison-Wesley Professional; 2014.
4. Rubin KS., "Essential Scrum: a practical guide to the most popular agile process", Addison-Wesley; 2012.
5. Cohn M. User stories applied: For agile software development. Addison-Wesley Professional; 2004.

SEMESTER V

23CCE303	Digital Communication (Prerequisite: Communication Theory)	L-T-P-C: 3-1-0-4

Course Objectives
- To introduce the concepts of digital modulation and demodulation techniques
- To provide an understanding of optimum receiver design
- To enable performance analysis of digital communication systems

Course Outcomes: At the end of the course, the student should be able to
    CO1: understand the concepts of waveform coding and signal design
    CO2: understand the principles of digital modulation techniques
    CO3: design optimum receivers for digital communication systems
    CO4: conduct performance analysis of digital modulation techniques

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										2			3
CO2	3	2										3			3
CO3	3	3										2			3
CO4	3	3										3			3

Syllabus
Unit 1
Introduction: major blocks and functions; Analog to Digital Conversion; Waveform Coding –PCM –DPCM –DM; Time Division Multiplexing; Geometric representation of signal waveforms- Binary pulse modulation –Optimum receiver for binary modulated signals in additive white Gaussian noise: M-ary binary and orthogonal pulse modulation –Probability of error for binary and M-ary pulse modulation.
Unit 2

Transmission of digital information via carrier modulation: Types of digital modulation –Amplitude shift keying (ASK) –Phase shift keying (BPSK, QPSK, M-PSK); Quadrature amplitude modulated signals (M-QAM) –Frequency shift keying (FSK), Minimum Shift Keying (MSK), Continuous phase modulation - calculation of probability of error, Performance analysis and comparison of different modulation techniques.

Unit 3
Digital Transmission through band-limited channel- Baseband, Bandpass, Band limited channels, Inter-Symbol Interference (ISI) - Signal design for band-limited channels –Probability of error for detection of digital PAM –System design in the presence of channel distortion.

Textbook(s)
1. John.G.Proakis and Masoud Salehi, "Fundamentals of Communication Systems", Pearson Education, First Edition, 2007.
2. Simon Haykin, "Digital Communication systems", John Wiley&sons,2014.

References(s)
1. Ziemer and Peterson, Introduction to Digital Communication, Pearson Education, 2000.
2. B.Sklar, "Digital Communications", Pearson Education, Second Edition, 2006.

SEMESTER V

23CCE304	**Embedded Systems** **(Prerequisite: Microcontrollers and Interfacing)**	**L-T-P-C: 3-0-0-3**

Course Objectives
- To provide foundation on Embedded System Platforms
- To enable configuration of advanced peripherals for Embedded Applications
- To provide basic understanding of Real Time Operating Systems

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the architectural features of an Embedded System
CO2: configure the peripherals of an advanced Microcontroller
CO3: understand the concepts of Real Time Operating Systems
CO4: understand the design of an Embedded System

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2									2		3	
CO2	3	2	2									2		3	
CO3	3		2									2		3	
CO4	3	2	3									2		3	

Syllabus
Unit 1
Fundamentals of Embedded Systems - Introduction to Cortex M3 Architecture – Registers - Operating Modes - NVIC - Memory Map - MPU – Exceptions - Debug Support in Cortex M3 - Stack Pointer - Link Register - Program Status Registers - Interrupt Mask Registers - Control Registers - Stack Memory Operations - Reset Sequence - Bit Banding - Memory Access Attributes - Advantages of Bit Banding – Pipelining - Detailed Cortex M3 Architecture - Bus Interfaces - Reset Types - Preempt and Sub Priority - Interrupt Input and Pending Behavior

Unit 2
Bus Faults - Memory Management Fault - Usage Fault - Hard Fault - Methods of dealing with Faults - Supervisory Call - Pendable Service Call - System Tick Timer - Sleep on Exit - Wake up Interrupt Controller - Multiprocessor Communication - Self Reset Control - Debug Architecture - CoreSight Architecture, Modified CoreSight Architecture - TM4C123 Architecture - GPIO - ADC - Timers - PWM - External Interrupt

Unit 3
SPI - I2C – DAC Interfacing using SPI – RTC Interfacing using I2C - Software Architectures - Round Robin - Round Robin with Interrupt - Function Queue Scheduling - RTOS software architecture – Task - Task States - Context of Task - Shared Data Problem – Reentrancy – Semaphore – Types - Semaphore problems - Priority Inversion - Deadly Embrace - Ways to Protect Shared Data, Message Queue - Mailbox – Pipe - Pitfalls with MQ, Mailboxes and Pipes

Textbook(s)
1. J. Yiu, "The Definitive Guide to the ARM Cortex M3 and Cortex M4 Processors", Third Edition, Elsevier Inc., 2014

2. M. A. Mazidi, S. Chen, S. Naimi, Ti Tiva Arm Programming for Embedded Systems: Programming Arm Cortex-M4 TM4C123G with C, 2016
3. Richard Barry, "Using the FreeRTOS Real Time Kernel ARM Cortex-M3 Edition", Real Time Engineers Ltd., 2010.

References(s)
1. D. V. Gadre, S. Gupta, Getting Started with Tiva ARM Cortex M4 Microcontrollers, Springer, 2018
2. Richard Barry, "Mastering the FreeRTOS Real Time Kernel, A Hands-On Tutorial Guide", Real Time Engineers Ltd., 2016.

SEMESTER V

| 23CCE381 | Open Lab - I
(Prerequisite: Nil) | L-T-P-C: 0-0-3-1 | Course |

Objectives
- To provide platform for creative and innovative thinking
- To enable understanding of available state of art in the identified area of interest
- To enable simulation/hardware-prototyping of solutions to effectively transform ideas to reality

Course Outcomes: At the end of the course, the student should be able to
  CO1: analyze simple practical problems and investigate scope for applying technology to develop feasible solutions
  CO2: design a solution for the identified, using appropriate tools
  CO3: simulate the solution and analyse the results
  CO4: suggest improvements or modifications
  CO5: Present and defend the results

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	2	2	3	2	2	2	3	3	3
CO2	3	3	3	3	2	1	2	2	3	2	2	2	3	3	3
CO3	3	3	3	3	3	1	2	2	3	2	2	2	3	3	3
CO4	3	3	3	3	2	1	2	2	3	2	2	2	3	3	3
CO5					3				3	3		2	2	2	2

SEMESTER V

| 23CCE384 | Embedded Systems Lab
(Prerequisite: Microcontrollers and Interfacing) | L-T-P-C: 0-0-3-1 |

Course Objectives
- To provide hands-on experience to use peripherals of an advanced Microcontroller
- To enable implementation of Real Time Operating System (RTOS) concepts
- To enable design of an Embedded System using advanced Microcontroller

Course Outcomes: At the end of the course, the student should be able to
CO1: configure peripherals of an advanced Microcontroller
CO2: interface External Peripherals with an Embedded Platform
CO3: implement Task Management and Inter Task Communication using RTOS
CO4: prototype an Embedded System using advanced Microcontroller

CO-PO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO														
CO1	3		2		3			3	3		2		3	
CO2	3		2		3			3	3		2		3	
CO3	3		2		3			3	3		2		3	
CO4	3	3	3		3			3	3		2		3	

Syllabus
1. GPIO Programming using Cortex M4
2. Delay Time Generation using Timer
3. Analog Sensor Interfacing using ADC
4. External DAC Interfacing using SPI
5. External RTC Interfacing using I2C
6. Task Management using FreeRTOS
7. Inter Task Communication using FreeRTOS
8. Term Project

Textbook(s)
1. M. A. Mazidi, S. Chen, S. Naimi, Ti Tiva Arm Programming for Embedded Systems: Programming Arm Cortex-M4 TM4C123G with C, 2016
2. Richard Barry, "Using the FreeRTOS Real Time Kernel ARM Cortex-M3 Edition", Real Time Engineers Ltd., 2010.

References(s)
1. Richard Barry, "Mastering the FreeRTOS Real Time Kernel, A Hands-On Tutorial Guide", Real Time Engineers Ltd., 2016.

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SEMESTER V

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23CCE382	IoT and Cloud Computing Lab (Prerequisite: Nil)	L-T-P-C: 0-0-3-1

Course Objectives
- To provide hands-on experience on IoT Hardware
- To provide exposure to Cloud Computing Platforms
- To enable integration of IoT with Cloud Computing Systems

Course Outcomes: At the end of the course, the student should be able to
CO1: prototype simple IoT based Systems
CO2: use Cloud Computing Platforms for Data Processing
CO3: integrate IoT with Cloud Computing
CO4: demonstrate simple IoT Applications on Cloud

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2				3	3		2		3	
CO2	3	2			3				3	3		2		3	
CO3	3	2			3				3	3		2		3	
CO4	3	2	3		3				3	3		2		3	

Syllabus
1. GPIO and Motor Control using Raspberry Pi
2. Sensor interfacing and Data Logging using Raspberry Pi with SenseHAT
3. LCD Interfacing using Raspberry Pi
4. Web Server Implementation using Raspberry Pi
5. Raspberry Pi and IoT Cloud Server Interface using MQTT Protocol
6. Machine Learning using IRIS Dataset using Raspberry Pi
7. Image Processing using Raspberry Pi
8. Building Machine Learning Models using Azure Cloud Platform
9. Training Deep Neural Networks on Azure

Textbook(s)

1. S. Monk, "Raspberry Pi Cookbook: Software and Hardware Problems and Solutions", Fourth Edition, Oreilly, 2022
2. D. J. Norris, "Machine Learning with the Raspberry Pi Experiments with Data and Computer Vision", Apress, 2020
3. A. Pajankar, "Raspberry Pi Image Processing Programming Develop Real-Life Examples with Python, Pillow, and SciPy", Apress, 2017
4. C. Korner, K. Waaijer, "Mastering Azure Machine Learning", Packt Publishing, 2020

References(s)
1. P. Waher, "Mastering Internet of Things: Design and Create your own IoT Applications using Raspberry Pi 3", Packt Publishing, 2018
2. D. J. Norris, "Beginning Artificial Intelligence with the Raspberry Pi", Apress, 2017
3. D. Mukunthu, P. Shah, W. H. Tok, "Practical Automated Machine Learning on Azure", Fourth Edition, Oreilly, 2019

SEMESTER V

23CCE383	Communication Systems Lab (Prerequisite: Nil)	L-T-P-C: 0-0-3-1

Course Objectives
- To provide hands-on exposure to digital communication techniques using ICs and discrete components
- To enable performance analysis of various digital modulation schemes
- To provide exposure to hardware platforms for communication systems

Course Outcomes: At the end of the course, the student should be able to
CO1: build electronic circuits for digital communication
CO2: simulate and verify digital modulation schemes
CO3: analyze the performance of digital modulation techniques
CO4: utilize hardware platforms to realize communication systems

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2						3	3		2			3
CO2	3	3			3				3	3		2			3
CO3	3	3			3				3	3		3			3
CO4	3		2		3				3	3		3			3

Syllabus
1. Sampling and reconstruction of an analog signal by designing pulse amplitude modulator and demodulator circuits.
2. Application of sampling by designing time division multiplexer and demultiplexer circuits.
3. Amplitude modulator which can be used to transmit digital information via carrier and be able to reconstruct the message signal.
4. Phase modulator which can be used to transmit the digital information via carrier and be able to reconstruct the message signal.
5. Pulse code modulator and Delta modulator
6. Geometric representation of the given signal using Gram-Schmidt orthogonalization procedure implemented in MATLAB.
7. ASK (OOK) and BPSK modulator and demodulator and BER performance comparison
8. M-PSK and QAM modulator and demodulator and BER performance comparison
9. To study the effects of ISI by generating an Eye pattern
10. Specifications, characterization of Hardware platforms like NooRadio, SDR, etc.
11. Establishment of wireless communication link using a pair of hardware platform

Textbook(s)
1. John G. Proakis, Masoud Salehi and Gerhard Bauch, "Contemporary Communication Systems Using MATLAB.Cengage Learning India", Third Edition, 2012.

References(s)
1. John.G.Proakis and Masoud Salehi, "Fundamentals of Communication Systems", Pearson Education, First Edition, 2007.
2. Simon Haykin, "Digital Communication systems", John Wiley&sons,2014.

23LSE301	LIFE SKILLS FOR ENGINEERS III	L-T-P-C: 1-0-2-2

Pre-requisite(s): Willingness to learn, communication skills, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Help students understand corporate culture, develop leadership qualities and become good team players
- Assist them in improving group discussion skills
- Help students to sharpen their problem solving and reasoning skills
- Empower students to communicate effectively

Course Outcomes

CO1 - Soft Skills: To improve the inter-personal communication and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities.

CO2 - Soft Skills: To develop the ability to create better impact in a Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.

CO3 - Aptitude: To identify, investigate and arrive at appropriate strategies to solve questions on geometry, statistics, probability and combinatorics.

CO4 - Aptitude: To analyze, understand and apply suitable methods to solve questions on logical reasoning.

CO5 - Verbal: To be able to use diction that is more refined and appropriate and to be competent in spotting grammatical errors and correcting them.

CO6- Verbal: To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3	2	3
CO2										3	2	2
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Professional Grooming and Practices: Basics of corporate culture, key pillars of business etiquette – online and offline: socially acceptable ways of behavior, body language, personal hygiene, professional attire and Cultural adaptability and managing diversity. Handling pressure, multi-tasking. Being enterprising. Adapting to corporate life: Emotional Management (EQ), Adversity Management, Health consciousness. People skills, Critical Thinking and Problem solving.

Group Discussions: Advantages of group discussions, Types of group discussion and Roles played in a group discussion.

Personality traits evaluated in a group discussion. Initiation techniques andmaintaining the flow of the discussion, how to perform well in a group discussion. Summarization/conclusion.

Aptitude

Problem Solving III

Geometry: 2D, 3D, Coordinate Geometry, and Heights & Distance.

Permutations & Combinations: Basics, Fundamental Counting Principle, CircularArrangements, and Derangements.

Probability: Basics, Addition & Multiplication Theorems, Conditional Probability and Bayes'Theorem.

Statistics: Mean, Median, Mode, Range, Variance, Quartile Deviation and Standard Deviation.

Logical Reasoning: Blood Relations, Direction Test, Syllogisms, Series, Odd man out, Coding

\& Decoding, Cryptarithmetic Problems and Input - Output Reasoning.

Verbal

Vocabulary: Create an awareness of using refined language through idioms and phrasal verbs. **Grammar** (**Upper Intermediate-Advanced**): Train Students to comprehend the nuances of Grammarand empower them to spot errors in sentences and correct them.

Reasoning: Enable students to connect words, phrases and sentences logically.

Oral Communication Skills: Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.

Writing Skills: Practice closet tests that assess basic knowledge and skills in usage and mechanics of writing such as punctuation, basic grammar and usage, sentence structure and rhetorical skills such as writing strategy, organization, and style.

Reference(s)

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita VishwaVidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), *"Effective Team Building: How to make * winning team",* London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)
9. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
10. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations,Amrita Vishwa Vidyapeetham.
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
12. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
14. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
16. A Modern Approach to Logical Reasoning, R S Aggarwal.
17. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation Pattern: 50:50

Assessment	Internal	External
Continuous Assessment (CA) – Soft Skills	30	-

Continuous Assessment (CA) – Aptitude	10	25
Continuous Assessment (CA) – Verbal	10	25
Total	50	50

*CA - Can be presentations, speaking activities and tests.

23LIV390	**Live-in Lab -1** (**Pre-requisite:** Nil)	**L-T-P-C: 0-0-9-3**

Course Objectives

- Identify and analyse the various challenge indicators present in the village by applying concepts of Human Centered Design and Participatory Rural Appraisal.
- Assess the user need through quantitative and qualitative measurements
- Design a solution by integrating human centered design concepts
- Devising proposed intervention strategies for sustainable social change management

Course Outcome: At the end of the course, the student should be able to

CO1: learn ethnographic research and utilise the methodologies to enhance participatory engagement.
CO2: prioritize challenges and derive constraints using Participatory Rural Appraisal.
CO3: identify and formulate the research challenges in rural communities.
CO4: design solutions using human centered approach.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3		3		1	1		3	3		3
CO2		3						3	3	3		
CO3		3					1		3	3		3
CO4	3		3				3	3	3	3		3

Syllabus

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.
Thematic Areas
- Agriculture & Risk Management
- Education & Gender Equality
- Energy & Environment
- Livelihood & Skill Development
- Water & Sanitation
- Health & Hygiene
- Waste Management & Infrastructure

The objectives and the projected outcome of the project will be reviewed and approved by the department chairperson and a faculty assigned as the project guide.

23CCE311	Software Defined Radio Architecture (Prerequisite: Digital Communication)	L-T-P-C: 3-0-0-3

Course Objectives
- To provide advanced level of theoretical knowledge on baseband processing
- To enable analysis, configuration and programming for software defined radio
- To introduce integration of programmable hardware baseband processing with RF modules

Course Outcomes: At the end of the course, the student should be able to
CO1: understand baseband processing techniques including multi-rate systems
CO2: understand Multi-standard radio systems
CO3: understand the integration of baseband techniques with radio systems
CO4: analyze the performance of baseband techniques for SDR

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										3			3
CO2	3	2										3			3
CO3	3	3	2									3			3
CO4	3	3										3			3

Syllabus
Unit 1
Introduction to wireless communication systems – Baseband signal processing – overview of wireless digital communication – Digital modulation and demodulations techniques: transmitter for complex PAM – symbol mapping – pulse shaping – wireless channel: source and channel coding schemes – channel impairments techniques: time and frequency offset corrections - Signal processing with passband signals – Multi-rate signal processing – down sampling – up sampling – polyphase structure – changing the sampling rate– Digital generation of signals – Analog to Digital (ADC) and Digital to Analog (DAC) conversion architectures
Unit 2
Software Communication Architecture: Operating environments - operating scenarios - general requirements and services – Devices and device manager - Hardware Architecture: General Purpose Processor (GPP) based SDR – FPGA based SDR – Multi-channel SDR – Software Centric SDR platform – RF front end architecture – Development tools – Digital hardware choices – Case studies: SPEAKeasy – Joint Tactical Radio Systems (JTRS) – Spectrumware
Unit 3
Applications of SDR: Cognitive Radio: architecture – Dynamic spectrum access – OpenBTS – OpenLTE – WiFi Transceiver – Zigbee Transceiver – Military communication – deep space communication – Video streaming applications – satellite signal reception – HAM radio communication – MIMO-OFDM communication system.

Textbooks
1. Heath Jr, Robert W. Introduction to Wireless Digital Communication: A Signal Processing Perspective. Prentice Hall, 2017.
2. Bard, John, and Vincent J. Kovarik Jr. Software defined radio: the software communications architecture. John Wiley & Sons, 2007.
3. Grayver, Eugene. Implementing software defined radio. Springer Science & Business Media, 2012.
4. Arslan, Hüseyin, ed. Cognitive radio, software defined radio, and adaptive wireless systems. Springer Science & Business Media, 2007.
5. Reed, Jeffrey Hugh. Software radio: a modern approach to radio engineering. Prentice Hall Professional, 2002.

References(s)
1. www.gnuradio.org
2. https://in.mathworks.com/discovery/sdr.html
3. https://www.ni.com/

23CCE312	Wireless Communication and Networks (Prerequisite: Digital Communication)	L-T-P-C: 3-0-0-3

Course Objectives
- To introduce the

characteristics of wireless channels

- To provide the fundamental techniques to combat fading channels
- To introduce multiple access techniques in wireless networks

Course Outcomes: At the end of the course, the student should be able to
CO1: characterize wireless channels
CO2: apply techniques to improve performance in fading channels
CO3: understand multiple access techniques in wireless networks
CO4: understand working principles of modern wireless networks

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2								3			3
CO2	3	3	2	2								2			3
CO3	3	3	2									2			3
CO4	3	3										3			3

Syllabus
Unit 1
Introduction: Wireless communication, importance and requirements, types and classifications; Block diagram, brief function of major blocks; Wireless channels- characterization of wireless channel, Communication link, propagation phenomenon, LoS, NLoS; Mobile wireless channel- multipath propagation, ISI, fading, large scale-Friss free-space path-loss model, ray tracing model, two-ray tracing model, shadowing, small scale multipath measurements; Rayleigh, Rician model, Fading parameters like power-delay profile, coherence bandwidth, delay spread, etc., Passband representation of received signal; Channel capacity –AWGN, fading channel capacity, outage capacity, BER performance.
Unit 2
Performance improvement techniques: Equalization-adaptive, DFE; Diversity techniques- types, receive diversity, transmit diversity, MIMO, MIMO-Channel, capacity, data rate; receiver architecture – combiners, rake receiver. Chanel Coding – Parity, block codes, convolution codes, interleaving, randomizer. Multicarrier communication – Frequency selective channels, OFDM, Single-carrier vs multi-carrier. Multiple access- techniques, TDMA, FDMA, CDMA, space division.
Unit 3
Introduction to Wireless networks: Wireless Local Area Networks, 802.11n; Cellular mobile communication architecture, 2G network, evolution of cellular mobile communication 1G-5G.

