SRI VENKATESWARA COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University, Chennai – 600025)

GENERAL CURRICULUM

&

SYLLABUS

REGULATION 2022

Value Added Course							
Board Responsible	COURSE CODE	COURSE TITLE	T/P	L	T	P	C
MEC	VC22001	Basics of Entrepreneurship Development (Common to all branches)	T	2	0	0	0
MEC	VC22002	Advances in Entrepreneurship Development (Common to all branches)	T	2	0	0	0
HSS	VC22003	Communicative German (Common to all branches)	T	2	0	0	0
HSS	VC22004	Communicative Hindi (Common to all branches)	T	2	0	0	0
HSS	VC22005	Communicative Japanese (Common to all branches)	T	2	0	0	0
MEC	VC22006	Design Thinking and Prototyping laboratory (Common to all branches)	T	2	0	0	0

Mandatory Course							
Board Responsible	COURSE CODE	COURSE TITLE	T/P	L	T	P	C
APH	MC22001	Indian Constitution (Common to all branches)	T	3	0	0	0
APH	MC22002	Essence of Indian Traditional Knowledge (Common to all branches)	T	3	0	0	0
HSS	MC22003	Gender Sensitization (Common to all branches)	T	3	0	0	0

General Elective							
Board Responsi	COURSE CODE	COURSE TITLE	T/P	L	T	P	C
APH	GN22001	Introduction to NCC for Engineers. (Common to all branches)	T	2	0	2	0
APH	GN22002	Yoga and physical culture (Common to all branches)	P	0	0	2	0
HSS	GN22003	Introduction to Fine arts (Common to all branches)	T	2	0	0	0

FINTECH AND BLOCK CHAIN

Board Responsible	COURSE CODE	COURSE TITLE	T/P	L	T	P	C
INT	CV22011	Financial Management	T	3	0	0	3
INT	CV22012	Fundamentals of Investment	T	3	0	0	3
INT	CV22013	Banking, Financial Services and Insurance	T	3	0	0	3
INT	CV22014	Introduction to Fintech	T	3	0	0	3
INT	CV22015	Fintech Personal Finance and Payments	T	3	0	0	3
INT	CV22016	Introduction to Blockchain and its application: Theory and Practices	T&P	2	0	2	3
INT	CV22017	Digital Product Development and Management: Theory and Practices	T&P	2	0	2	3
INT	CV22010	Capstone Project	P	0	0	4	2

ENTREPRENEURSHIP

Board Responsible	COURSE CODE	COURSE TITLE	T/P	L	T	P	C
MEC	CV22021	Entrepreneurship and Innovation	T	3	0	0	3
MEC	CV22022	Startup Formation and Scalability	T	3	0	0	3
MEC	CV22023	Innovative Technologies for Startups	T	3	0	0	3
MEC	CV22024	Family Business Management	T	2	1	0	3
MEC	CV22025	Women Entrepreneurship	T	3	0	0	3
MEC	CV22026	Design Thinking and Human Centered Design	T&P	2	0	2	3
MEC	CV22027	Social Innovation and Entrepreneurship	T&P	2	0	2	3
MEC	CV22020	Business Plan	P	0	0	4	2
MEC	CV22090	Social Innovation - Field Immersion	P	0	0	4	2

BUSINESS DATA ANALYTICS							
Board Responsible	COURSE CODE	COURSE TITLE	T/P	L	T	P	C
CSE	CV22031	Statistics for management	T	3	0	0	3
CSE	CV22032	Datamining for Business Intelligence	T	3	0	0	3
CSE	CV22033	Human Resource Analytics	T	3	0	0	3
CSE	CV22034	Marketing and Social Media Web Analytics	T	3	0	0	3
CSE	CV22035	Operation and Supply Chain Analytics	T	3	0	0	3
CSE	CV22036	Financial Analytics	T	3	0	0	3
CSE	CV22030	Capstone Project	P	0	0	4	2

ENVIRONMENT AND SUSTAINABILITY							
Board Responsible	COURSE CODE	COURSE TITLE	T/P	L	T	P	C
CVE	CV22041	Sustainable Infrastructure Development	T	3	0	0	3
CVE	CV22042	Sustainable Agriculture and Environmental Management	T	3	0	0	3
CVE	CV22043	Sustainable Biomaterials	T	3	0	0	3
CVE	CV22044	Materials for Energy Sustainability	T	3	0	0	3
CVE	CV22045	Green Technology	T	3	0	0	3
CVE	CV22046	Environmental Quality Monitoring and Analytics	T	3	0	0	3
CVE	CV22047	Integrated Energy Planning for Sustainable Development	T	3	0	0	3
CVE	CV22048	Energy Efficiency for Sustainable Development	T	3	0	0	3
CVE	CV22040	Mini Project	P	0	0	4	2

SPECIAL ELECTIVE							
Board Responsible	**COURSE CODE**	**COURSE TITLE**	**T/P**	**L**	**T**	**P**	**C**
Dean AD	SE22001	Financial Statement Analysis (Common to All branches)	T	3	0	0	3
Dean AD	SE22002	Introduction to Securities Market (Common to All branches)	T	3	0	0	3
Dean AD	SE22003	Option Trading Strategies (Common to All branches)	T	3	0	0	3
Dean AD	SE22004	Corporate Finance (Common to All branches)	T	3	0	0	3
Dean AD	SE22005	Managerial Economics (Common to All branches)	T	3	0	0	3
Dean AD	SE22006	Project Management (Common to All branches)	T	3	0	0	3
Dean AD	SE22007	Mathematics for AI & ML (Common to All branches)	T	3	0	0	3

OPEN ELECTIVE							
Board Responsible	**COURSE CODE**	**COURSE TITLE**	**T/P**	**L**	**T**	**P**	**C**
ACH	OC22002	Fuel Cell Chemistry	T	3	0	0	3
APH	OP22006	Opto Electronics and Applications	T	3	0	0	3
APH	OP22008	Basics for Environmental Safety	T	3	0	0	3
APM	OM22001	Statistical Methods for Engineers	T	2	1	0	3

VC22001	BASICS OF ENTREPRENEURSHIP DEVELOPMENT (Common to all branches)	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

1. To provide Knowledge on Self-discovery and Problem identification.
2. To provide Skill set on Identifying customer segment and Practice on Business Model.
3. To understand the Market, Sales and support.

UNIT I SELF-DISCOVERY & PROBLEM IDENTIFICATION 6

Orientation of Entrepreneurship – Case Study – activity – Effectuation – Principles of Effectuation – Identifying Entrepreneur skill.

Problem Identification – Design thinking – look for solution – activity – Brain storming.

UNIT II CUSTOMER & BUSINESS MODEL 6

Identifying customer segment, understanding the market – Product selection –activity – value proposition canvas.