Textbook(s)
1. Andrea Goldsmith, "Wireless Communication", Cambridge University Press, 2005.
2. David Tse and Pramod Viswanath, "Fundamentals of wireless communication", 2005

References(s)
1. William C Y Lee, "Wireless and Cellular Communications", Tata McGraw Hill Publishing Company Limited, Third Edition, 2006.

23CCE313	Computer Networks and Protocols (Prerequisite: Nil)	L-T-P-C: 3-0-0-3

Course Objectives
- To provide an understanding of layered architecture of computer networks
- To provide fundamentals of internetworking
- To provide foundations on network protocols

Course Outcomes: At the end of the course, the student should be able to
CO1: understand layered architecture of computer networks
CO2: understand the concepts of addressing, switching, routing and reliable transport of data
CO3: understand the working of network protocols

CO4: analyze the qualitative aspects of protocols

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											3			3
CO2	3											3			3
CO3	3											2			3
CO4	3	2										2			3

Syllabus
Unit 1
Introduction: Types of computer networks, network topology, Circuit vs. Packet Switching. The Internet (network of networks) - Protocol Layering: The OSI Model- TCP/IP Protocol suite; Network Performance Metrics: throughput, delay, jitter, QoS, scalability, reliability – packet error, packet drop; Application Layer – client-server vs. Peer-to-peer protocols, HTTP, DNS, Transport Layer: reliable transport, flow control, congestion control, TCP, UDP.
Unit 2
Network Layer: addressing, forwarding and routing, data plane and control plane, packet switces, Internet Protocol, IPv4, IPv6, DHCP, NAT; Routing Algorithms: link state, distance vector, routing on the Internet – RIP, OSPF, BGP, Broadcast and Multicast routing, SDN approach.
Unit 3
Data link layer and its functions-protocols, Frame, ARP - Error detection and correction - Medium Access control (MAC)- Random access- Controlled access- Ethernet; PHY Layer and its functions, PHY protocols.

Textbook(s)
1. James Kurose and Keith Ross, "Computer Networking: A Top-Down Approach", 6th Edition, Pearson Education Ltd., 2017.
2. Behrouz Forouzan, "Data Communication and Networking", Tata McGraw Hill, 5th edition, 2012.

References(s)
1. Andrew S Tannenbaum, David J. Whetheral, "Computer Networks", Prentice Hall, 5th edition, 2010.
2. William Stallings, "Data and Computer Communications", 8th edition, Pearson Education Asia, 2007
3. Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach", Morgan Kaufmann, Fifth Edition, 2011.

SEMESTER VI

23CCE385	Open Lab - II (Prerequisite: Open Lab - I)	L-T-P-C: 0-0-6-2	**Course Objectives**

- To provide platform for creative and innovative thinking
- To enable understanding of available state of art in the identified area of interest
- To enable simulation/hardware-prototyping of solutions to effectively transform ideas to reality

Course Outcomes: At the end of the course, the student should be able to
CO1: analyze simple practical problems and apply technology to develop feasible solutions
CO2: identify, troubleshoot and rectify simple problems while prototyping
CO3: analyse the results and develop justifiable inferences
CO4: understand the process of developing ideas to feasible prototypes
CO5: Present and defend the results

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	1	2	2	3	2	2	2	3	3	3
CO2	3	3	3	3	2	1	2	2	3	2	2	2	3	3	3

CO3	3	3	3	3	3	1	2	2	3	2	2	2	3	3	3
CO4	3	3	3	3	2	1	2	2	3	2	2	2	3	3	3
CO5					3				3	3		2	2	2	2

SEMESTER VI

23CCE386	Wireless Communication and Networks Laboratory (Prerequisite: Communication Systems Laboratory)	L-T-P-C: 0-0-3-1

wireless communication over fading channels through simulations
  • To enable develop wireless networks using hardware modules
  • To provide hands-on exposure to computer networks and protocols

Course Outcomes: At the end of the course, the student should be able to
   CO1: analyze performance of wireless communication systems over fading channels
   CO2: demonstrate wireless networks using hardware modules
   CO3: simulate and configure wireless networks
   CO4: analyze the performance of computer networks

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			3				3	3		2			3
CO2	3	2			3				3	3		3			3
CO3	3	2			3				3	3		2			3
CO4	3	3			3				3	3		2			3

Syllabus
   1. Study of Propagation Path loss Models: Indoor & Outdoor
   2. Performance comparison of different propagation models including fading channels, Rayleigh, Rician, CDF, PDF
   3. Outdoor Propagation – Okumura Model, Hata Model
   4. Hardware based radio set up, communication through wireless channel using hardware platform like SDR
   5. Network topology design using any tool like OMNET++, NS, Cisco Packet Tracer, NetSim
   6. Simple topology, WAN design with few routers, study and configure of protocols
   7. Study of TCP protocol using packet sniffers.
   8. Study of application layer protocols- HTTP.
   9. Client-server communication using socket programming (TCP and UDP).

Textbook(s)
   1. F. Pe´rez Fonta´n and P. Marin˜o Espin˜eira, "Modeling the Wireless Propagation Channel A Simulation Approach with MATLAB, Willey Publications, 2008
   2. A Hands-On Introduction to SDR with USRP and GNU Radio, ETUSS

Reference(s)
   1. B. P. Paris, Simulation of Wireless Communication Systems using MATLAB, Lecture Note, 2007

SEMESTER VI

23CCE387	Software Defined Radio Laboratory (Prerequisite: Signal Processing and Communication Systems Laboratory)	L-T-P-C: 0-0-3-1

Course Objectives
   • To provide hands-on experience on baseband techniques for software defined radio (SDR)
   • To enable configuration and programming for SDR
   • To enable implementation of SDR-based communication systems

Course Outcomes: At the end of the course, the student should be able to
   CO1: carry out performance analysis of baseband techniques for SDR

CO2: implement and evaluate multi-rate signal processing schemes for communication systems

CO3: implement baseband techniques on SDR platform

CO4: demonstrate communication system using SDR

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3			3				3	3		3			3
CO2	3	3	3		3				3	3		3			3
CO3	3	3	3		3				3	3		3			3
CO4	3	3	3		3				3	3		3			3

Syllabus
1. Generation and analysis of real, complex analog signals and digital signals with its time / spectral / water fall / constellation / eye diagram plots. (Simulation and Real time)
2. Creation of LTI system and its performance. (Simulation and Real time)
3. Design and analysis of LPF/HPF/BPF filter. (Simulation and Real time)
4. Amplitude Modulation and demodulation. (Simulation and Real time)
5. Frequency Modulation and demodulation. (Simulation and Real time)
6. Performance analysis of Binary/Quad Phase shift keying modulation and demodulation (Simulation and Real time)
7. Performance analysis of QAM modulation and demodulation-based communication system (Simulation and Real time)
8. Performance study of various wireless channels impairments and recovery. (Simulation and Real time)
9. Simple audio / video streaming and decoding. (Simulation and Real time)
10. Spectrum sensing implementation using SDR hardware (Simulation and Real time)

Textbook(s)
1. Heath Jr, Robert W. Introduction to Wireless Digital Communication: A Signal Processing Perspective. Prentice Hall, 2017.
   Software Tools : PYTHON / C++ / GNU Radio / MATLAB / LABVIEW
   Hardware : USRP / RTL-SDR / ADALM-PLUTO

References(s)
1. www.gnuradio.org
2. https://in.mathworks.com/discovery/sdr.html
3. https://www.ni.com/
4. www.rtl-sdr.com
5. www.ettus.com
6. https://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/adalm-pluto.html#eb-discussions

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23LSE311	LIFE SKILLS FOR ENGINEERS IV	L-T-P-C: 1-0-2-2

Pre-requisite(s): Self-confidence, presentation skills, listening skills, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Help students prepare resumes and face interviews with confidence
- Support them in developing their problem-solving ability
- Assist them in improving their problem solving and reasoning skills
- Enable them to communicate confidently before an audience

Course Outcomes

CO1: Soft Skills: To acquire the ability to present themselves confidently and showcase their knowledge, skills, abilities, interests, practical exposure, strengths and achievements to potential recruiters through a resume, video resume, and personal interview.

CO2: Soft Skills: To have better ability to prepare for facing interviews, analyse interview questions, articulate correct responses and respond appropriately to convince the interviewer of one's right candidature through displaying etiquette, positive attitude and courteous communication.

CO3: Aptitude: To manage time while applying suitable methods to solve questions on arithmetic, algebra and statistics.

CO4: Aptitude: To investigate, understand and use appropriate techniques to solve questionson logical reasoning and data analysis.

CO5: Verbal: To use diction that is less verbose and more precise and to use prior knowledgeof grammar to correct/improve sentences.

CO6: Verbal: To understand arguments, analyze arguments and use inductive/deductivereasoning to arrive at conclusions. To be able to generate ideas, structure them logically and express them in a style that is comprehensible to the audience/recipient.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3		2
CO2								2	3	3		2
CO3		3		2								
CO4		3		2								
CO5										3		3
CO6									3	3		3

Syllabus

Soft Skills

Teamwork: Value of teamwork in organizations, Definition of a team. Why team? Effective team building. Parameters for a good team, roles, empowerment and need for transparent communication, Factors affecting team effectiveness, Personal characteristics of members and its influence on team. Project Management Skills, Collaboration skills.

Leadership: Initiating and managing change, Internal problem solving, Evaluation and co-ordination, Growth and productivity, Importance of Professional Networking.

Facing an interview: Importance of verbal & aptitude competencies, strong foundation in core competencies, industry orientation / knowledge about the organization, resume writing (including cover letter, digital profile and video resume), being professional. Importance of good communication skills,etiquette to be maintained during an interview, appropriate grooming and mannerism.

<u>**Aptitude**</u>

Problem Solving II

Sequence and Series: Basics, AP, GP, HP, and Special Series.

Data Sufficiency: Introduction, 5 Options Data Sufficiency and 4 Options Data Sufficiency.

Logical reasoning: Clocks, Calendars, Cubes, Non-Verbal reasoning and Symbol based reasoning.

Campus recruitment papers: Discussion of previous year question papers of all major recruiters ofAmrita Vishwa Vidyapeetham.

Competitive examination papers: Discussion of previous year question papers of CAT, GRE,GMAT, and other management entrance examinations.

Miscellaneous: Interview Puzzles, Calculation Techniques and Time Management Strategies.

Verbal

Vocabulary: Empower students to communicate effectively through one-word substitution. **Grammar**: Enable students to improve sentences through a clear understanding of the rules ofgrammar.

Reasoning: Facilitate the student to tap his reasoning skills through Syllogisms, critical reasoningarguments and logical ordering of sentences.

Reading Comprehension (**Advanced**): Enlighten students on the different strategies involved intackling reading comprehension questions.

Public Speaking Skills: Empower students to overcome glossophobia and speak effectively andconfidently before an audience.

Writing Skills: Practice formal written communication through writing emails especially composing   job application emails.

References

1. Students" Career Planning Guide, Corporate & Industry Relations, Amrita VishwaVidyapeetham.
2. Soft Skill Handbook, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
3. Adair. J., (1986), "Effective Team Building: How to make * winning team", London, U.K
4. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)
9. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
10. A Modern Approach to Verbal Reasoning – R.S. Aggarwal
11. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations,Amrita Vishwa Vidyapeetham.

12. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
15. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
16. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
17. A Modern Approach to Logical Reasoning, R S Aggarwal.
18. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal

Evaluation Pattern: 50:50

Assessment	Internal	External
Continuous Assessment (CA) – Soft Skills	30	-
Continuous Assessment (CA) – Aptitude	10	25
Continuous Assessment (CA) – Verbal	10	25

Total	50	50

*CA - Can be presentations, speaking activities and tests.

23LIV490	Live-in Lab-II (**Pre-requisite:** Nil)	L-T-P-C: 0-0-9-3

Objectives

- Identify and analyse the various challenge indicators present in the village by applying concepts of Human Centered Design and Participatory Rural Appraisal.
- Assess the user need through quantitative and qualitative measurements
- Design a solution by integrating human centered design concepts
- Devising proposed intervention strategies for sustainable social change management

Course Outcome: At the end of the course, the student should be able to

CO1: learn ethnographic research and utilise the methodologies to enhance participatory engagement.
CO2: prioritize challenges and derive constraints using Participatory Rural Appraisal.
CO3: identify and formulate the research challenges in rural communities.
CO4: design solutions using human centered approach.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3		3		1	1		3	3		3
CO2		3						3	3	3		
CO3		3					1		3	3		3
CO4	3		3				3	3	3	3		3

Syllabus

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.

Thematic Areas

- Agriculture & Risk Management
- Education & Gender Equality
- Energy & Environment
- Livelihood & Skill Development
- Water & Sanitation
- Health & Hygiene
- Waste Management & Infrastructure

The objectives and the projected outcome of the project will be reviewed and approved by the department chairperson and a faculty assigned as the project guide.

Courses offered under the framework of

Amrita Values Programmes I and II

22AVP201   Message from Amma's Life for the Modern World

Amma's messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

22ADM211 Leadership from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

22ADM201 Strategic Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

22AVP204 Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

22AVP205   Message of the Bhagavad Gita

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of Kurukshetra War – The anguish of Arjuna – Counsel by Sri. Krishna – Key teachings of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Concept of Avatar - Relevance of Mahabharata for modern times.

22AVP206 Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda's Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji's life.

22AVP207 Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, AdiShankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri RamanaMaharshi, Mata Amritanandamayi Devi.

22AVP208   Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

22AVP209 Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

22AVP210 Kerala Mural Art and Painting

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

22AVP213 Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is 'Únity in Diversity" and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

22AVP214 Principles of Worship in India

Indian mode of worship is unique among the world civilizations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realization of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

22AVP215   Temple Mural Arts in Kerala

The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, dirties, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhīma and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the Vasthupurusha.

22AVP218 Insights into Indian Classical Music

The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala,- Saptatalas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

22AVP219 Insights into Traditional Indian Painting

The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

22AVP220 Insights into Indian Classical Dance

The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the AbhinavaBharati. The course introduces various styles of Indian classical dance such as Bharatanatyan, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.

22AVP221 Indian Martial Arts and Self Defense

The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala's traditional KalariPayattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

PROFESSIONAL ELECTIVES UNDER SCIENCE STREAM

CHEMISTRY

23CHY240	COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING	L-T-P-C: 3-0-0-3

Course Outcomes:

CO1: Get to understand the structure of molecules using symmetry.

CO2: Understanding Quantum mechanical approach to calculate the energy of a system.

CO3: Applying mathematical knowledge and quantum mechanical approach in finding out the characteristics-reactivity, stability, etc., of the molecule.

CO4: To get a brief idea about molecular mechanics based chemical calculations.CO5: To get an idea about general methodology of molecular modeling.

SyllabusUnit 1

Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber

cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.

Molecular mechanics: Basic theory - Harmonic oscillator – Parameterization - Energy equations - Principle of coupling - Matrix formalism for two masses - Hessian matrix - enthalpy of formation - enthalpy of reactions.

Introduction to Quantum mechanics - Schrodinger equation - Position and momentumMO formation - Operators and the Hamiltonian operator - The quantum oscillator Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2

Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel's MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel's theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel's coefficient matrix - Wheeland's method - Hoffmann's EHTmethod - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3

Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman's theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes

Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction tomolecular simulation - M.D. simulation.

TEXTBOOKS:

K. I. Ramachandran, G Deepa and K Namboori, "Computational Chemistry and Molecular Modeling -Principles and Applications", Springer-Verlag, Berlin, Heidelberg, 2008, ISBN-13 978-3-540-77302-3.

1. *Donald W Rogers, "Computational Chemistry Using PC", Wiley, (2003).*
2. *Alan Hinchliffe, "Chemical Modeling from atoms to liquids", Wiley, (2005).*

REFERENCES:

1. *James B Forseman and Aeleen Frisch-Gaussian, "Exploring Chemistry with Electronic Structure Method", Inc., Pittsburgh, PA, 2nd edition, (2006).*
2. *A C Philips, "Introduction to Quantum mechanics", Wiley, (2003).*
3. *Wolfram Koch, Max C. Holthausen, "A Chemist's guide to Density Functional Theory", Wiley, VCH, 2nd edition, (2001).*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	

*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CHY241	ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES	L-T-P-C: 3-0-0-3

Course Outcomes:

CO1:   Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics CO2: Learn the application of the electrochemical principles for the functioning and fabrication of industrial

batteries and fuel cells

CO3:   Acquire knowledge in solving numerical problems on applied electrochemistry
CO4:   Analysis and practical problem solving in fabrication of batteries and fuel cells
CO5:   Application of concepts and principle in industrial electrochemical processes
CO6:   Evaluation of comprehensive knowledge through problem solving

SyllabusUnit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen

electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicatorand ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler- Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafelplots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed)lead acid), nickel-cadmium, nickel-zinc, nickel- metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Reserve batteries and Fuel cells: Reserve batteries - water activated, electrolyte activated and thermally activated batteries - remote activation - pyrotechnic materials. Fuel Cells: Principle, chemistry and functioning - carbon, hydrogen-oxygen, proton exchange membrane (PEM), direct methanol(DMFC), molten carbonate electrolyte (MCFC) fuel cells and outline of biochemical fuel cells.

Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical

machining of metals and alloys.

TEXTBOOKS:

1. *Derek Pletcher and Frank C. Walsh, "Industrial Electrochemistry", Blackie Academic and Professional, (1993).*
2. *Dell, Ronald M Rand, David A J, "Understanding Batteries", Royal Society of Chemistry, (2001).*

REFERENCES:

1. *Christopher M A, Brett, "Electrochemistry – Principles, Methods and Applications", Oxford University, (2004).*
2. *Watanabe T, "Nano-plating: microstructure control theory of plated film and data base of plated film microstructure", Elsevier, Oxford, UK (2004).*
3. *Kanani N, "Electroplating and electroless plating of copper and its alloy", ASM International, Metals Park, OH and Metal Finishing Publications, Stevenage, UK (2003).*
4. *Lindon David, "Handbook of Batteries", McGraw Hill, (2002).*
5. *Curtis, "Electroforming", London, (2004).*

6. Rumyantsev E and Davydov A, *"Electrochemical machining of metals"*, Mir, Moscow, (1989).

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CHY242	FUELS AND COMBUSTION	L-T-P-C: 3-0-0-3

Course Objectives:

To provide the basic knowledge about fuels, rocket propellants and explosives.

Course Outcomes:

CO1:   Understand the types of fuels and variation in their properties
CO2:   Able to analyze the fuel content

CO3:   Obtain knowledge in identifying a proper fuel as per the requirement
CO4:   Ability to know the preparation and working of propellants and explosives

SyllabusUnit 1

Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing -flow test, smoke points, storage and handling.

Secondary liquid fuels - Gasoline, diesel, kerosene and lubricating oils. Liquid fuels - refining, cracking, fractional distillation, polymerization. Modified and synthetic liquid fuels. ASTM methods of testing the fuels.

Unit 2

Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression, engines, octane number, fuels forjet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

Unit 3

Combustion: Stochiometry, thermodynamics. Nature and types of combustion processes - Mechanism - ignition temperature, explosion range, flash and fire points, calorific value, calorific intensity, theoretical flame temperature. Combustion calculations, theatrical air requirements, flue gas analysis, combustion kinetics – hydrogen - oxygen reaction and hydrocarbon - oxygen reactions.

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

TEXTBOOK:

1. *Fuels and Combustion, Samir Sarkar, Orient Longman Pvt. Ltd, 3rd edition, 2009.*

REFERENCES:

1. *Fuels - Solids, liquids and gases - Their analysis and valuation, H. Joshua Philips, Biobliolife Publisher, 2008.*
2. *An introduction to combustion: Concept and applications - Stephen R Turns, Tata Mc. Graw Hill, 3rd edition, 2012.*
3. *Fundamentals of Combustion, D P Mishra, 1st edition, University Press, 2010*
4. *Engineering Chemistry - R. Mukhopadhyay and Sriparna Datta, Newage International Pvt. Ltd, 2007.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23CHY243 | GREEN CHEMISTRY AND TECHNOLOGY | L-T-P-C: 3-0-0-3 |

Course Objectives:

1. Understand the principles of green chemistry and its contribution to the development of sustainable products
2. Possess knowledge of the migration from a hydrocarbon-based economy to carbohydrate-based economy
3. Evaluate the deficiencies of traditional process and acknowledge the invent of new processes
4. Distinctly map the culmination of academic research to industrial chemistry

Course Outcomes:

CO1:   Understand the evolving concept of Green Chemistry and its application to the manufacture of sustainableproducts

CO2:   Appreciate the need for Renewable energy and Feed stock along with carbon sequestration through thefundamentals of Green Chemistry Techniques

CO3:   Develop a coherence to evaluate systematic deficiencies in traditional Chemical science process and products CO4: Undertake a purposeful Journey through the microscopic domain of academic research to the macroscopic

domain of Industrial chemistry

SyllabusUnit 1

Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990,USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept ofzero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Unit 2

Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behaviour and solvent attributes of supercritical CO_2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO_2 fixation, green plastics, green oxidations, etc.

Unit 3

Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

REFERENCES:

1. *Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell*

      Publishing.

2. *Anastas, P. T., Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press Inc., New York, 1998.*

3. *Matlack, A. S. Introduction to Green Chemistry Marcel Dekker: New York, NY, 2001.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CHY244	INSTRUMENTAL METHODS OF ANALYSIS	L-T-P-C: 3-0-0-3

Course Outcomes:

CO1: To develop an understanding of principle and working of the range of instrumental methods in analyticalchemistry

CO2: To provide an understanding and skills in contemporary methods of separation and appropriate selection ofinstruments for the successful analysis of chemical compounds

CO3: To impart skills in the scientific method of planning, conducting, reviewing, reporting experiments andproblem solving in chemical analysis.

SyllabusUnit 1

Error Analysis and Sampling: Accuracy - Precision - Classification of Errors -Minimization of errors - Standard

deviation - Coefficient of variance - F-test - t-test - Significant figures. Sampling - Basis of sampling, Sampling andphysical state - Safety measures of sampling.

Separation Techniques: Brief out line of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2

Gas chromatography - principle and applications – gel chromatography.

Electroanalytical techniques: Potentiometry - Potentiometric titration - determination of equivalence point - acidbase, complexometric, redox and precipitation titrations - merits and demerits. Voltammetry - Cyclic voltammetry -basic principle and application - Polarography - introduction - theoretical principles - migration current - residual current - half wave potential - instrumentation - analytical applications.

Unit 3

Spectro-chemical techniques: UV-VIS spetrophotometry - principle - Beer's Law application - photometric titration - single and double beam spectrophotometer - instrumentation of IR - sample handling - IR applications - H - NMR - Instrumentation and applications – principle - instrumentation - applications of atomic absorption spectroscopy.

Thermal and Diffraction techniques: Principles and applications of DTG - DTA DSC - X-ray - Electron DiffractionStudies - SEM, TEM.

TEXTBOOKS:

1. *Willard H W, Merritt J R, "Instrumental Methods of Analysis", 6th edition, Prentice Hall, (1986).*
2. *Skoog Douglas A, West Donald, "Fundamentals of Analytical Chemistry", 7th edition, New York Addison, Wesley, (2001).*

REFERENCES:

1. *"Vogel's Textbook of Quantitative Chemical Analysis", 5th edition, ELBS, (1989).*
2. *Kaur. H, "Instrumental Methods of Chemical Analysis", Goel Publisher, (2001).*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CHY245	BATTERIES AND FUEL CELLS	L-T-P-C: 3-0-0-3

Course Objective:

To provide sound knowledge on the application of electrochemistry in energy storage systems.

Course Outcome

CO1:   Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics CO2:   Learn the application of the electrochemical principles for the functioning and fabrication industrial batteries

and fuel cells

CO3:   Analysis of practical problem solving in fabricating batteries and fuel cells
CO4:   Evaluation of comprehensive knowledge through problem solving

SyllabusUnit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen

electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicatorand ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler- Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafelplots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other

components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.

Fuels for Fuel Cells: Hydrogen, methane, methanol - Sources and preparation, reformation processes for hydrogen –clean up and storage of the fuels – use in cells, advantages and disadvantages of using hydrogen as fuel.

TEXTBOOKS:

1. *Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, (2001).*
2. *M. Aulice Scibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India (2006).*

REFERENCES:

1. *Kanani N, 'Electroplating and electroless plating of copper and its alloy', ASM International, Metals Park,*

OH and Metal Finishing Publications, Stevenage, UK (2003).

2. *Curtis, 'Electroforming', London, (2004).*
3. *F. Barbir, 'PEM fuel cells: theory and practice', Elsevier, Burlington, MA, (2005).*
4. *G. Hoogers, 'Fuel cell handbook', CRC, Boca Raton, FL, (2003).*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CHY246	CORROSION SCIENCE	L-T-P-C: 3-0-0-3

Course Outcome:

CO1: Development of skill in identifying the nature and type of corrosionCO2: Understanding the mechanism of various types of corrosion

CO3: Analysing the problem and find out a solution to combat corrosion in any sort of environment.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	-	-	-	-	-	-	-	3	1	-	-
CO2	-	3	1	2	-	-	-	-	-	-	-	1	1	2	-	-
CO3	-	3	3	3	2	3	3	-	-	-	-	1	3	2	3	-

SyllabusUnit 1

Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2

Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.Corrosion

Inhibitors: Passivators - Vapour phase inhibitor.

Unit 3

Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.

Corrosion protection: Automobile bodies – engines – building construction.

TEXTBOOKS:

1. *Fontana and Mars G, "Corrosion Engineering", 3rd edition, McGraw Hill, (1987).*
2. *Uhlig H H and Reviees R W, "Corrosion and its Control", Wiley, (1985).*

REFERENCES:

1. *ASM Metals Handbook, "Surface Engineering", Vol. 5, ASM Metals Park, Ohio, USA, (1994).*
2. *ASM Metals Handbook, "Corrosion", Vol. 13, ASM Metals Park, Ohio, USA, (1994).*
3. *Brain Ralph, "Material Science and Technology", CRC Series, Boston, New York.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

PHYSICS

23PHY240	ADVANCED CLASSICAL DYNAMICS	L-T-P-C: 3-0-0-3

Course Outcomes:

CO1: Able to use the Lagrangian formalism to solve simple dynamical system

CO2: Able to understand Hamiltonian formalism and apply this in solving dynamical systems

CO3: Able to apply Lagrangian formalism in bound and scattered states with specific reference to Kepler's lawsand Scattering states

CO4: Able to solve problems in the Centre of Mass frame and connect it to Laboratory Frame of ReferenceCO5: Understand and solve problems in rigid body rotations applying of Euler's equations.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	0	0	0	0	1	0	0	0
CO2	3	3	1	1	0	0	0	0	0	0	0	1	0	0	0
CO3	3	3	3	1	0	0	0	0	0	0	0	1	0	0	0
CO4	3	3	3	1	0	0	0	0	0	0	0	2	0	0	0
CO5	3	3	3	2	0	0	0	0	0	0	0	2	0	0	0

SyllabusUnit 1

Introduction to Lagrangian dynamics

Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D'Alembert's principle and Lagrange's equation, simple applications of the Lagrangian formulation, variational principles and Lagrange's equations, Hamilton's principles, derivation of Lagrange's equations from Hamilton's principle, conservation theorems and symmetry properties.

Unit 2

Central field problem

Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square lawof force, motion in time in Kepler's problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler's theorem on the motion of a rigid body.

Unit 3

Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.

Practical rigid body problems

Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite maneouvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity- gradient stabilization.

TEXTBOOKS:

1. *H. Goldstein, Classical Mechanics, Narosa Publishing House, New Delhi, 1980, (Second Edition)*
2. *H. Goldstein, Charles Poole, John Safko, Classical Mechanics, Pearson education, 2002 (Third Edition)*
3. *Howard D. Curtis, Orbital Mechanics for Engineering Students, Elsevier, pp.475 - 543*
4. *Anderson John D, Modern Compressible flow, McGraw Hill.*

REFERENCE BOOKS:

1. *D. A. Walls, Lagrangian Mechanics, Schaum Series, McGraw Hill, 1967.*
2. *J. B. Marion and S. T. Thornton, Classical dynamics of particles and systems, Ft. Worth, TX: Saunders, 1995.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23PHY241	ELECTRICAL ENGINEERING MATERIALS	L-T-P-C: 3-0-0-3

Course Outcomes

CO1: To understand the nature of interaction between atoms in crystalline solid materials that determines their dielectric, magnetic and electrical properties.

CO2: Analyze the relation between the macroscopic dielectric constant and the atomic structure of an insulator.

CO3: Fundamental concepts of magnetic fields required to illustrate the magnetic dipoles. This forms the basis to understand the magnetic properties of dia, para, ferro, antiferro and ferri magnetic materials.

CO4: Fundamentals concerned with conduction mechanism in metals and superconductors.

CO5: Understand the basics for classification of materials based on its conductivity, nature of chemical bonds inSi and Ge, carrier density, energy band structure and conduction mechanism in intrinsic and extrinsic semiconductors.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1											1	-
CO2	2	2	2										1	-
CO3	2	2	2										2	-
CO4	2	2	2										2	-
CO5	2	2	2					2					1	-

SyllabusUnit 1

Conducting materials: The nature of chemical bond, crystal structure Ohm's law and the relaxation time, collisiontime, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it'sconsequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2

Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and it's applications.

Unit 3

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of

the p-n junction rectifier, the n-p-n transistor.

TEXTBOOK:

1.   A J Decker, *"Electrical Engineering materials", PHI, New Delhi, 1957.*

REFERENCES:

1. *A J Decker, "Solid State Physics", Prentice Hall, Englewood Cliffs, N J 1957.*
2. *C Kittel, "Introduction to solid state Physics", Wieley, New York, 1956 (2nd edition).*
3. *Allison, Electronic Engineering materials and Devices, Tata Mc Graw Hill*
4. *F K Richtmyer E H Kennard, John N Copper, "Modern Physics", Tata Mc Graw Hill, 1995 (5th edition).*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23PHY242	PHYSICS OF LASERS AND APPLICATIONS	L-T-P-C: 3-0-0-3

Unit 1

Review of some basic concepts and principle of laser.

Introduction to light and its properties: Reflection, refraction, interference, diffraction and polarization. Photometry

– calculation of solid angle. Brewster's law. Snell's law and, its analysis.

Introduction to LASERS: Interaction of radiation with matter - induced absorption, spontaneous emission, stimulated emission. Einstein's co-efficient (derivation). Active material. Population inversion – concept and discussion about different techniques. Resonant cavity.

Unit 2

Properties of LASERS

Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadeningin gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3

Types of LASERS

Solid state LASER: (i) Ruby LASER – principle, construction, working and application. (ii) Neodymium (Nd) LASERS. gas LASER: (i) He-Ne LASER - principle, construction, working and application. (i) CO_2 LASER - principle, construction, working and application.

Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.

Applications in Communication field:

LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.

Applications of LASERS in other fields:

Holography: Principle, types, intensity distribution, applications. laser induced fusion. Harmonic generation. LASER spectroscopy. LASERS in industry: Drilling, cutting and welding. Lasers in medicine: Dermatology, cardiology, dentistry and ophthalmology.

REFERENCES:

1. *William T Silfvast, "Laser Fundamentals", Cambridge University Press, UK (2003).*

2. *B B Laud, "Lasers and Non linear Optics", New Age International (P) Ltd., New Delhi.*

3. *Andrews, "An Introduction to Laser Spectroscopy (2e)", Ane Books India (Distributors).*

4. *K R Nambiar, "Lasers: Principles, Types and Applications", New Age International (P) Ltd., New Delhi.*

5. *T Suhara, "Semiconductor Laser Fundamentals", Marcel Dekker (2004).*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23PHY243	CONCEPTS OF NANOPHYSICS AND NANOTECHNOLOGY	L-T-P-C: 3-0-0-3

Course Outcomes

CO1: Understand, Comprehend and acquaint with concepts of NanoPhysics

CO2: To familiarize the material's property changes with respect to the dimensional confinements.

CO3: Acquire knowledge on the modern preparation process and analysis involved in the nanomaterial's research CO4: To learn about the technological advancements of the nano-structural materials and devices in the engineering

applications

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2												
CO2	2	3												
CO3				3										
CO4						3	2					1		

Syllabus Unit 1

Introduction

Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

Concept of quantum confinement and phonon confinement

Basic concepts – excitons, effective mass, free electron theory and its features, band structure of solids. Bulk to nano transition – density of states, potential well - quantum confinement effect – weak and strong confinement regime.

Electron confinement in infinitely deep square well, confinement in two and three dimension. Blue shift of band gap

- effective mass approximation. Vibrational properties of solids - phonon confinement effect and presence of surface modes.

Unit 2

Tools for characterization:

Structural – X-ray diffraction, transmission electron microscope,scanning tunneling microscope, atomic force microscope. Optical - UV – visible absorption and photoluminescence techniques, Raman spectroscopy.

Nanoscale materials – properties and applications:

Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

Unit 3

Field emission and shielding – computers – fuel cells – chemical sensors – catalysis – mechanical reinforcement. Quantum dots and Magnetic nanomaterials – applications.

Nanoelectronics and nanodevices:

Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

TEXTBOOKS:

1. *Robert W. Kelsall, Ian W. Hamley and Mark Geoghegan, Nanoscale Science and Technology, John Wiley and Sons Ltd 2004.*
2. *W. R. Fahrner (Ed.), Nanotechnology and Nanoelectronics, Springer 2006.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23PHY244	PHYSICS OF SEMICONDUCTOR DEVICES	L-T-P-C: 3-0-0-3

Course Outcomes:

CO1: Understand, comprehend and acquaint with the basics working principles and governing equations ofelectronic devices like diodes, Bipolar junction transistors, Mosfet and heterojunction transistors

CO2: Analyze and Solve physics problems pertaining to various process like charge conduction across semiconductor device.

CO3: Apply the knowledge for the development and design of new methods to determine semiconductorparameters and devices

SyllabusUnit 1

Introduction: Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects

Electrical conductivity: Classical free electron theory – assumptions, drift velocity, mobility and conductivity, drawbacks. quantum free electron theory – Fermi energy, Fermi factor, carrier concentration. Band theory of solids –origin of energy bands, effective mass, distinction between metals, insulators and semiconductors.

Unit 2

Theory of semiconductors: Intrinsic and extrinsic semiconductors, band structure of semiconductors, carrier concentration in intrinsic and extrinsic semiconductors, electrical conductivity and conduction mechanism in semiconductors, Fermi level in intrinsic and extrinsic semiconductors and its dependence on temperature and carrier concentration. Carrier generation - recombination, mobility, drift-diffusion current. Hall effect.

Theory of p-n junctions – diode and transistor:p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, current, electric field, barrier potential. V-I characteristics, junction capacitance and voltage breakdown.

Unit 3

Bipolar junction transistor, p-n-p and n-p-n transistors: principle and modes of operation, current relations. V-I characteristics. Fundamentals of MOSFET, JFET. Heterojunctions – quantum wells.

Semiconducting devices: Optical devices: optical absorption in a semiconductor, e--hole generation. Solar cells – p-n junction,

conversion efficiency, heterojunction solar cells. Photo detectors – photo conductors, photodiode, p-i-n diode. Light emitting diode (LED) – generation of light, internal and external quantum efficiency.

Modern semiconducting devices: CCD - introduction to nano devices, fundamentals of tunneling devices, design considerations, physics of tunneling devices.

TEXTBOOKS:

1. *C Kittel, "Introduction to Solid State Physics", Wiley, 7th Edn., 1995.*
2. *D A Neamen, "Semiconductor Physics and Devices", TMH, 3rd Edn., 2007.*

REFERENCES:

1. *S M Sze, "Physics of Semiconductor Devices", Wiley, 1996.*
2. *P Bhattacharya, "Semiconductor Opto- Electronic Devices", Prentice Hall, 1996.*
3. *M K Achuthan & K N Bhat, "Fundamentals of Semiconductor Devices", TMH, 2007.*
4. *J Allison, "Electronic Engineering Materials and Devices", TMH, 1990.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23PHY245	ASTROPHYSICS	L-T-P-C: 3-0-0-3

Course Outcomes:

After completion of the course students should be able to

CO1:   Get a broad knowledge of scientific and technical methods in astronomy and astrophysics.CO2:Apply mathematical methods to solve problems in astrophysics.

CO3:   Develop critical/logical thinking, scientific reasoning and skills in the area of modern astrophysics.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3											1		
CO2	2	2												
CO3	1	2												

SyllabusUnit 1

Historical introduction: Old Indian and western – astronomy - Aryabhatta, Tycho Brahe, Copernicus, Galileo - Olbers paradox - solar system – satellites, planets, comets, meteorites, asteroids.

Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Celestial mechanics - Kepler's laws - and derivations from Newton's laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Unit 2

Stellar astronomy: H-R diagram, color-magnitude diagram - main sequence - stellar evolution – red giants, white dwarfs, neutron stars, black holes - accretion disc - Schwartzchild radius - stellar masses Saha–Boltzman equation -derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system

- measurement of relative masses and velocities. Interstellar clouds - Nebulae.

Unit 3

Galactic astronomy: Distance measurement - red shifts and Hubble's law – age of the universe, galaxies – morphology

- Hubble's classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.

Relativity: Special theory of relativity - super-luminal velocity - Minkowski space - introduction to general theory of relativity – space - time metric, geodesics, space-time curvature. Advance of perihelion of Mercury, gravitational lens.

Cosmology: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - planklength and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

REFERENCES:

1. *"Textbook of Astronomy and Astrophysics with elements of Cosmology", V. B. Bhatia, Narosa publishing 2001.*
2. *William Marshall Smart, Robin Michael Green "On Spherical Astronomy", (Editor) Carroll, Bradley W Cambridge University Press ,1977*
3. *Bradley W. Carroll and Dale A. Ostlie. "Introduction to modern Astrophysics" Addison-Wesley, 1996.*
4. *Bradley W. Carroll and Dale A. Ostlie, "An Introduction to Modern Astrophysics" Addison-Wesley*

Publishing Company,1996

> 5. *'Stellar Astronomy' by K. D Abhayankar.*
> 6. *'Solar Physics' by K. D Abhayankar.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

MATHEMATICS

23MAT240	STATISTICAL INFERENCE	L-T-P-C: 3-0-0-3

Syllabus

Unit 1

Introduction to Statistics: Data Collection and Descriptive Statistics, Populations and Samples, describing data sets, summarizing data sets, Normal Data Sets, Paired Data Sets and the Sample Correlation Coefficient. Review of Random Variables and Distributions, Distributions of Sampling Statistics, The Sample Mean, The Central Limit Theorem, The Sample Variance, Sampling Distributions from a Normal Population, Distribution of the Sample Mean, Joint Distribution of $\bar{X}$ and S^2, Sampling from a Finite Population.

Unit 2

Parameter Estimation: Introduction, Maximum Likelihood Estimators, Interval Estimates, Estimating the Difference in Means of Two normal populations, Approximate Confidence Interval for the Mean of a Bernoulli random variable, Confidence Interval of the Mean of the Exponential Distribution, Evaluating a Point Estimator, The Bayes Estimator. Hypothesis Testing: Introduction, Significance Levels, Tests Concerning the Mean of a Normal Population, Testing the Equality of Means of Two Normal Populations, Hypothesis Tests Concerning the Variance of a Normal Population, Tests Concerning the Mean of a Poisson Distribution.

Unit 3

Regression: Introduction, Least Squares Estimators of the Regression Parameters, Distribution of the Estimators, Statistical Inferences about the Regression Parameters, the Coefficient of Determination and the Sample Correlation Coefficient, Analysis of Residuals, transforming to Linearity, Weighted Least Squares, Polynomial Regression, Multiple Linear Regression, Predicting Future Responses, Logistic Regression Models for Binary Output Data.

TEXTBOOK:

1.　　　　　*Ross S.M., Introduction to Probability and Statistics for Engineers and Scientists, 3rd edition, Elsevier Academic Press.*

REFERENCES:

1. *Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons Inc., 2005*
2. *Ravichandran, J. Probability and Statistics for engineers, First Reprint Edition, Wiley India, 2012.*
3. *Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 8th Edition, Pearson Education Asia, 2007.*

4. Hogg, R.V., Tanis, E.A. and Rao J.M., *Probability and Statistical Inference, Seventh Ed*, Pearson Education, New Delhi.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23MAT241	INTRODUCTION TO GAME THEORY	L-T-P-C: 3-0-0-3

Syllabus

Unit 1

Elements of Game theory, examples, Strategic Games, 2 Player Strategy Games, payoffs, Minimax, Weak and Strong Domination, Saddle Points, Nash Equilibrium, Prisoner's Dilemma, Stag Hunt, Matching pennies, BOS, Multi NE, Cooperative and Competitive Games, Strict and Non Strict NE, Best response functions for NE.

Unit 2

Combinatorial games, Winning and losing positions, Subtraction Game, 3-Pile and K-Pile Games, Proof of Correctness, Variations of K-Pile Games, Graph Games, Construction, Proof of finiteness, SG theorem for sum of games.

Unit 3

Cournot's Oligopoly, Bertrand's Oligopoly, Electoral Competition, Median Voter Theorem, Auctions, role of knowledge, Decision making and Utility Theory, Mixed Strategy Equilibrium, Extensive Games with Perfect Information, Stackelberg's model of Duopoly, Buying Votes, Committee Decision making, Repeated Gmes, Prisoner's Dilemma, Supermodular Game and Potential games

TEXTBOOK:

1.   Martin Osborne, An Introduction to Game Theory, Oxford University Press.

REFERENCES:

1. *Thomas Ferguson, Game Theory, World Scientific, 2018.*
2. *Stef Tijs. Introduction to Game Theory, Hindustan Book Agency.*
3. *Allan MacKenzie, Game Theory for Wireless Engineers, Synthesis Lectures On Communications.*

Evaluation Pattern

Assessment	Internal	End Semester

Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23MAT242	NUMERICAL METHODS AND OPTIMIZATION	L-T-P-C: 3-0-0-3

Syllabus

09 (a) Roots finding methods:

Roots of Transcendental and Polynomial Equations: Bisection method, Iteration methods based on first degree equation, Rate of convergence, system of nonlinear equations.

09 (b) Interpolations:

Interpolation and Approximation: Lagrange, Newton's Divided Difference, Newton's Forward and Backward interpolations.

07 (b) Multivariable optimization (2 Credits)

Optimality criteria – unidirectional search – direct search methods – gradient based methods. Lagrangian and Kuhn-Tucker conditions.

TEXTBOOK:

1. *Edwin K.P. Chong, Stanislaw H. Zak, "An introduction to Optimization", 2nd edition, Wiley, 2013.*
2. *M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical methods for scientific and Engineering computation, New Age International Publishers, 2007, 5th edition.*

REFERENCES:

1. *Kalyanmoy Deb, "Optimization for Engineering Design: Algorithms and Examples, Prentice Hall, 2002.*
2. *S.S. Rao, "Optimization Theory and Applications", Second Edition, New Age International (P) Limited Publishers, 1995.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	

*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

FREE ELECTIVES OFFERED UNDER MANAGEMENT STREAMCOMMON TO ALL PROGRAMS

23MNG331	FINANCIAL MANAGEMENT	L-T-P-C: 3-0-0-3

Course Objectives

- Understand the overview of financial management
- Inculcate methods and concepts on valuation
- Familiarize with working capital management, financial analysis and planning

Course Outcomes

CO1: Understand and apply time value concept of money and use this for investment criteria decisions.

CO2: Evaluate the risk and return for various alternatives of investment.

CO3: Apply the capital budgeting techniques and evaluate the investment decisions.

CO4: Understand working capital management, cash and liquidity management and financial statements**. CO/PO**

Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3					1	1		3	3	1			
CO2	3	3					2	1		3	3	1			
CO3	3	2					1	1		3	3	1			
CO4	3	2			1		2	1	2	3	3	1			

SyllabusUnit 1

Introduction: Financial Management an overview – Financial Decisions in a firm – Goal of FM – Function of the financial system.

Unit 2

Fundamental Valuation Concepts:Time value of money – Risk and Return. Capital Budgeting: Techniques of capital budgeting investment criteria– NPV – Benefit Cost Ratio – IRR – Payback Period – ARR – Investment appraisal inPractice – Estimation of Project cost flows.

Unit 3

Working Capital Management: Current Assets – Financing Ruling – Profit Criterion. Cash and Liquidity Management. Working Capital Financing.

Financial Analysis and Planning**:** financial instruments, sources of long-term, intermediate term and short term finance. Analyzing Financial Performance – Break – even analysis and Leverages – Financial Planning and Budgeting.

Mergers and Takeovers-International trade.

TEXT BOOKS

1. *Chandra, P., 'Financial Management: Theory and Practice', 9e, TMH, 2017*.
2. *Denzil Watson & Antony Head, 'Corporate Finance- Principles and Practice', 2e, Pearson Education Asia, 2016.*
3. *R L Varshney& K L. Maheshwari, 'Managerial Economics', S Chand & Sons, 22e, 2014.*

REFERENCE BOOKS

1. *Stephen Blyth, 'An Introduction to Corporate Finance ',McGraw Hill Book Company, 2014.*
2. *Eugene F. Brigham & Louis C.Gapenski, 'Financial Management – Theory and Practice',14e, 2015.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

23MNG332	SUPPLY CHAIN MANAGEMENT	L-T-P-C: 3-0-0-3

Course Objectives

- Understand the complexity and key issues in supply chain management.
- Describe logistics networks, distribution planning, routing design and scheduling models.
- Familiarize dynamics of supply chain and the role of information in supply chain.
- Understand the issues related to strategic alliances, global supply chain management, procurement andoutsourcing strategies.

Course Outcomes

CO1: Analyze the complexity and key issues in supply chain management

CO2: Evaluate single and multiple facility location problems, logistics network configuration, vehicle routing and scheduling models

CO3: Analyze inventory management models and dynamics of the supply chain

CO4: Develop the appropriate supply chain through distribution requirement planning and strategic alliances

CO5: Identify the issues in global supply chain management, procurement and outsourcing strategies

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1									1	3		
CO2	2	2	3	1						1	1	2	2		
CO3	3	3	3	3	2				3	1	1	3	2		
CO4	2	2	1	1						1	1	2	2		
CO5	3	3	3	1					3	1	1	3	2		

SyllabusUnit 1

Introduction: Introduction to SCM-the complexity and key issues in SCM – Location strategy – facility locationdecisions – single facility and multiple location models.

Logistics: Logistics Network Configuration – data collection-model and data validation- solution techniques-network configuration DSS – Transport strategy – Service choices: single service and inter modal services – vehicle routingand scheduling models – traveling salesman problems – exact and heuristic methods.

Unit 2

Inventory: Inventory Management and risk pooling-managing inventory in the SC. Value of Information-bullwhipeffect-lead time reduction.

Supply Chain Integration: Supply chain integration-distributed strategies-push versus pull systems. Distribution Requirements Planning – DRP and demand forecasting, DRP and master production scheduling. DRP techniques –time-phased order point – managing variations in DRP – safety stock determination-Strategic alliances-third partylogistics-distribution integration.

Unit 3

Issues in SCM**:** Procurement and outsourcing strategies – framework of e-procurement. International issues in SCM-regional differences in logistics. Coordinated product and supply chain design-customer value and SCM.

TEXT BOOK

Simchi-Levi,D.,Kaminsky,P.,Simchi-Levi,E., Shankar,R., 'Designing and Managing the Supply Chain: Concepts,Strategies, and Cases', Tata McGraw Hill, 2008.

REFERENCE BOOKS

1. *Christopher, M., 'Logistics and Supply Chain Management: Strtegies for reducing Cost and Improving Service', PH, 1999.*
2. *Ballou, M., 'Business logistics / Supply chain management', Pearson Education, 2003.*
3. *Vollmann, T.E., 'Manufacturing Planning and Control for Supply Chain Management', 5e, McGraw Hill, 2005.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

23MNG333	MARKETING MANAGEMENT	L-T-P-C: 3-0-0-3

Course Objective

To educate the students to apply concepts and techniques in marketing so that they become acquainted with the duties of a marketing manager with an emphasis to make the students exposed to the development, evaluation, and implementation of marketing management in a variety of business environments.

Course Outcomes

On successful completion of the Course students will be able to:

CO1: Illustrate key marketing concepts, theories and techniques for analysing a variety of marketing situations

CO2: Identify and demonstrate the dynamic nature of the environment in which marketing decisions are taken and appreciate the implication for marketing strategy determination and implementation

CO3: Develop the ability to carry out a research project that explores marketing planning and strategies for aspecific marketing situation

CO4: Understand the need and importance of sales promotions and make use of advertising

CO5: Manage a new product development process from concept to commercialization.

CO6: Illustrate the importance of modern trends in retailing and marketing logistics

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			3	1								1			
CO2		1	3	3		2	1			2	2	2			
CO3	1	1	1	3	2	2	2		2	2	2	3			
CO4			2	2		2	1	1		3	3	3			

CO5	1	1	3	2		1	1			1	2	3			
CO6	1	1	3	2		1	1			1	2	3			

SyllabusUnit 1

Marketing Process: Definition, Marketing process, dynamics, needs, wants and demands, value and satisfaction, marketing concepts, environment, mix. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

Buying Behaviour and Market Segmentation: Major factors influencing buying behaviour, buying decision process, businessbuyingbehaviour. Segmenting consumer and business markets, market targeting.

UNIT 2

Product Pricing and Marketing Research: Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT 3

Developing New Products - Challenges in new-product Development - Effective organizational arrangements - Managing the development Process: ideas - Concept to strategy - Development to commercialization – The consumer- adoption process.

Advertising Sales Promotion and Distribution: Characteristics, impact, goals, types, and sales promotions- point of

purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TEXT BOOKS

1. *Kolter, P.,'Marketing Management', Pearson Education 2001.*
2. *Ramasamy and Namakumari, 'Marketing Environment: Planning, implementation and control the Indian context', 1990.*

REFERENCE BOOKS

1. *Paul, G.E. and Tull, D., 'Research for marketing decisions', Prentice Hall of India, 1975.*
2. *Tull, D.S. and Hawkins, 'Marketing Research', Prentice Hall of Inida-1997.*
3. *Kotler, P. and Armstrong, G., 'Principles of Marketing' Prentice Hall of India, 2000.*
4. *Skinner, S.J., 'Marketing', All India Publishers and Distributes Ltd. 1998.*
5. *Govindarajan, M., 'Industrial marketing management', Vikas Publishing Pvt. Ltd, 2003.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

23MNG334	PROJECT MANAGEMENT	L-T-P-C: 3-0-0-3

Course Objectives

- To discuss the project life cycle and build a successful project from pre-implementation to completion.
- To introduce different project management tools and techniques

Course Outcomes

CO1: Appraise the selection and initiation of individual projects and its portfolios in an enterprise.
CO2: Analyze the project planning activities that will predict project costs, time schedule, and quality.
CO3: Develop processes for successful resource allocation, communication, and risk management.

CO4: Evaluate effective project execution and control techniques that results in successful project completion

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	1				2		3	1	2	3	2
CO2	2	3	3	2	2				3		3	2	2	3	3
CO3	1	2	3	2	2				2		3	2	1	2	3
CO4	1	1	2		1				2		3	1	1	1	2

SyllabusUnit 1

Overview of Project Management: Verities of project, Project Features, Project Life Cycle – S-Curve, J-C **Project Selection:** Project Identification and Screening – New ideas, Vision, Long-term objectives, SWOT Analysis (Strength, Weakness, Opportunities, Threats).

Project Appraisal – Market Appraisal, Technical Appraisal, Economic Appraisal, Ecological Appraisal, and Financial Appraisal – Payback, Net Present Value (NPV), Internal Rate of Returns (IRR).

Project Selection – Decision Matrix, Technique for Order Preference using Similarity to Ideal Solution (TOPSIS), Simple Additive Weighting (SAW).

Unit 2

Project Presentation: WBS, Project Network – Activity on Arrow (A-O-A), Activity on Node (A-O-N).**Project Scheduling:** Gant Chart, Critical Path Method (CPM), Project Evaluation & Review Technique (PERT).**(6hrs)**

Linear time cost trade-offs in project - Direct cost, indirect cost, Project crashingResource Consideration - Profiling, Allocation, Levelling.

Introduction to project management software: Primavera/ Microsoft project

Unit 3

Project Execution: Monitoring control cycle, Earned Value Analysis (EVA), Project Control – Physical control, Human control, financial control.

Organizational and Behavioral Issues: Organizational Structure, Selection-Project Manager, Leadership Motivation, Communication, Risk Management.

Project Termination: Extinction, Addition, Integration, Starvation.

TEXT BOOKS

1. *Jack R. Meredith and Samuel J. Mantel, Jr. - 'Project Management- A Managerial Approach' Eighth Edition - John Wiley & Sons Inc - 2012.*
2. *Arun Kanda – 'Project Management-A Life Cycle Approach' PHI Learning Private Limited - 2011*

REFERENCE BOOKS

1. 'A Guide to Project Management Body of Knowledge' PMBOK GUIDE, Sixth edition, Project management Institute – 2017
2. Ted Klastrorin - 'Project Management, Tools, and Trade-Offs' - John Wiley – 2011

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

| 23MNG335 | ENTERPRISE MANAGEMENT | L-T-P-C: 3-0-0-3 |

Course Objectives

- To impart knowledge on the fundamentals of costing, pricing methods and strategies.
- To give an overview of production operations planning.
- To summarize various quantitative methods of plant location, layout and lean manufacturing.
- To familiarize the concepts of e-commerce, e-purchasing, MRP and ERP in business

Course Outcomes

At the end of the course, the student will be able to:

CO1: Understand the concepts of cost and pricing of goods and appraise project proposals

CO2: Design and analyze manufacturing and service processes and to measure the work performed.

CO3: Understand and analyze the key issues of supply chain Management

CO4: Understand the application of lean manufacturing tools and six sigma concepts

CO5: Select appropriate plant location and their layout methods

CO6: Create capacity plan, aggregate plan, schedule, ERP & MRP systems

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1							2	2			
CO2	2	1								1		2	1		1
CO3	2	1										2	1		1
CO4	2	1	1	1						1		2	1		1
CO5	2	1		1								2			
CO6	2	2	1	1							1	2	1		1

SyllabusUnit 1

Engineering Economics: cost concepts - types of costs - cost functions. Cost controls: reduction – tools & applications.Pricing policies – methods – problems.Process design and improvement – process capacity – process layout – process reengineering

– job design. Work standards – work measurement – work sampling – problems.

Unit 2

Supply Chain Management – Basic Concepts, SC dynamics, push-pull boundary, integrated supply chain, logistics, customer relationship, supplier relationship – selection, rating and development, procurement, SC metrics and performance measurement - problems. Lean Manufacturing – concepts, wastes – tools viz., pull system, standardized work, takt time, kanban system, JIT, kaizen, SMED, 5S, value stream mapping, benefits of lean and implementation issues. Introduction to Six Sigma. Plant Location – globalization, factors affecting location decisions, facility location- Break-even method, rectilinear, factor-rating and centre of gravity – problems. Plant Layout – types, process layout, product layout, Systematic layout planning (SLP), Line Balancing problems. Capacity Planning – Aggregate Planning

– importance, planning process, methods – problems.

Unit 3

Role of IT in business performance improvement – e-commerce – e-purchasing –Master Production Schedule, inventory lot sizing strategies, MRP basics – MRP explosion, Available to Promise(ATP) inventory – MRP calculations – MRP II – Scheduling – Gantt chart – Introduction to ERP – ERP software – ERP modules – ERP implementation.

TEXT BOOKS

1. *L J Krajewski, L.P.RitzmanMalhotra.M and Samir K. Srivastava, 'Operations Management: Processes and Value chains, 11e, Pearson, 2015.*
2. *R L Varshney& K L. Maheshwari, 'Managerial Economics', S Chand & Sons, 22e, 2014.*

REFERENCE BOOKS

1. *Richard B. Chase, Ravi Shankar, F. Robert Jacobs, 'Operations and Supply Chain Management' McGraw Hill Education (India) Private Limited.14e, 2017.*
2. *E S Buffa and R K Sariss, 'Modern Production/Operations Management', Wiley India Private Limited, 8e, 2007.*
3. *Harrison.B, Smith.C., and Davis.B.,, 'Introductory Economics', 2e Pr Macmillan, 2013.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports.

23MNG336	OPERATIONS RESEARCH	L-T-P-C: 3-0-0-3

Course Objectives

Familiarizing the students with quantitative tools and techniques, which are frequently applied in operational decisions

Course Outcomes

CO1:   Formulate operations research models to optimize resources.

CO2:   Solve transportation and assignment problems using suitable techniques.

CO3:   Apply appropriate technique to analyze a project with an objective to optimize resources.

CO4:   Solve operational problems using decision theory approaches.

CO5:   Select suitable inventory model for effective utilisation of resources.

CO6:   Solve Operations Research problems using software package

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2		2						2	2	2		
CO2	3	2	2		2						2	2	2		
CO3	3	2	2		2						2	2	2		
CO4	3	2	2		2						2	2	2		
CO5	3	2	2		2						2	2	2		
CO6	3	2	2		2						2	2	2		

SyllabusUnit1

Linear Programming: Formulations - graphical solutions - Simplex Method - Duality, Dual simplex method.Transportation model: Assignment model – Travelling Salesman Problem.

Unit 2

Decision Theory: Decision Trees. Game theory - 2 person zero sum; mixed strategies; 2 x n and m x 2 games. Network Models- Project Networks- CPM / PERT- Project Scheduling – crashing networks and cost considerations-Resource

leveling and smoothing - shortest route problem, minimal spanning tree problem, maximal flow problem.

Unit 3

Sequencing model – 2 machines 'n' jobs, 'm' machines 'n' jobs – n jobs 2 machines.

Inventory models: deterministic & probabilistic models. Quantity discounts. Selective Inventory Management Queuing models: Poisson arrival and exponential service times. Single server, multi-server. Queues -infinite and finite capacity queues.

Simulation –Monte Carlo simulation: simple problems

Lab session: Practicing case problems with excel solver/MatLab/LINGO package

TEXT BOOK

Hillier, F .S. and Lieberman, G .J, 'Operations Research', 9e, McGraw Hill, 2010

REFERENCE BOOKS

1. *Taha,H.A., 'Operations Research: an Introduction', 8e, Prentice Hall, New Delhi, 2008.*
2. *Ravindran, A., Phillips, D.J., and Solberg, J.J., 'Operations Research- Principles and Practice', John Wiley& Sons, 2005.*
3. *Wagner, H.M., 'Principles of Operations Research', Prentice Hall, New Delhi, 1998.*

4. Hardley, G.,'Linear Programming', Narosa Book Distributors Private Ltd 2002.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	10	
Periodical 2	10	
*Continuous Assessment (Theory) (CAT)	15	
*Continuous Assessment(Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignments, Projects, and Reports

| 23MEE321 | INDUSTRIAL ENGINEERING | L-T-P-C: 3-0-0-3 |

Course Objectives

- To inculcate the concepts of work study and its application to industrial practice
- Impart skills to design, develop, implement, and improve manufacturing/service systems

Course Outcomes

At the end of the course, the student will be able to

CO1: Create value to organizations through the analysis, evaluation, and improvement of work systems using work study and method study

CO2: Develop work systems through motion economy principles

CO3: Apply work measurement techniques to improve productivity, fix wages and incentives

CO4: Apply systematic layout planning techniques and work station design principles based on ergonomics andmaterial handling.

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1						1		3	2		
CO2	2	1	2	1	1					1		3	2		
CO3	1	2		1	1						1	3	2		
CO4	2	2		1	2						2	3	2		

SyllabusUnit 1

Work System: Elements of work, maintenance of machines, interaction, effect of working conditions and environment, physical and mental fatigue.

Productivity: Productivity, factors affecting production, Measurement of productivity.

Work Study: Definition and scope of work study; Areas of application of work study in industry; Human aspects ofwork study.

Method Study: Information collection, recording techniques, and processing aids; critical examination; development, installation and maintenance of improved methods.

Unit 2

Motion Economy and Analysis: Principles of motion economy; Motion analysis; Micromotion and Memomotion study; Therbligs and SIMO charts; Normal work area and design of work places; Basic parameters and principles of work design.

Work Measurement: Work measurement techniques; Calculation of standard time, work sampling and predetermined Motion time systems.

Wages and Incentive Schemes: Introduction, wage payment of direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour

Unit 3

Plant Layout: Concept of plant layout, types of layout; factors affecting plant layout.

Ergonomics: Ergonomic Design of equipment and work place. work station design, factors considered in designing a work station, ergonomic design standards - Study of development of stress in human body and their consequences. Case Studies. Production planning and scheduling.

Material Handling: Introduction and functions of material handling equipment, selection of material handling equipment for different requirements, safety requirements.

Recent advances in Industrial Engineering.

TEXT BOOKS

1. *Barnes, R, "Motion and Time Study" - Design and Measurement of Work . NY: John Wiley and Sons, 8th Edition, 1985.*
2. *"Introduction to Work Study", 4ed, International Labor Office, Geneva, 2006.*

REFERENCE BOOKS

1. *Martand T. Telsang, 'Industrial Engineering and Production Management' S Chand; 2nd Rev Edn 2006.*
2. *Mahajan M., "Industrial Engineering and Production Management" Dhanpat rai and Sons Publishers, 2005.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continues Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

23MEE323	MANAGERIAL STATISTICS	L-T-P-C: 3-0-0-3

Course Objective

To impart the knowledge of basic statistical tools for analysis and interpretation of qualitative and quantitativedata for decision making

Course Outcomes

CO1: Apply basic probability and statistics concepts for various business problems

CO2: Perform test of hypothesis

CO3: Compute and interpret the result of regression and correlation analysis for forecasting

CO4: Solve real time problems by applying different decision making methods.

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3		2	2						2	2	3		
CO2	3	3		2	2						2	2	3		
CO3	3	3		2	2						2	2	3		
CO4	3	3		2	2						2	2	3		

SyllabusUnit 1

Quantitative methods: Basic terminology in probability, probability rules, conditions of statistical dependence and independence, Bayes Theorem, Discrete Random Variables review of probability distributions, measure of central tendency.

Sampling and sampling distributions: Introduction to sampling, random sampling, design of experiments, introduction to sampling distributions

Estimation: point estimates, interval estimates and confidence intervals, calculating interval estimates of mean from large samples, using t test, sample size estimation**.**

Unit 2

Testing hypothesis: Introduction, basic concepts, testing hypothesis, testing when population standard deviation is known and not known, two sample tests.

Chi-square and analysis of variance: introduction, goodness of fit, analysis of variance, inferences about a population variation

Unit 3

Regression and correlation: Estimation using regression line, correlation analysis, finding multiple regression equation, modelling techniques,

Non parametric methods and time series and forecasting: Sign test for paired data, rank sum test, rank correlation, Kolmogrov – smirnov test, variations in time series, trend analysis, cyclic variation, seasonal variation and irregular variation. Decision theory**:** Decision tree analysis

TEXT BOOKS

1. *Levin R. I. and Rubin D. S. - 'Statistics for management' - Pearson Education – 2007 - 5th Edition*
2. *Montgomery D. C. and Runger G. C. - 'Applied Statistics and Probability for Engineers' - John Wiley & Sons - 2002 - 3rd Edition*

REFERENCE BOOKS

1. *Bain.L. J. and Engelhardt M. - 'Introduction to Probability and Mathematical Statistics' - Duxbury Press -*

March 2000 - 2nd Edition

2. *Hinkelmann K. and Kempthorne O. - 'Design and Analysis of Experiments : Volume I' - John Wiley & Sons, Inc. - December 2007 - 2nd Edition*
3. *Johnson R. A. and Wichern D. W. - 'Applied Multivariate Statistical Analysis' - Prentice-Hall, Inc. - December 2001 - 5th Edition*
4. *Myers R. H. - 'Classical and Modern Regression with Applications' - PWS-Kent Publishing Company - March 2000 - 2nd Edition*
5. *Devore J. L. - 'Probability and Statistics for Engineering and the Sciences' - Brooks/Cole Publishing Company - December 1999 - 5th Edition*
6. *Freund J. E. and Walpole R. E. - 'Mathematical Statistics' - Prentice-Hall Inc. - October 1986 - 4th Edition*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

23MEE323	TOTAL QUALITY MANAGEMENT	L-T-P-C: 3-0-0-3

Course Objective

To impart knowledge on quality management principles, tools, techniques and quality standards for real lifeapplications

Course Outcomes

CO1: Evaluate the principles of quality management and to explain how these principles can be applied withinquality management systems.

CO2: Evaluate the performance measures using various quality and management tools

CO3: Apply the Quality Function Deployment, Taguchi principles, Total Productive Maintenance and Failure Mode and Effect Analysis concepts to solve industrial problems.

CO4: Practice the various quality system in industry.

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2										2	2		
CO2	1	2										2	2		
CO3	2	2	2									2	2		
CO4	2	2	2	2								2	2		

SyllabusUnit 1

Definition of quality - dimensions of quality. Quality planning - quality costs. Total Quality Management: historical review and principles –leadership - quality council - quality statements - strategic planning - Deming philosophy.Barriers to TQM implementation

Unit 2

Customer satisfaction – Customer retention - Employee involvement - Performance appraisal - Continuous process improvement - Supplier partnership - Performance measures. Seven tools of quality.Statistical fundamentals - Control Charts for variables and attributes - Process capability - Concept of six sigma - New seven management tools

- Benchmarking**.**

Unit 3

Quality function deployment (QFD) - Taguchi quality loss function - Total Productive Maintenance (TPM) - FMEA.Need for quality systems - ISO 9000:2000 – Elements of quality systems (such as ISO 9000:2000). Implementation of quality system – documentation - quality auditing - QS 9000-ISO 14000

TEXT BOOK

Besterfiled D. H. - 'Total Quality Management' - Pearson Education Asia – 2015-4th Edition

REFERENCE BOOKS

1. *Evans J. R, and Lidsay W. M. - 'The Management and Control of Quality' - Southwestern (Thomson Learning) - 2002 - 5th Edition*
2. *Feigenbaum A. V. - 'Total Quality Management - Vol I &II ' – McGraw Hill - 1991*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

23MEE324	LEAN MANUFACTURING	L-T-P-C: 3-0-0-3

Course Objectives

- Understand Lean manufacturing principles and tools
- Inculcate the concepts of value stream mapping
- Familiarize lean implementation practices

Course Outcomes

CO1: Identify key requirements and concepts in lean manufacturing.

CO2: Initiate a continuous improvement change program in a manufacturing organization**CO3:** Analyze and improve a manufacturing system by applying lean manufacturing tools**CO4:** Build value stream map for improving the productivity

CO5: Improve productivity through lean practices

CO/PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2											2	2		
CO2	2	2	2	1					2	1		1	2		1
CO3	2	2	2	2	1				2	1		1	2	1	2
CO4	2	2	2	1	1	1	1			1		2	2	1	1
CO5	2	2	2	1	1	1	1			1		2	2	1	1

SyllabusUnit 1

Introduction to Lean and Factory Simulation: History of Lean and comparison to other methods - The 7 Wastes, their causes and the effects - An overview of Lean Principles / concepts / tools - Stockless Production.

The Tools of Lean Manufacturing: Continuous Flow – Continuous Flow Manufacturing and Standard Work Flow –5S and Pull Systems (Kanban and ConWIP systems) – Error Proofing and Set-up Reduction – Total Productive Maintenance (TPM) – Kaizen Event examples. Toyota production systems.

Ford production systems – FPS gear model

Unit 2

Value Stream Mapping – Current state: Preparation for building a Current State Value Stream Map – Building a Current State Map (principles, concepts, loops, and methodology) – Application to the factory Simulation scenario.

Unit 3

Value Stream Mapping – Future State: Key issues in building the Future State Map – Process tips in building the map and analysis of the customer loop, supplier loop, manufacturing loop and information loop – Example of completedFuture State Maps – Application to factory simulation

Implementation of lean practices - Best Practices in Lean Manufacturing.

TEXT BOOKS

1. Womack, J.P., Jones, D.T., and Roos, D.,'The Machine that Changed the World', Simon & Schuster, New York, 2007.
2. Liker, J.K., 'Becoming Lean', Industrial Engineering and Management Press, 1997.

REFERENCES BOOKS

1. Womack, J.P. and Jones, D.T.,'Lean thinking', Simon & Schuster, USA, 2003.
2. Rother, M. and Shook, J., 'Learning to see', The Lean Enterprise Institute, Brookline, USA, 2003.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1	15	
Periodical 2	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignments, Projects, and Reports

23CSE321	SOFTWARE PROJECT MANAGEMENT	L-T-P-C: 3-0-0-3

Course Objectives

- This course describes the key aspects of a software project.
- It introduces the basic principles of Engineering Software Projects. Most, if not all, students' complete projects as part of assignments in various courses undertaken. These projects range in size, subject and complexity but there are basic project essentials that need to be understood and practiced for successful team project outcomes.
- The course provides an understanding of the purpose, methods and benefits of process management by exposing the student to the concepts, practices, processes, tools and techniques used in process managementfor software development.

Course Outcomes

CO 1: To understand the basic concepts, terminologies and issues of software project management.

CO 2: To apply appropriate methods and models for the development of solutions.

CO 3: To analyze the cost-benefits of calculations so as to optimize the selection strategy**CO 4:** To evaluate methods, models and technologies towards achieving project success**CO 5:** To design and evaluate network planning models with criticality

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1								1		3	2
CO2	3	2	3						3	3		2	3	2
CO3	3	2	2	3	2	2	2	2	3	3	2	2	3	2
CO4	2	2	2	1	3	2	2	2	3	3		2	3	2
CO5	3	2	3	3	3	2	2	2	3	3		2	3	2

SyllabusUnit 1

Introduction to Software Project Management- Software Projects - ways of categorizing software projects – problems with software projects - Project Life Cycle– Management -Setting objectives –Stakeholders - Project Team- Step-wise

: An overview of project planning -project Evaluation –Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis-Object Point-COCOMO.

Unit 2

Activity planning-- project schedules - sequencing and scheduling projects - Network planning model – AON andAOA-identifying critical activities-Crashing And Fast Tracking-,Risk management—Categories , Risk planning, Management and Control - Evaluating risks to the schedule. PERT- Resource Allocation, Monitoring and Tracking -Monitoring and control - allocation - identifying resource requirements - scheduling resources - creating critical paths

- publishing schedule - cost schedules- sequence schedule.

Unit 3

Monitoring and control – Visualizing Progress, Earned value analysis, managing people and organizing teams-organizational structures- Planning for small projects. Case Study: PMBOK , Agile Development

TEXT BOOK(S)

Mike Cotterell, Bob Hughes. Software Project Management, Fifth Edition, Tata McGraw-Hill; 2012.

REFERENCE(S)

1. *Roger S. Pressman. Software Engineering – A Practioner's Approach, Eighth Edition, Tata McGraw-Hill publishers; 2014.*
2. *Jalote P. Software Project Management in practice, Second edition, Person Education; 2003.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23CSE322 | FINANCIAL ENGINEERING | L-T-P-C: 3-0-0-3 |

Pre-Requisite(s): 19MAT112 Linear Algebra, 19MAT205 Probability and Random Processes

Course Objectives

- This course serves as an introduction to financial engineering including cash flows, financial decision making etc
- It gives a thorough yet highly accessible mathematical coverage of standard and recent topics of introductory investments: fixed-income securities, modern portfolio theory, optimal portfolio growth and valuation ofmulti-period risky investments.

Course Outcomes

CO1: Apply basic concepts to understand and evaluate cash flows

CO2: Evaluate and arrive at a financial investment decision employing the underlying knowledge of stocks andderivatives

CO3: Analyse and design Portfolio selection methods

CO4: Understand capital market theory for stock performance evaluation

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			2								3	2
CO2	2	3	1										3	2
CO3	1	3			2								3	2
CO4	2	1											3	2

SyllabusUnit 1

Cash Flows and Fixed income securities: Investments and markets - Principal and interest - Present and future valuesof streams - IRR. Fixed income securities - Market value for future cash - Bond value - Bond details – Yields – Convexity – Duration - Immunization. Bond portfolio management - Level of market interest rates, Term structureof interest-rate theories.

Unit 2

Stocks and Derivatives: Common stock valuation - Present value of cash dividends - Earnings approach - Value versus price - Efficient markets theory - Technical analysis. Analysis of financial statements. Derivatives - futures and options

- Black Scholes formula - Utility functions - Applications in financial decision making.

Unit 3

Portfolio analysis and capital market theory: Covariance of returns – Correlation - Portfolio return - Portfolio standard deviation - Two asset case - Efficient frontier - Optimum portfolio. Capital market theory - Capital market line - Sample diversifications to reduce risk - Characteristic line - Capital asset pricing model. Arbitrage price theory - Stock performance evaluation.

TEXT BOOK(S)

1. *David Luenberger, Investment Science. Second Edition, Oxford University Press; 2013*
2. *Jack Clark Francis, Richard W. Taylor. Investments, Schaum's Outlines, Tata McGraw Hill ;2006.*

REFERENCE(S)

1. Lyuu YD. Financial Engineering and Computation. Cambridge University Press; 2004.
2. Perry H. Beaumont. Financial Engineering Principles. John Wiley and Sons Inc, New Jersey; 2004.

Evaluation Pattern

Assessment	Internal	External
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CSE323	ENGINEERING ECONOMIC ANALYSIS	L-T-P-C: 3-0-0-3

Course Objectives

- Prepare engineering students to analyze and understand the business, impact of economic environment onbusiness decisions

Course Outcomes

CO1: Understand and evaluate the economic theories, cost concepts and pricing policies and draw inferences forthe investment decisions for appraisal and profitability

CO2: Appraise the dynamics of the market and market structures and portray implication for profit and revenuemaximization

CO3: Employ operations research and allied techniques in managerial economics for an enhanced analysis anddecision making

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2		2		2			3	2	3	2
CO2	1	3	2	1		2		2			3	2	3	2
CO3	2	3	2	2		2		2			3	2	3	2

SyllabusUnit 1

Economics: Nature and scope of managerial economics. Economic theory and managerial economics, Cost Concepts: Types of costs - Cost functions. Cost controls: reduction – Tools & Areas. Pricing policies- methods. Capital budgeting

- cost of capital. Appraising project profitability

Unit 2

The essentials of demand and supply: The law of demand. Market demand curve. Other determinants of market demand. The law of supply. Determinants of market supply. The market mechanism. Price elasticity of demand, Profit and revenue maximization: Optimal input combination. Total revenue maximization.

Unit 3

Market structure: Perfect competition and monopoly. Characteristics of monopolistic competition. Oligopoly Operations Research techniques in managerial economics: Inventory models. Theory of games. Decision theory, Risk and Uncertainty, Measuring risk, Consumer behavior and risk aversion, Decision making under uncertainty with complete ignorance

TEXT BOOK(S)

Webster, T.J. Managerial Economics- Theory and Practice, Elsevier; 2004.

REFERENCE(S)

1. *Panneerselvam, R. Engineering Economics, Second Edition, PHI; 2013.*
2. *R L Varshney,K L. Maheshwari. Managerial Economics, S Chand & Sons;2014.*
3. *Harrison.B, Smith.C., and Davis.B. Introductory Economics, Second Edition, Pr Macmillan; 2013.*

Evaluation Pattern

Assessment	Internal	External
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CSE324	INFORMATION SYSTEMS	L-T-P-C: 3-0-0-3

Course Objectives

- This course is to expose the students to the managerial issues relating to information systems and alsounderstand the role of Business Process Reengineering technique in an organization.
- The course also focus on the management of information technology to provide efficiency and effectiveness or strategy decision making.

Course Outcomes

CO1: Understand the fundamental concepts of Information Systems in business.

CO2: Understand and analyse the strategic role played by Information Systems in e-commerce.

CO3: Analyse management challenges in Global Businesses predominantly dependent on IS functions.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3												3	2
CO2	2	2			2								3	2
CO3	1	3			2	2					2	1	3	2

SyllabusUnit 1

Introduction to IS -Fundamental concepts-IS in Business- Role of IS –Information system and technologies – Components of IS –resources and acivities –Types of IS- E business Applications –Role of BI and Analytics in IS-Functional Business Systems - Marketing Systems, Manufacturing systems, Human Resource Systems, AccountingSystems and Financial Management Systems.-Cross-Functional Enterprise Systems Cross-Functional Enterprise Applications, Enterprise Application Integration, Transaction Processing Systems and Enterprise Collaboration Systems. Enterprice Business Systems CRM, ERP, SCM , Case Studies

Unit 2

Electronic Commerce Systems : Scope of e-Commerce, Essential e-Commerce Processes and Electronic Payment Processes - E-commerce Applications & Issues -Decision Support Systems- Business and Decision Support, Decision Support Trends, Management Information Systems, Online Analytical Processing, Decision Support Systems, Executive

Information Systems, Enterprise Portals and Decision Support - Knowledge Management Systems. Artificial Intelligence Technologies and its application in Business- Strategic role of IT- Competing with IT, valuechain ,reengineering, virtual organization ,knowledge creation-Organizational Planning, The Scenario Approach, Planning for Competitive Advantage, SWOT Business Models and Planning, Business IT Planning, -Business/ ITStrategies and Business Application Planning- Developing and Implementing Business Systems - ImplementationChallenges- barriers - change management- : Case Studies

Unit 3

Management challenges-Security, Ethical and Societal Challenges- Ethical Responsibility of Business Professionals, Computer Crime, Privacy Issues, Health Issues, and Societal Solutions- Security Management of IT- Tools of security Management, Internetworked Security Defenses, other security measures –system controls and audits- Enterprise and Global Management of IT- Managing the IS Function and Failures in IT Management - Global IT Management, Cultural, Political and Geo-economic Challenges, Global Business/IT Strategies, Global Business/IT Applications,Global IT Platforms, Global Data Access Issues and Global Systems Development –Case studies

TEXT BOOK(S)

1. O'Brien JA, Marakas GM. Management information systems. McGraw-Hill Irwin; 2006.
2. Brien,Marakas G M and Behi R , MIS,9th edition, Tata McGraw Hill Special Indian Edition;2010.

REFERENCE(S)

Laudon K, Laudon JP. Management Information Systems;2010

Evaluation Pattern

Assessment	Internal	External
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

FREE ELECTIVES OFFERED UNDER HUMANITIES / SOCIAL SCIENCE STREAMSCOMMON TO ALL PROGRAMS

23CUL230	ACHIEVING EXCELLENCE IN LIFE -AN INDIAN PERSPECTIVE	L-T-P-C: 2-0-0-2

Course Objectives:

The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilitiesfor manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspectiveof Personality Enrichment through pragmatic approach of self analysis and application.

SyllabusUnit 1

Goals of Life – Purusharthas

What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life & Professional life; Followed by a Goal setting workshop;

Yogic way of Achieving Life Goals – (Stress Free & Focused Life)

Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop);Experiencing life through its Various Stages

Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2

Personality Development

What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental

/ Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;

Learning Skills (Teachings of Amma)

Art of Relaxed Learning; Art of Listening; Developing 'Shraddha' – a basic qualification for obtaining Knowledge; Communication Skills - An Indian Perspective;

Unit 3

Developing Positive Attitude & Friendliness - (Vedic Perspective);

Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);

Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);

REFERENCE BOOKS:

1. *Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9*
2. *Complete works of Swami Vivekananda (Volumes 1 to 9)*
3. *Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)*
4. *Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)*
5. *Message of Upanishads, by Swami Ranaganathananda published by Bharatiya Vidya Bhavan, Bombay.*
6. *Personality Development – Swami Vivekananda published by Advaitha Ashram, Kolkatta.*
7. *Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay*
8. *Will Power and its Development- Swami Budhananda published by Advaitha Ashram, Kolkatta*
9. *Ultimate Success - Swami Ramakrishnananada Puri published by Mata Amritanandamayi Math, Kollam*
10. *Yoga In Daily Life - Swami Sivananda – published by Divine Life Society*
11. *Hindu Dharma - H. H. Sri Chandrasekharandra Saraswati published by Bharatiya Vidya Bhavan, Bombay*
12. *All about Hinduism – Swami Sivananda - Published by Divine Life Society*
13. *The Mind and its Control by Swami Budhananda published by Advaitha Ashram, Kolkatta*
14. *Krida Yoga - Vivekananda Kendra, Publication.*
15. *Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi*

16. *New perspectives in Stress Management - Dr H R Nagendra & Dr R Nagaratna published by Swami Vivekananda Yoga Prakashana, Bangalore.*
17. *Mind Sound Resonance Technique (MSRT) Published by Swami Vivekananda Yoga Prakashana, Bangalore.*
18. *Yoga & Memory - Dr H R Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CUL231	EXCELLENCE IN DAILY LIFE	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

1. The anatomy of 'Excellence'. What is 'excellence'? Is it judged by external factors like wealth?
2. The Great Flaw. The subject-object relationship between individual and world. Promote subject enhanceexcellence.
3. To work towards excellence, one must know where he is. Our present state... An introspective analysis.Our faculties within.

Unit 2

4. The play of the mind. Emotions – convert weakness into strength.
5. The indispensible role of the intellect. How to achieve and apply clear thinking?
6. The quagmire of thought.The doctrine of Karma – Law of Deservance.
7. Increase Productivity, reduce stress.. work patterning.

Unit 3

8. The art of right contact with the world. assessment, expectations.
9. Myths and Realities on key issues like richness, wisdom, spirituality.
10. Collect yourself, there is no time to waste. The blue-print of perfect action.

REFERENCES:

The Bhaja Govindam and the Bhagavad Gita.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23CUL232 | **EXPLORING SCIENCE AND TECHNOLOGY IN ANCIENT INDIA** | **L-T-P-C: 2-0-0-2** |

OBJECTIVES:

This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as well as actual techniques.

SyllabusUnit 1

1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2

1. Astronomy & mathematics in Jain and Buddhist literature;
2. The transition to the Siddhantic period; Aryabhata and his time;
3. The Aryabhatiya: concepts, content, commentaries;
4. Brahmagupta and his advances;
5. Other great Siddhantic savants;
6. Bhaskara II and his advances;

Unit 3

1. The Kerala school of mathematics;
2. The Kerala school of astronomy;
3. Did Indian science die out?;
4. Overview of recent Indian scientists, from S. Ramanujan onward;
5. Conclusion: assessment and discussion;

TEXTBOOK:

Indian Mathematics and Astronomy: Some Landmarks, by S. Balachandra Rao

REFERENCE:

IFIH's interactive multimedia DVD on Science & Technology in Ancient India.

Evaluation Pattern

| Assessment | Internal | End Semester |

Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23CUL233	YOGA PSYCHOLOGY	L-T-P-C: 2-0-0-2

OBJECTIVES:

This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. The course includes experiential components centering on meditation and spiritual practice.

SyllabusUnit 1

Introduction

Introduction to Modern Psychology

A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

Introduction to Indian Psychology

What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of allYoga-schools.

Patanjali Yoga Sutra – 1

Introduction to Rishi Patanjali - Bird view of Yoga-Sutra - Definition of Yoga – Vrittis.

Patanjali Yoga Sutra – 2

Five Kinds of Vrittis - Pramanam - sources of right knowledge - Viparyayah – unfolded belief - Vikalpah – Unfoldedbelief - Smriti – Memory.

Unit 2

Patanjali Yoga Sutra – 3

Two formulae - Necessity of Abhyasah and Vairagyah - Foundation of Abhyasah - Foundation of Vairagyah.

Patanjali Yoga Sutra – 4

Introduction to Samadhi - Samprajnata-Samadhi - Reasoning in Samprajnata-Samadhi - Reflection in Samprajnata-Samadhi - Bliss in Samprajnata-Samadhi - Sense of Individuality in Samprajnata-Samadhi.

Patanjali Yoga Sutra – 5

Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.

Patanjali Yoga Sutra – 6

How to make mind peaceful? - Cultivating opposite virtues: happiness – friendliness - misery – compassion - virtue

– gladness - vice – indifference.

Patanjali Yoga Sutra – 7

Five causes of Pain - avidya – ignorance (Root Cause) - asmita – 'I-Feeling' – raga – attraction - dwesha – repulsion

- abhinivesha – clinging to life.

Unit 3

Patanjali Yoga Sutra – 8

Necessity of Yoga practice - eight parts of Yoga practice - five Yamas: ahimsa – satya – asteya – brahmacharyam

– aparigraha.

Patanjali Yoga Sutra – 9

Five Niyamas: Soucha – Santhosha – Tapas – Swadyah – Ishwara - Pranidhanam.

Patanjali Yoga Sutra – 10

Asanam – Pranayamah - various kinds of Pranayamah - Pratyaharah - Mastery over the senses.Report review Conclusion

REFERENCES:

1. *The course book will be "The four chapters of Freedom" written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.*
2. *"The message of Upanishads" written by Swami Ranganathananda. Published by Bharathiya Vidya Bhavan.*
3. *Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttaranjal.*
4. *'Hatha Yoga Pradipika' Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23ENG230	BUSINESS COMMUNICATION	L-T-P-C: 1-0-3-2

OBJECTIVES:

To introduce business vocabulary; to introduce business style in writing and speaking; to expose students to the cross-cultural aspects in a globalised world; to introduce the students to the art of persuasion and negotiation in business contexts.

Course Outcomes

CO1: Familiarize and use appropriate business vocabulary and etiquettes in verbal communication in the professional context

CO2: Understand organizational structures, pay structures and performance assessments

CO3: Apply language skills in drafting various business documents and other necessary communications in the business context

CO4: Understand and address cross cultural differences in the corporate environment CO5: Participate in planned and extempore enactments of various business situations

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										3		2
CO2									1		1	
CO3										3		
CO4						2						
CO5									2			

Syllabus Unit 1

Business Vocabulary - Writing: Drafting Notices, Agenda, and Minutes - Reading: Business news, Business articles.

Unit 2

Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking:Conversational practice, telephonic conversations, addressing a gathering, conducting meetings.

Unit 3

Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, Group Dynamics, negotiation& persuasion techniques.

Activities

Case studies & role-plays.

BOOKS RECOMMENDED:

1. *Jones, Leo & Richard Alexander. New International Business English. CUP. 2003.*
2. *Horner, David & Peter Strutt. Words at Work. CUP. 1996.*
3. *Levi, Daniel. Group Dynamics for Teams. 3 ed. Sage Publications India Pvt. Ltd. New Delhi, 2011.*
4. *Owen, Roger. BBC Business English. BBC. 1996.*

5. *Henderson, Greta Lafollette & Price R Voiles. Business English Essentials. 7th Edition. Glencoe / McGraw Hill.*
6. *Sweeney, Simon. Communicating in Business. CUP. 2000.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23ENG231 | INDIAN THOUGHT THROUGH ENGLISH | L-T-P-C: 2-0-0-2 |

OBJECTIVES:

To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about thesocietal changes in the recent past.

SyllabusUnit 1

Poems

Rabindranath Tagore's Gitanjali (1-10); Nizzim Ezekiel's Enterprise; A.K. Ramanujam's Small-Scale Reflections

on a Great House.

Unit 2Prose

Khushwant Singh's The Portrait of a Lady; Jhumpa Lahiri's Short Story - Interpreter of Maladies.

Unit 3

Drama and Speech

Vijay Tendulkar's Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru/ S. Radhakrishnan

/ A. P. J. Abdul Kalam's My Vision for India etc. (any speech).

REFERENCES:

1. *Lahiri, Jhumpa. Interpreter of Maladies, Harper Collins Publications, 2000.*
2. *Ramanujan A. K. ed. K. M. George, Modern Indian Literature: An Anthology, Vol. I, Sahitya Akademi, 1992.*
3. *Singh, Khushwant. The Portrait of a Lady: Collected Stories, Penguin, 2009.*
4. *Tagore, Rabindranath. Gitanjali, Penguin Books India Pvt. Ltd, 2011.*
5. *Tendulkar, Vijay. Five Plays, Oxford University Press, 1996.*

Evaluation Pattern

| Assessment | Internal | End Semester |

Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23ENG232 | INSIGHTS INTO LIFE THROUGH ENGLISH LITERATURE | L-T-P-C: 2-0-0-2 |

OBJECTIVES:

To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literary insights; to enhance creative thinking; to promote aesthetic sense.

SyllabusUnit 1

Poems

1. W. H. Auden: Refugee Blues; 2. A. K. Ramanujan: Obituary; 3. William Blake: The LittleBlack Boy; 4. Gieve

Patel: Grandparents at a Family Get–together.

Unit 2

Short Stories

1. Chinua Achebe: Marriage is a Private Affair; 2. Ruskin Bond: The Thief; 3. Isai Tobolsky: Not Just Oranges; 4.K A Abbas: The Refugee

Unit 3Prose

     1. A G Gardiner: On The Philosophy of Hats; 2. Robert Lynd: Mispronunciation

Practicals:

Role plays: The Proposal, Chekov / Remember Ceaser, Gordon Daviot / Final Solutions, Mahesh Dattani, Bookreviews, Movie reviews.

SUGGESTED READING:

The Old Man and the Sea, Hemingway / Any one of the novels of R.K. Narayan, etc.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	

Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23ENG233 | TECHNICAL COMMUNICATION | L-T-P-C: 2-0-0-2 |

OBJECTIVES:

To introduce the students to the elements of technical style; to introduce the basic elements of formal correspondence; to introduce technical paper writing skills and methods of documentation; to improve oral presentation skills in formal contexts.

Course Outcomes:

After the completion of the course the student will be able to:

CO1:   Understand and use the basic elements of formal correspondence and methods of documentationCO2:   Learn to edit technical content for grammatical accuracy and appropriate tone and style

CO3:   Use the library and internet recourses for research purposes

CO4:   Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities

Mapping of course outcomes with program outcomes:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3				
CO2										3				
CO3				1										
CO4									3	3				

Syllabus:

Unit 1

Mechanics of writing: Grammar rules – punctuation - spelling rules - tone and style - graphical Representation.

Unit 2

Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals -reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume.

Unit 3

Technical paper writing: Library research skills - documentation style - document editing – proof reading – formatting.

Practice in oral communication and Technical presentations

REFERENCES:

1. Hirsh, Herbert. L "Essential Communication Strategies for Scientists, Engineers and Technology Professionals". II Edition. New York: IEEE press, 2002
2. Anderson, Paul. V. "Technical Communication: A Reader-Centred Approach". V Edition. Harcourt Brace College Publication, 2003
3. Strunk, William Jr. and White. E B. "The Elements of Style" New York. Alliyan & Bacon, 1999.
4. Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today" VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23ENG234	**INDIAN SHORT STORIES IN ENGLISH**	**L-T-P-C: 2-0-0-2**

OBJECTIVES:

To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio- cultural aspects of the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

Syllabus Unit 1

Introduction: Differences between novel and short stories – origin and development of short stories - Rabindranath

Tagore: Kabuliwallah; Mulk Raj Anand: The Gold Watch.

Unit 2

R. K. Narayan: Sweets for Angels; K. A. Abbas: The Refugee; Khushwant Singh: The Mark of Vishnu.

Unit 3

Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

TEXT:

M. G. Narasimha Murthy (ed), Famous Indian Stories. Hyderabad: Orient Black Swan, 2014

REFERENCE:

Mohan Ramanan (Ed), English and the Indian Short Story: Essays in Criticism, Hyderabad, Orient Black Swan, 2000.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	

*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23FRE230 | PROFICIENCY IN FRENCH LANGUAGE (LOWER) | L-T-P-C: 2-0-0-2 |

SyllabusUnit 1

Population - Identity

How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions; Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) inthe present; Interrogative sentence; Gender of adjectives.

Unit 2

The suburbs - At the train station

Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; Thecity (church, town hall, post office…)

Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3

Paris and the districts - Looking for a room

Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for thetime.

Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:

Metro St Michel - Publisher: CLE international

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	

*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23FRE231	PROFICIENCY IN FRENCH LANGUAGE (HIGHER)	L-T-P-C: 2-0-0-2

SyllabusUnit 1

The first room of a student

A party to celebrate the 1st room; Description of a room; furniture; Locate objects: prepositions (devant, derrière, dans…), Read advertisement; Appreciation (I like, I prefer,).

Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son…); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

Unit 2 Small jobs

Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time. Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur); Prepositions (à, pour, avec …); Pronoun as direct object (le, la, l', les).

Unit 3

University Restaurant

Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choosea menu or diet, Expression of quantities (beaucoup, peu).

Grammar - Partitif (expressing quantity) (du, de la, pas de….); Comparison (plus...que, moins….que, autant …que); Interrogation (continuation), inversion, Est-ce que, qu'est-ce que?.

TEXTBOOK:

Metro St Michel - Publisher: CLE International

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	

Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23GER230	GERMAN FOR BEGINNERS I	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation. Numbers 1-100; Saying the telephone number. Countries and Languages.

Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.

Vocabulary: Professions.

Unit 2

Giving the personal details. Name, age, marital status, year of birth, place of birth, etc.Numbers till 1000. Saying a year. Alphabets – spelling a word.

Filling up an application form; In the restaurant – making an order.

Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article Vocabulary: Food items

Unit 3

Numbers above 1000. Orientation in Shopping plazas: asking the price, where do I find what, saying the opinion.Grammar: Accusative – definite article. Adjectives and plural forms. Vocabulary: Furniture and currencies.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23GER231	GERMAN FOR BEGINNERS II	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form. Vocabulary: Consumables and measurements;

Unit 2

Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing upan appointment.

Grammar: Model verbs; Prepositions with time and place; Ordinal numbers. Vocabulary: Leisure activities, weekdays, months and seasons.

Unit 3

Family and household; Family and relations; household and daily routine. Grammar: Possessive articles; Divisibleand indivisible verbs.

Vocabulary: Family circle; Household articles.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23GER232 | PROFICIENCY IN GERMANLANGUAGE (LOWER) | L-T-P-C: 2-0-0-2 |

Syllabus

To have an elementary exposure to German language; specifically

1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able tocarry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;
5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.

(This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.)Some

useful websites will be given.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23GER233 | PROFICIENCY IN GERMAN LANGUAGE (HIGHER) | L-T-P-C: 2-0-0-2 |

Syllabus

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavourof this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative. Some German culture. Films.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HIN230	HINDI I	L-T-P-C: 2-0-0-2

OBJECTIVES:

To teach Hindi for effective communication in different spheres of life - Social context, Education, governance,Media, Business, Profession and Mass communication.

Course Outcomes:

After the completion of the course the student will be able to:

CO1:   Gain knowledge about the nature and culture of Hindi languageCO2:   Understand the structural aspects of Hindi language

CO3:   Apply the knowledge of the grammatical structures to communicate in HindiCO4:   Analyse the social significance of modern literature.

CO5:   Develop the ability to translate a given text to Hindi

CO-PO Mapping:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									2	3				
CO2									2	3				
CO3									2	3				
CO4										3				
CO5									2					

SyllabusUnit 1

Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindilanguage,

Devanagari script and Hindi alphabet.

Shabda Bhed, Roopanthar ki Drishti se- Bhasha – Paribhasha aur Bhed – Sangya - Paribhasha Aur Bhed - Sangyake Roopanthar - kriya.

Unit 2

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General vocabulary for conversations in given context –understanding proper pronunciation - Conversations, Interviews, Short speeches.

Unit 3

Poems – Kabir 1st 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

Unit 4

Letter writing – personal and Formal – Translation from English to Hindi.

Unit 5

Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juloos.

BOOKS:

1. *Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi*
2. *Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi*
3. *Kamtha Prasad Guru : Hindi Vyakaran, Best Book pub House, New Delhi*
4. *Poetry : Kavya Ras - Ed: T.V. Basker - Pachouri Press; Mathura*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23HIN231 | HINDI II | L-T-P-C: 2-0-0-2 |

OBJECTIVES:

Appreciation and assimilation of Hindi Literature both drisya & shravya using the best specimens provided as anthology.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understand the grammatical structures of Hindi CO2: Understand the post modern trends of literature CO3: Enhance critical thinking and writing skills

CO4: Identify and analyse different literary and audio-visual material

CO5: Apply fundamental knowledge of Hindi in formal and informal writing

CO-PO Mapping:

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									1	2				
CO2									1	2				
CO3									1	2				
CO4										3				
CO5									1	2				

Syllabus:

Unit 1

Kavya Tarang; Dhumil ke Anthim Kavitha [Poet-Dhumil]; Dhabba [Poet-Kedarnath Singh]; Proxy [Poet-Venugopal]; Vakth [Poet-Arun Kamal]; Maachis [Poet-Suneeta Jain].

Unit 2

Communicative Hindi - Moukhik Abhivyakthi

Unit 3

Audio-Visual Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. Newsreading and presentations in Radio and TV channels in Hindi.

Unit 4

Gadya Manjusha – Budhapa, Kheesa, Sadachar ka Thavis

Unit 5

Translation: Theory and Practice - Letter writing: Formal and Personal – Introduction to Hindi Software.

BOOKS:

1.   Kavay Tarang: Dr. Niranjan, Jawahar Pusthakalay, Mathura.

2.   Gadya Manjusha: Editor: Govind, Jawahar Pusthakalay, Mathura

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23HUM230 | EMOTIONAL INTELLIGENCE | L-T-P-C: 2-0-0-2 |

Syllabus

Unit 1

Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

Unit 2

Components of Emotional Intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills. Emotional Intelligence Competencies, Elements of Emotional Intelligence, Models of Emotional Intelligence: The Ability-based Model, The Trait Model of Emotional Intelligence, Mixed Models of Emotional Intelligence.

Unit 3

Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost–savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

REFERENCES:

1. *Daniel Goleman (1996). Emotional Intelligence- Why it can Matter More than IQ. Bantam Doubleday Dell Publishing Group*
2. *Daniel Goleman (2000). Working with Emotional Intelligence. Bantam Doubleday Dell Publishing Group*
3. *Liz Wilson, Stephen Neale & Lisa Spencer-Arnell (2012). Emotional Intelligence Coaching. Kogan Page India Private Limited*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM231	GLIMPSES INTO THE INDAN MIND -THE GROWTH OF MODERN INDIA	L-T-P-C: 2-0-0-2

Syllabus Unit 1
Introduction

General Introduction; 'His + Story' or 'History' ?; The concepts of 'nation', 'national identity' and 'nationalism';Texts and Textualities: Comparative Perspectives.

Unit 2

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;

Unit 3

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; JawaharlalNehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao;

V.S. Naipaul.

Conclusion.

REFERENCES:

1. *Tilak, Bal Gangadhar. The Orion / Arctic Home in the Vedas.*
2. *Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.*
3. *Vivekananda, Swami. "Address at the Parliament of Religions"/"The Future of India"/"In Defence of Hinduism" from Selections from the Complete Works of Swami Vivekananda.*
4. *Aurobindo, Sri. The Renaissance in India / On Nationalism.*
5. *Coomaraswamy, Ananda K. Essays in Indian Idealism (any one essay) / Dance of Shiva.*
6. *Nivedita, Sister. "Noblesse Oblige: A Study of Indian Caste" / "The Eastern Mother" from The Web of Indian Life.*
7. *Gandhi, Mahatma. Hind Swaraj.*
8. *Nehru, Jawaharlal. "The Quest" from Discovery of India.*
9. *Ambedkar, B. R. "Buddha and His Dhamma" from Collected Works.*
10. *Saraswati, Chandrasekharendra. "The Sastras and Modern Life" from The Hindu Dharma.*
11. *Dharampal. Bharatiya Chitta, Manas and Kala / Understanding Gandhi.*

12. *Naipaul, V. S. India: A Wounded Civilization / India: A Million Mutinies Now.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM232	GLIMPSES OF ETERNAL INDIA	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction

A peep into India's glorious past

Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira's ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism

– the sixteen Mahajanapadas and the beginning of Magadhan paramountcy - Kautilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2

India's contribution to the world: spirituality, philosophy and sciences

Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.

The arrival of Europeans, British paramountcy and colonization

What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

Unit 3

Women in Indian society

The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadarnyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya's Arthasastra and Mrichchhakatikamof Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

Modern India

The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, RabindranathTagore;

Understanding Mahatma Gandhi; A new nation is born as a republic – the pangs of birth and growth; India since Independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.

Conclusion

The Wonder that was India; The 'politics' and 'purpose' of studying India.

REFERENCES:

1. *Parameswaran, S. The Golden Age of Indian Mathematics. Kochi: Swadeshi Science Movement.*
2. *Somayaji, D. A. A Critical Study of Ancient Hindu Astronomy. Dharwar: 1972.*
3. *Sen, S. N. & K. V. Sarma eds. A History of Indian Astronomy. New Delhi, 1985.*
4. *Rao, S. Balachandra. Indian Astronomy: An Introduction. Hyderabad: Universities Press, 2000.*
5. *Bose, D. M. et. al. A Concise History of Science in India. New Delhi: 1971.*
6. *Bajaj, Jitendra & M. D. Srinivas. Indian Economy and Polity. Chennai: Centre for Policy Studies.*
7. *Bajaj, Jitendra & M. D. Srinivas.Timeless India, Resurgent India. Chennai: Centre for Policy Studies.*
8. *Joshi, Murli Manohar. Science, Sustainability and Indian National Resurgence. Chennai: Centre for Policy Studies, 2008.*
9. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.*

10. Vivekananda, Swami. *Selections from the Complete Works of Swami Vivekananda. Kolkata: Advaita Ashrama.*
11. Mahadevan, T. M. P. *Invitations to Indian Philosophy. Madras: University of Madras.*
12. Hiriyanna, M. *Outlines of Indian Philosophy. Motilal Banarsidass.*
13. Tagore, Rabindranath. *The History of Bharatavarsha / On Nationalism / Greater India.*
14. Majumdar, R. C. et. al. *An Advanced History of India. Macmillan.*
15. Mahajan, V. D. *India Since 1526. New Delhi: S. Chand & Company.*
16. Durant, Will. *The Case for India. Bangalore: Strand Book Stall, 2008.*
17. Aurobindo, Sri. *The Indian Renaissance / India's Rebirth / On Nationalism.*
18. Nivedita, Sister. *The Web of Indian Life. Kolkata: Advaita Ashrama.*
19. Durant, Will. *The Story of Civilization. Volume 1 – Our Oriental Heritage. New York: Simon & Schuster.*
20. Ranganathananda, Swami. *Eternal Values for A Changing Society. Bombay: Bharatiya Vidya Bhavan.*
21. Ranganathananda, Swami. *Universal Message of the Bhagavad Gita. Kolkata: Advaita Ashrama.*
22. Seturaman, V. S. *Indian Aesthetics. Macmillan.*
23. Coomaraswamy, Ananda K. *The Dance of Shiva. New Delhi: Sagar Publications.*
24. Coomaraswamy, Ananda K. *Essays on Indian Idealism. New Delhi: Munshiram Manoharlal.*
25. Danino, Michel. *The Invasion That Never Was.*
26. Kautilya. *Arthasastra.*
27. Altekar, A. S. *State and Government in Ancient India. New Delhi: Motilal Banarsidass.*
28. Altekar, A. S. *The Position of Women in Hindu Civilization. New Delhi: Motilal Banarsidass.*
29. Sircar, D. C. *Studies in the Religious Life of Ancient and Medieval India. New Delhi: Motilal Banarsidass.*
30. Sircar, D. C. *Studies in the Political and Administrative Systems in Ancient and Medieval Times. New Delhi: Motilal Banarsidass.*
31. Madhavananda, Swami & R. C. Majumdar eds. *The Great Women of India. Kolkata: Advaita Ashrama.*
32. Dutt, R. C. *The Economic History of India. London, 1902.*
33. Dharampal. *Collected Works.*
34. Dharampal. *Archival Compilations (unpublished)*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM233	GLIMPSES OF INDIAN ECONOMY AND POLITY	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction

General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historicpolity and social organization.

Ancient India – up to 600 B.C.

Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala;Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King(Sri Rama) and the ideal state (Ramarajya) – Yudhisthira's ramarajya; Sarasvati - Sindhu civilization and India'strade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of theIndo-Gangetic plain.

Unit 2

Classical India: 600B.C. – 1200 A.D.

The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya's Arthasastra; of Politics and trade –the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India's maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.

Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural productionand urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacyin the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

Unit 3

Modern India: 1720 - 1947

the Indian market and economy before the arrival of the European traders; Colonisation and British supremacy (dismantling of everything that was 'traditional' or 'Indian') – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance:banking and other business undertakings by the natives (the members of the early Tagore family, the merchants ofSurat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern bankingsystem; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large- scale industry – irrigation and railways –

money and credit – foreign trade; Towards partition – birth of two new nations

– division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947

India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact of science and (new/ emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.

Conclusion

REFERENCES:

1. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.*
   Kautilya. Arthasastra.

2. Altekar, A. S. *State and Government in Ancient India.* New Delhi: Motilal Banarsidass.
3. Sircar, D. C. *Studies in the Political and Administrative Systems in Ancient and Medieval Times.* New Delhi: Motilal Banarsidass.
4. Dutt, R. C. *The Economic History of India.* London, 1902.
5. Dharampal. *Collected Works (Volumes IV & V).*
6. Dharampal. *Archival Compilations (unpublished).*
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8. Bajaj, Jitendra & M. D. Srinivas. *Timeless India, Resurgent India.* Chennai: Centre for Policy Studies.
9. Joshi, Murli Manohar. *Science, Sustainability and Indian National Resurgence.* Chennai: Centre for Policy Studies, 2008.
10. Tripathi, Dwijendra. *The Oxford History of Indian Business.* New Delhi: Oxford University Press, 2004.
11. McGuire, John, et al, eds. *Evolution of World Economy, Precious Metals and India.* New Delhi: Oxford University Press, 2001.
12. Tripathi, Dwijendra and Jyoti Jumani. *The Concise Oxford History of Indian Business.* New Delhi: Oxford University Press, 2007.
13. Kudaisya, Medha M. *The Life and Times of G. D. Birla.* New Delhi: Oxford University Press, 2003.
14. Raychaudhuri, Tapan and Irfan Haib, eds. *The Cambridge Economic History of India.* Volume
15. New Delhi: Orient Longman, 2004.
16. Kumar, Dharma, ed. *The Cambridge Economic History of India.* Volume 2. New Delhi: Orient Longman, 2005.
17. Sabavala, S. A. and R. M. Lala, eds. *J. R. D. Tata: Keynote.* New Delhi: Rupa & Co., 2004.
18. Mambro, Arvind ed. *J. R. D. Tata: Letters.* New Delhi: Rupa & Co., 2004.
19. Lala, R. M., *For the Love of India: The Life and Times of Jamsetji Tata.* New Delhi: Penguin, 2006.
20. Thapar, Romila. *The Penguin History of Early India: From the Origins to AD 1300.* New Delhi Penguin, 2002.
21. Majumdar, R. C., et. al. *An Advanced History of India.* Macmillan.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM234	HEALTH AND LIFESTYLE	L-T-P-C: 2-0-0-2

SyllabusUnit 1

Introduction to Health

Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

Practicals - Therapeutic Diets

Unit 2

Food and Nutritional Requirements during Adolescence

Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern and postures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

Practicals - Ethnic Foods

Unit 3

Need for a Positive Life Style Change

Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

Practical - Cooking without Fire or Wire-healthy Snacks

TEXTBOOKS:

1. ~~B. Srilakshmi, "Dietetics", New age international (P) ltd, publishers, 2010.~~
2. "Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Council of Medical Research, ICMR, 2010.

REFERENCE BOOKS:

1. *K Park "Textbook of preventive and social medicine", 2010.*
2. *WHO Report on Adolescent Health: 2010*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM235	INDIAN CLASSICS FOR THE TWENTY-FIRST CENTURY	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introductory study of the Bhagavad Gita and the Upanishads.

Unit 2

The relevance of these classics in a modern age.

Unit 3

Goals of human life - existential problems and their solutions in the light of these classics etc.

REFERENCE:

The Bhagavad Gita, Commentary by Swami Chinmayananda

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23HUM236 | INTRODUCTION TO INDIA STUDIES | L-T-P-C: 2-0-0-2 |

PREAMBLE:

This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Syllabus Unit 1

A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2

Modern India: Challenges and Possibilities.

Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3

Modern Indian Writing in English: Trends in Contemporary Indian Literature in English.

TEXTBOOK:

Material given by the Faculty

BACKGROUND LITERATURE:

1. *Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.*
2. *Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.*

3. *Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.*
4. *Outlines of Indian Philosophy, M. Hiriyanna, MLBD.*
5. *An Advanced History of India, R. C. Majumdar et al, Macmillan.*
6. *India Since 1526, V. D. Mahajan, S. Chand & Company*
7. *The Indian Renaissance, Sri Aurobindo.*
8. *India's Rebirth, Sri Aurobindo.*
9. *On Nationalism, Sri Aurobindo.*
10. *The Story of Civilization, Volume I: Our Oriental Heritage, Will Durant, Simonand Schuster, New York.*
11. *Eternal Values for a Changing Society, Swami Ranganathananda, Bharatiya Vidya Bhavan.*
12. *Universal Message of the Bhagavad Gita, Swami Ranganathananda, Advaita Ashrama.*
13. *Awaken Children: Conversations with Mata Amritanandamayi*
14. *Indian Aesthetics, V. S. Seturaman, Macmillan.*
15. *Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.*
16. *Web of Indian Thought, Sister Nivedita*
17. *Essays on Indian Nationalism, Anand Kumaraswamy*
18. *Comparative Aesthetics, Volume 2, Kanti Chandra Pandey, Chowkhamba, Varanasi*
19. *The Invasion That Never Was, Michel Danino*
20. *Samskara, U. R. Ananthamurthy, OUP.*
21. *Hayavadana, Girish Karnard, OUP.*

22. Naga-Mandala, Girish Karnard, OUP.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM237	INTRODUCTION TO SANSKRIT LANGUAGE AND LITERATURE	L-T-P-C: 2-0-0-2

OBJECTIVES:

To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit;to help students appreciate and imbibe India's ancient culture and values.

SyllabusUnit 1

Sanskrit Language – Vakya Vyavahara - Introduction to Sanskrit language - Devanagari script and Sanskrit alphabet - Vowels and Consonants – Pronunciation (प्रथमादीक्षा) - Classification of Consonants – Samyukthakshara Words – Nouns and Verbs - Cases – Introduction to Numbers and Time – Verbs: Singular, Dual and Plural – SarvaNamas: First Person, Second Person, Third Person – Tenses: Past, Present and Future -Words for Communication – Selected Slokas – MoralStories – Subhashithas – Riddles.

Unit 2

Language Studies - Role of Sanskrit in Indian & World Languages.

Unit 3

Introduction to Sanskrit Classical Literature – KavyaTradition – Drama Tradition - Stotra Tradition – Panchatantra Stories.

Unit 4

Introduction to Sanskrit Technical Literature – Astronomy – Physics – Chemistry – Botany – Engineering – Aeronautics – Ayurveda – Mathematics – Medicine – Architecture - Tradition of Indian Art – Administration –Agriculture.

Unit 5

Indology Studies – Perspectives and Innovations.

TEXTBOOKS AND REFERENCE BOOKS:

1. *Vakya Vyavahara- Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi*
2. *The Wonder that is Sanskrit - Dr.Sampadananda Mishra, New Delhi*
3. *Science in Sanskrit – Samskritha Bharathi, NewDelhi*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM238	NATIONAL SERVICE SCHEME	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto,song, badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.

NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption of village / slums, methodology of conducting survey, financial pattern of the scheme, other youth programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

Unit 2

Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

Unit 3

Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth, Youth as an agent of social change.

Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy life style

Unit 4

Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national level, state level and voluntary sector, youth-focused and youth-led organizations.

Youth and Crime: Sociological and psychological factors influencing youth crime, Peer mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice.

Unit 5

Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management, rain water harvesting, energy conservation, waste land development.

Project Work / Practical

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM239	PSYCHOLOGY FOR EFFECTIVE LIVING	L-T-P-C: 2-0-0-2

Course Objectives

1. To help students acquire the basic knowledge of behavior and effective living
2. To create an awareness of the hazards of health compromising behaviours
3. To develop and strengthen the tools required to handle the adversities of life

Course Outcome

CO 1: Understand the basic concepts of Behavioral PsychologyCO 2: Demonstrate self reflective skills through activities

CO 3: Apply the knowledge of psychology to relieve stress

CO 4: Analyse the adverse effects of health compromising behaviours.

CO 5: Evaluate and use guided techniques to overcome and cope with stress related problems.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1						1
CO2						2	3		3	3		
CO3						3	3	2	1		3	2
CO4						2	2	3				1
CO5						1	2				1	1

SyllabusUnit 1

Self-Awareness & Self-Motivation

Self analysis through SWOT, Johari Window, Maslow's hierarchy of motivation, importance of self esteem and enhancement of self esteem.

Unit 2

The Nature and Coping of Stress

Conflict, Relationship issues, PTSD. Stress – stressors – eustress - distress, coping with stress, stress management techniques.

Unit 3

Application of Health Psychology

Health compromising behaviours, substance abuse and addiction.

TEXTBOOKS:

1. *V. D. Swaminathan & K. V. Kaliappan "Psychology for effective living - An introduction to Health*
2. *Psychology. 2nd edition Robert J. Gatchel, Andrew Baum & David S. Krantz, McGraw Hill.*

REFERENCE BOOKS:

1. *S. Sunder, 'Textbook of Rehabilitation', 2nd edition, Jaypee Brothers, New Delhi. 2002.*
2. *Weiben & Lloyd, 'Psychology applied to Modern Life', Thompson Learning, Asia Ltd.2004.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM240	PSYCHOLOGY FOR ENGINEERS	L-T-P-C: 2-0-0-2

Course Objectives:

1. To strengthen the fundamental knowledge of human behavior
2. To strengthen the ability to understand the basic nature and behavior of humans in organizations as awhole
3. To connect the concepts of psychology to personal and professional life

Course Outcome

CO 1:   Understand the fundamental processes underlying human behavior such as learning, motivation,individual differences, intelligence and personality.

CO 2:   Apply the principles of psychology in day- to- day life for a better understanding of oneself and others.CO 3:   Apply the knowledge of Psychology to improve study skills and learning methods

CO 4:   Apply the concepts of defense mechanisms to safeguard against abusive relationships and to nurturehealthy relationships.

CO-PO Mapping

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3	3		3	2		1
CO2						3	3	2	3	3	1	2
CO3										2	1	
CO4							3		2	2		2

SyllabusUnit 1

Psychology of Adolescents: Adolescence and its characteristics.

Unit 2

Learning, Memory & Study Skills: Definitions, types, principles of reinforcement, techniques for improving study skills,

Mnemonics.

Unit 3

Attention & Perception: Definition, types of attention, perception.

TEXTBOOKS:

1. *S. K. Mangal, "General Psychology", Sterling Publishers Pvt. Ltd.2007*
2. *Baron A. Robert, "Psychology", Prentice Hall of India. New Delhi 2001*

REFERENCE BOOKS:

1. *Elizabeth B. Hurlock, Developmental Psychology - A life span approach, 6th edition.*
2. *Feldman, Understanding Psychology, McGraw Hill, 2000.*
3. *Clifford Morgan, Richard King, John Scholper, "Introduction to Psychology", Tata Mcgraw Hill, PvtLtd 2004.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM241	SCIENCE AND SOCIETY - AN INDIAN PERSPECTIVE	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction

Western and Indian views of science and technology

Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

Unit 2

Indian sciences

Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD

Science and technology under the British rule

Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3

Science and technology in Independent India

Introduction; An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination.

Building upon the Indian tradition

Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion

REFERENCES:

1. *Joseph, George Gheverghese. The Crest of the Peacock: Non-European Roots of Mathematics. London: Penguin (UK), 2003.*
2. *Iyengar, C. N. Srinivasa. History of Hindu Mathematics. Lahore: 1935, 1938 (2 Parts).*
3. *Amma, T. A. Saraswati. Geometry in Ancient and Medieval India. Varanasi: Motilal Banarsidass, 1979.*
4. *Bag, A. K. Mathematics in Ancient and Medieval India. Varanasi: Motilal Banarsidass, 1979.*
5. *Sarma K. V. & B. V. Subbarayappa. Indian Astronomy: A Source-Book. Bombay: Nehru Centre, 1985.*
6. *Sriram, M. S. et. al. eds. 500 Years of Tantrasangraha: A Landmark in the History of Astronomy. Shimla: Indian Institute of Advanced Study, 2002.*
7. *Bajaj, Jitendra & M. D. Srinivas. Restoring the Abundance: Regeneration of Indian Agriculture to Ensure Food for All in Plenty.Shimla: Indian Institute of Advanced Study, 2001.*
8. *Bajaj, Jitendra ed. Report of the Seminar on Food for All: The Classical Indian Discipline of Growingand Sharing Food in Plenty. Chennai: Centre for Policy Studies, 2001.*
9. *Bajaj, Jitendra & M. D. Srinivas. Annam Bahu Kurvita: Recollecting the Indian Discipline of Growingand Sharing Food in Plenty. Madras: Centre for Policy Studies, 1996.*
10. *Parameswaran, S. The Golden Age of Indian Mathematics. Kochi: Swadeshi Science Movement.*
11. *Somayaji, D. A. A Critical Study of Ancient Hindu Astronomy. Dharwar: 1972.*
12. *Sen, S. N. & K. V. Sarma eds. A History of Indian Astronomy. New Delhi, 1985.*
13. *Rao, S. Balachandra. Indian Astronomy: An Introduction. Hyderabad: Universities Press, 2000.*
14. *Bose, D. M. et. al. A Concise History of Science in India. New Delhi: 1971.*
15. *Bajaj, Jitendra & M. D. Srinivas. Indian Economy and Polity. Chennai: Centre for Policy Studies.*

16. *Bajaj, Jitendra & M. D. Srinivas. Timeless India, Resurgent India. Chennai: Centre for Policy Studies.*
17. *Joshi, Murli Manohar. Science, Sustainability and Indian National Resurgence. Chennai: Centre for Policy Studies, 2008.*
18. *The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.*

* The syllabus and the study material in use herein has been developed out of a 'summer programme' offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas, Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM242	THE MESSAGE OF BHAGWAD GITA	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha. ArjunaVishada

Yoga: Arjuna's Anguish and Confusion – Symbolism of Arjuna's Chariot.

Sankhya Yoga: Importance of Self-knowledge – Deathlessness: Indestructibility of Consciousness – Being Established in Wisdom – Qualities of a Sthita-prajna.

Unit 2

Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Conceptof Swadharma.

Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

Unit 3

Bhakti Yoga: Yoga of Devotion – Form and Formless Aspects of the Divine – Inner Qualities of a True Devotee.

GunatrayaVibhaga Yoga: Dynamics of the Three Gunas: Tamas, Rajas, Sattva – Going Beyond the Three Gunas – Description of a Gunatheetha.

TEXTBOOKS / REFERENCES:

1. *Swami Chinmayananda, "The Holy Geeta", Central Chinmaya Mission Trust, 2002.*
2. *Swami Chinmayananda, "A Manual of Self Unfoldment", Central Chinmaya Mission Trust, 2001.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	

Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM243	THE MESSAGE OF THE UPANISHADS	L-T-P-C: 2-0-0-2

OBJECTIVES:

To give students an introduction to the basic ideas contained in the Upanishads; and explores how their messagecan be applied in daily life for achieving excellence.

SyllabusUnit 1

An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti

versus Smrti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and ModernScience.

Unit 2

The challenge of human experience & problems discussed in the Upanishads – the True nature of Man – theMoving power of the Spirit – The Message of Fearlessness – Universal Man - The central problems of theUpanishads – Ultimate reality – the nature of Atman - the different manifestations of consciousness.

Unit 3

Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada,Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada's answers to the six questions in Prasnopanishad.

REFERENCES:

1. *The Message of the Upanishads by Swami Ranganathananda, Bharatiya Vidya Bhavan*
2. *Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama*
3. *Indian Philosophy by Dr. S. Radhakrishnan, Oxford University Press*
4. *Essentials of Upanishads by R L Kashyap, SAKSI, Bangalore*
5. *Upanishads in Daily Life, Sri Ramakrishna Math, Mylapore.*
6. *Eternal stories of the Upanishads by Thomas Egenes and Kumuda Reddy*
7. *Upanishad Ganga series – Chinmaya Creations*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	

End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23HUM244	UNDERSTANDING SCIENCE OF FOOD AND NUTRITION	L-T-P-C: 2-0-0-2

Course Objectives:

- To introduce the significance of food, nutrients, locally available food resources, synergic food combinations, good cooking methods and importance of diversity in foods
- To understand nutritional imbalances and chronic diseases associated with the quality of food.
- To gain awareness about the quality of food - Organic food, genetically modified food, adulterated food,allergic food, , food poisoning and food safety.
- To understand food preservation processing, packaging and the use of additives.

Course Outcome:

CO1: Acquire knowledge about the various food and food groups

CO2: Understand nutritional imbalances and chronic diseases prevailing among different age groups.CO3: Understand the significance of safe food and apply the food safety standards

CO4: Demonstrate skills of food processing, preservation and packaging methods with or without additives CO5: Evaluate the quality of food based on the theoretical knowledge of Food and Nutrition

CO-PO Mapping:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1		1	1			1	2	1	1	1	1	3
CO 2		1	1			1	1	1	1	1	1	3
CO 3		1	1			1	1	1	1	1	1	3
CO 4		1	1			1	1	1	1	1	1	3
CO 5		1	1			1	2	1	2	1	1	3

SyllabusUnit 1

Food and Food Groups

Introduction to foods, food groups, locally available foods, Nutrients, Cooking methods, Synergy between foods, Science behind foods, Food allergies, food poisoning, food safety standards.

Cookery Practicals - Balanced Diet

Unit 2

Nutrients and Nutrition

Nutrition through life cycle, RDA, Nutrition in disease, Adulteration of foods & Food additives, Packaging and labeling of foods.

Practicals - Traditional Foods

Unit 3

Introduction to Food Biotechnology

Future foods - Organic foods and genetically modified foods, Fortification of foodsvalue addition of foods, functional foods, Nutraceuticals, supplementary foods, Processing and preservation of foods, applications of food

technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advancedresearch.

Practicals - Value added foods

TEXTBOOKS:

1. *N. Shakuntalamanay, M. Shadaksharaswamy, "Food Facts and principles", New age international (P) ltd, publishers, 2005.*
2. *B. Srilakshmi, "Dietetics", New age international (P) ltd, publishers, 2010.*

REFERENCE BOOKS:

1. *B. Srilakshmi, "Food Science", New age international (P) ltd, publishers, 2008.*
2. *"Nutrient requirement and Recommended Dietary Allowances for Indians", published by Indian Council of Medical Research, ICMR, 2010.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23JAP230 | PROFICIENCY IN JAPANESE LANGUAGE (LOWER) | L-T-P-C: 2-0-0-2 |

Syllabus

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23JAP231	PROFICIENCY IN JAPANESE LANGUAGE (HIGHER)	L-T-P-C: 2-0-0-2

Syllabus

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught towrite as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japaneselanguage selecting their own topics.

By the end of the semester they the students will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japaneselanguage themselves.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23KAN230	KANNADA I	L-T-P-C: 2-0-0-2

OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

Syllabus Unit 1

Adalitha Kannada: bhashe, swaroopa, belavanigeya kiru parichaya Paaribhaashika padagalu

Vocabulary Building

Unit 2

Prabhandha – Vyaaghra Geethe - A. N. Murthy Rao

Prabhandha – Baredidi…baredidi, Baduku mugiyuvudilla allige…- Nemi Chandra Paragraph writing –Development: comparison, definition, cause & effect Essay – Descriptive & Narrative

Unit 3

Mochi – Bharateepriya

Mosarina Mangamma – Maasti Venkatesh Iyengar Kamalaapurada Hotelnalli – Panje Mangesh Rao Kaanike – B.

M. Shree

Geleyanobbanige bareda Kaagada – Dr. G. S. Shivarudrappa Moodala Mane – Da. Ra. Bendre
Swathantryada Hanate – K. S. Nissaar Ahmed

Unit 4

Letter W riting - Personal: Congratulation, thanks giving, invitation, condolence

Unit 5

Reading Comprehension; nudigattu, gaadegalu Speaking Skills: Prepared speech, pick and speak

REFERENCES:

1. *H. S. Krishna Swami Iyangar – Adalitha Kannada – Chetana Publication, Mysuru*
2. *N. Murthy Rao – Aleyuva Mana – Kuvempu Kannada Adyayana Samste*
3. *Nemi Chandra – Badhuku Badalisabahudu – Navakarnataka Publication*
4. *Sanna Kathegalu - Prasaranga, Mysuru University , Mysuru*
5. *B. M. Shree – Kannadada Bavuta – Kannada Sahitya Parishattu*
6. *K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.*
7. *Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23KAN231 | KANNADA II | L-T-P-C: 2-0-0-2 |

OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Syllabus Unit 1

Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2

Nanna Hanate - Dr. G. S. Shivarudrappa

Mankuthimmana Kaggada Ayda bhagagalu – D. V. Gundappa (Padya Sankhye 5, 20, 22, 23, 25, 44, 344, 345,

346, 601)

Ella Marethiruvaga - K. S. Nissaar Ahmed Saviraru Nadigalu – S Siddalingayya

Unit 3

Sayo Aata – Da. Ra. Bendre

Unit 4

Sarva Sollegala turtu Maha Samelana - Beechi Swarthakkaagi Tyaga - Beechi

Unit 5

Essay writing: Argumentative & Analytical Précis writing

REFERENCES:

1. *H. S. Krishnaswami Iyangar – Adalitha Kannada – Chetan Publication, Mysuru*
2. *Dr. G. S. Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana*
3. *Shrikanth - Mankuthimmana Kagga – Taatparya – Sri Ranga Printers & Binders*

4. *K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house*
5. *Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication*
6. *Beechi – Sahukara Subbamma – Sahitya Prakashana*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23MAL230	MALAYALAM I	L-T-P-C: 2-0-0-2

Course Objectives:

To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother0-tongue; to learn ourculture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality

Course Outcome:

After the completion of the course the student will be able to:

CO1:   Understand and inculcate philosophical thoughts and practices CO2:   Understand and appreciate the post modern trends of literature.

CO3:   Analyse the literary texts and comprehend the cultural diversity of KeralaCO4:   Distinguish the different genres in Malayalam literature

CO5:   Demonstrate the ability to effectively communicate in Malayalam

CO-PO Mapping:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	1	1	-	-

SyllabusUnit 1

Ancient poet trio: Adhyatmaramayanam,

Lakshmana Swanthanam (valsa soumitre… mungikidakayal), Ezhuthachan - Medieval period classics –Jnanappana (kalaminnu… vilasangalingane), Poonthanam

Unit 2

Modern Poet trio: Ente Gurunathan, Vallathol Narayana Menon - Critical analysis of the poem.

Unit 3

Short stories from period 1/2/3, Poovanpazham - Vaikaom Muhammed Basheer - Literary & Cultural figures ofKerala and about their literary contributions.

Unit 4

Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasante Chiri - Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kutti Krishna Mararu & his outlook towards literature & life.

Unit 5

Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation – Thettillatha Malayalam

Writing - a. Expansion of ideas; b .Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script /Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

1. *P. K. Balakrishnanan, Thunjan padhanangal, D. C. Books, 2007.*
2. *G. Balakrishnan Nair, Jnanappanayum Harinama Keerthanavum, N. B. S, 2005.*
3. *M. N. Karasseri, Basheerinte Poonkavanam, D. C. Books, 2008.*
4. *4 M. N. Vijayan, Marubhoomikal Pookkumbol, D. C. Books, 2010.*
5. *M. Thomas Mathew, Lavanyanubhavathinte Yukthisasthram, National Book Stall, 2009.*
6. *M. Leelavathy, Kavitha Sahityacharitram, National Book Stall, 1998.*
7. *Thayattu Sankaran, Vallathol Kavithapadhanam, D. C. Books, 2004.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23MAL231	MALAYALAM II	L-T-P-C: 2-0-0-2

OBJECTIVES:

To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Course Outcome:

After the completion of the course the student will be able to:

CO1: Understand the different cultural influences in linguistic translation CO2: Identify and appreciate the Romantic elements of modern literature CO3: Analyze the genre of autobiographical writing

CO4: Critically evaluate the significance of historical, political and socio cultural aspects in literature CO5: Demonstrate good writing skills in Malayalam

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	1	1	-	-

Syllabus Unit 1

Ancient poet trio: Kalayanasougandhikam, (kallum marangalun… namukkennarika vrikodara) Kunjan Nambiar - Critical analysis of his poetry - Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasan (Translated by Attor Krishna Pisharody).

Unit 2

Modern / romantic / contemporary poetry: Manaswini, Changampuzha Krishna Pillai – Romanticism – modernism.

Unit 3

Anthology of short stories from period 3/4/5: Ninte Ormmayku, M. T. Vasudevan Nair - literary contributions of his time

Unit 4

Part of an autobiography / travelogue: Kannerum Kinavum, V. T. Bhattathirippadu - Socio-cultural literature - historical importance.

Unit 5

Error-free Malayalam - 1. Language; 2. Clarity of expression; 3. Punctuation - Thettillatha Malayalam

W riting - a. Expansion of ideas; b. Précis Writing ; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script /Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciationof literary works (Any one or two as an assignment).

REFERENCES:

1. *Narayana Pillai. P. K, Sahitya Panchanan. Vimarsanathrayam, Kerala Sahitya Academy, 2000*
2. *Sankunni Nair. M. P, Chathravum Chamaravum, D. C. Books, 2010.*
3. *Gupthan Nair. S, Asthiyude Pookkal, D. C Books. 2005*
4. *Panmana Ramachandran Nair, Thettillatha Malayalam, Sariyum thettum etc., D. C. Book, 2006.*
5. *M. Achuthan, Cherukatha-Innale, innu, National Book Stall, 1998.*
6. *N. Krishna Pillai, Kairaliyude Katha, National Book Stall, 2001.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23SAN230 | SANSKRIT I | L-T-P-C: 2-0-0-2 |

OBJECTIVES:

To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskritverses and sentences; to help them acquire expertise for self- study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

SyllabusUnit 1

Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of

consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns,communicating time in Sanskrit. Practical classes in spoken Sanskrit

Unit 2

Verbs- Singular, Dual and plural – First person, Second person, Third person. Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi-karthariprayoga

Unit 3

Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

Unit 4

Selected slokas from Valmiki Ramayana, Kalidasa's works and Bhagavad Gita. Ramayana – chapter VIII - verse5, Mahabharata - chapter 174, verse -16, Bhagavad Gita – chapter - IV verse 8, Kalidasa's Sakuntalam Act IV – verse 4

Unit 5

Translation of simple sentences from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. *Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085*
2. *Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad*
3. *Prakriya Bhashyam written and published by Fr. John Kunnappally*
4. *Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston*
5. *Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad*

6. *Namalinganusasanam by Amarasimha published by Travancore Sanskrit series*
7. *Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar press*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23SAN231	SANSKRIT II	L-T-P-C: 2-0-0-2

OBJECTIVES:

To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskritverses and sentences; to help them acquire expertise for self- study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

SyllabusUnit 1

Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2

Ktavatu Pratyaya, Upasargas, Ktvanta, Tumunnanta, Lyabanta. Three Lakaras – brief introduction, Lot lakara.

Unit 3

W ords and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashitas, riddles.

Unit 4

Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas- Bhagavad Gita – chapter - II verse 47, chapter - IV verse 7, chapter -VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa's Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

Unit 5

Translation of paragraphs from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. *Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085*
2. *Sanskrit Reader I, II and III, R.S. Vadhyar and Sons, Kalpathi, Palakkad*
3. *Prakriya Bhashyam written and published by Fr. John Kunnappally*
4. *Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston*
5. *Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad*
6. *Namalinganusasanam by Amarasimha published by Travancore Sanskrit series*
7. *Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nirnayasagar Press.*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23SWK230	CORPORATE SOCIAL RESPONSIBILITY	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy. CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules underSection 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

Unit 2

CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

Unit 3

Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

REFERENCES:

1. *Corporate Governance, Ethics and Social Responsibility, V Bala Chandran and V Chandrasekaran, PHI learning Private Limited, New Delhi 2011.*
2. *White H. (2005) Challenges in evaluating development effectiveness: Working paper 242, Institute of Development Studies, Brighton.*
3. *UNDP (nd) Governance indicators: A users guide. Oslo: UNDP*
4. *Rao, Subbha (1996) Essentials of Human Resource Management and Industrial Relations, Mumbai, Himalaya*
5. *Rao, V. S. L. (2009) Human Resource Management, New Delhi, Excel Books,*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23SWK231	WORKPLACE MENTAL HEALTH	L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Mental Health – concepts, definition, Bio-psycho-social model of mental health. Mental health and mental illness, characteristics of a mentally healthy individual, Signs and symptoms of mental health issues, presentation of a mentally ill person. Work place – definition, concept, prevalence of mental health issues in the work place, whyinvest in workplace mental health, relationship between mental health and productivity, organizational culture and mental health. Case Study, Activity.

Unit 2

Mental Health Issues in the Workplace: Emotions, Common emotions at the workplace, Mental Health issues - Anger, Anxiety, Stress & Burnout, Depression, Addictions – Substance and Behavioural, Psychotic Disorders - Schizophrenia, Bipolar Disorder, Personality disorders. Crisis Situations - Suicidal behavior, panic attacks, reactions to traumatic events. Stigma and exclusion of affected employees. Other issues –work-life balance, Presenteeism, Harassment, Bullying, Mobbing. Mental Health First Aid - Meaning. Case Study, Activity.

Unit 3

Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being- corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals-talking about mental health, making reasonable adjustments, Resources and support for employees - Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations. Case Study, Activity.

REFERENCES:

1. *American Psychiatric Association. "Diagnostic and statistical manual of mental disorders: DSM-IV 4th ed." www.terapiacognitiva.eu/dwl/dsm5/DSM-IV.pdf*
2. *American Psychiatric Association. (2000) www.ccsa.ca/Eng/KnowledgeCentre/OurDatabases/ Glossary/Pages/index.aspx.*
3. *Canadian Mental Health Association, Ontario "Workplace mental health promotion, A how to guide"wmhp.cmhaontario.ca/*
4. *Alberta Health Services Mental Health Promotion. (2012). Minding the Workplace: Tips for employees and managers together. Calgary: Alberta Health Services.http:// www.mentalhealthpromotion.net/resources/minding-the-workplace-tips-for-employees-and- managers-together.pdf*
5. *Government of Western Australia, Mental Health Commission. (2014) "Supporting good mental health in the work place." http://www.mentalhealth.wa.gov.au/Libraries/pdf_docs/ supporting_good_mental_health_in_the_workplace_1.sflb.ashx*
6. *Mental Health Act 1987 (India) www.tnhealth.org/mha.htm*
7. *Persons with disabilities Act 1995 (India) socialjustice.nic.in*
8. *The Factories Act 1948 (India) www.caaa.in/Image/19ulabourlawshb.pdf*

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

23TAM230	TAMIL I	L-T-P-C: 2-0-0-2

Course Objectives:

- To introduce the students to different literature- Sangam literature, Epics, Bhakthi literatureandmodern literature.
- To improve their ability tocommunicate with creative concepts, and also to introduce them to theusefulness of basicgrammaticalcomponents in Tamil.

Course Outcomes

CO 1: To understand the Sangam literatureCO 2:
To understand the creative literature

CO 3: To understand the literary work on religious scripturesCO 4:
To improve the communication and memory skills

CO 5: To understand the basic grammar components of Tamil language and their usage and applications.CO 6:
Understand creative writing aspects and apply them.

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			-	-	-	-	-	-	2	2	-	-
CO2			-	-	-	-	-	-	2	2	-	-
CO3			-	-	-	-	-	-	2	2	-	-
CO4			-	-	-	-	-	-	2	2	-	-
CO5			-	-	-	-	-	-	2	2	-	-
CO6			-	-	-	-	-	-	2	2	-	-

SyllabusUnit1

The history ofTamilliterature: Nāṭṭupuṟap pāṭalkaḷ, kataikkaḷ, paḻamoḻikaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum, ciṟṟilakkiyaṅkaḷ: Kaliṅkattup paraṇi (pōrpāṭiyatu) - mukkūṭaṟ paḷḷu 35.

Kāppiyaṅkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiñciṟuṅ kāppiyaṅkaḷ toṭarpāṉa ceytikaḷ.

Unit 2

tiṇai ilakkiyamum nītiyilakkiyamum - patiṉeṇkīḻkkaṇakku nūlkaḷ toṭarpāṉa piṟa ceytikaḷ - tirukkuṟaḷ (aṉpu, paṇpu, kalvi, oḻukkam, naṭpu, vāymai, kēḷvi, ceynaṉṟi, periyāraittuṇakkōṭal, viḻippuṇarvu pēṉṟa atikārattil uḷḷa ceytikaḷ.

Aṟanūlkaḷ: Ulakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṉantak kaḷippu –1, 4, 6, 7,

8), maṟṟum akappēy cittar pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikaḷ – taṉviṉai piṟaviṉai – nērkkūṟṟu ayaṟkūṟṟu

Unit 4

tamiḻaka aṟiñarkaḷiṉ tamiḻ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṉ, paṭṭukkōṭṭai kalyāṇacuntaram, curatā, cujātā, ciṟpi, mēttā, aptul rakumāṉ, na.Piccaimūrtti, akilaṉ, kalki, jī.Yū.Pōp, vīramāmuṉivar, aṇṇā, paritimāṟ kalaiñar, maṟaimalaiyaṭikaḷ.

Unit 5

tamiḻ moḻi āyvil kaṇiṇi payaṉpāṭu. - Karuttu parimāṟṟam - viḷampara moḻiyamaippu – pēccu - nāṭakam paṭaippu -ciṟukatai, katai, putiṉam paṭaippu.

Textbooks:

1. http:/Www.tamilvu.trg/libirary/libindex.htm.
2. http:/Www.tunathamizh.tom/2013/07/blog0post_24.html
3. Mu.Varatarācaṉ "tamiḻ ilakkiya varalāṟu" cāhitya akaṭemi papḷikēṣaṉs, 2012
4. nā.Vāṉamāmalai "paḻaṅkataikaḷum, paḻamoḻikaḷum" niyū ceñcuri puttaka veḷiyīṭṭakam,
5. 1980,2008
6. nā.Vāṉamāmalai, "tamiḻar nāṭṭuppāṭalkaḷ" niyū ceñcuri puttaka veḷiyīṭṭakam 1964,2006
7. poṉ maṇimāṟaṉ "aṭōṉ tamiḻ ilakkaṇam "aṭōṉ papḷiṣiṅ kurūp, vañciyūr,
8. tiruvaṉantapuram, 2007.

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.

| 23TAM231 | TAMIL II | L-T-P-C: 2-0-0-2 |

Course Objectives

- To learn the history of Tamil literature.
- To analyze different styles of Tamil Language.
- To strengthen the creativity in communication, Tamil basic grammar and use of computer on TamilLanguage.

Course Outcomes

CO 1: Understand the history of Tamil literature.

CO 2: Apply practical and comparative analyses on literature.

CO 3: Understand thinai literature, literature on justice, Pathinenkeelkanaku literature.CO 4: Understand the tamil scholars' service to Tamil language and society.

CO 5: Understand components of Tamil grammar and its usageCO 6: Understand creative writing aspects and apply them

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			-	-	-	-	-	-	2	2	-	-
CO2			-	-	-	-	-	-	2	2	-	-
CO3			-	-	-	-	-	-	2	2	-	-
CO4			-	-	-	-	-	-	2	2	-	-
CO5			-	-	-	-	-	-	2	2	-	-
CO6			-	-	-	-	-	-	2	2	-	-

SyllabusUnit 1

The history ofTamilliterature: Nāṭṭupuṟap pāṭalkaḷ, kataikkaḷ, paḻamoḻikaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum, ciṟṟilakkiyaṅkaḷ: Kaliṅkattup paraṇi (pōrpāṭiyatu) - mukkūṭaṟ paḷḷu 35.

Kāppiyaṅkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiñciṟuṅ kāppiyaṅkaḷ toṭarpāṉa ceytikaḷ.

Unit 2

tiṇai ilakkiyamum nītiyilakkiyamum - patiṉeṇkīḻkkaṇakku nūlkaḷ toṭarpāṉa piṟa ceytikaḷ - tirukkuṟaḷ (aṉpu, paṇpu, kalvi, oḻukkam, naṭpu, vāymai, kēḷvi, ceynaṉṟi, periyāraittuṇakkōṭal, viḷippuṇarvu pēṉṟa atikārattil uḷḷa ceytikaḷ.

Aṟanūlkaḷ: Ulakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṉantak kaḷippu –1, 4, 6, 7,

8), maṟṟum akappēy cittar pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikaḷ – taṉviṉai piṟaviṉai – nērkkūṟṟu ayaṟkūṟṟu

Unit 4

tamiḻaka aṟiñarkaḷiṉ tamiḻ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṉ, paṭṭukkōṭṭai kalyāṇacuntaram, curatā, cujātā, ciṟpi, mēttā, aptul rakumāṉ, na.Piccaimūrtti, akilaṉ, kalki, jī.Yū.Pōp, vīramāmuṉivar, aṇṇā, paritimāṟ kalaiñar, maṟaimalaiyaṭikaḷ.

Unit 5

tamiḻ moḻi āyvil kaṇiṇi payaṉpāṭu. - Karuttu parimāṟṟam - viḷampara moḻiyamaippu – pēccu - nāṭakam paṭaippu -ciṟukatai, katai, putiṉam paṭaippu.

Text Books / References

http:/Www.tamilvu.trg/libirary/libindex.htm. http:/Www.tunathamizh.tom/2013/07/blog0post_24.html Mu.Varatarācaṉ "tamiḻ ilakkiya varalāṟu" cāhitya akaṭemi papḷikēṣaṉs, 2012

nā.Vāṉamāmalai "paḷaṅkataikaḷum, paḻamoḻikaḷum" niyū ceñcuri puttaka veḷiyīṭṭakam, 1980,2008 nā.Vāṉamāmalai, "tamiḻar nāṭṭuppāṭalkaḷ" niyū ceñcuri puttaka veḷiyīṭṭakam 1964,2006 poṉ maṇimāṟaṉ "aṭōṉ tamiḻ ilakkaṇam "aṭōṉ papḷiṣiṅ kurūp, vañciyū

Evaluation Pattern

Assessment	Internal	End Semester
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

*CA – Can be Quizzes, Assignment, Projects, and Reports.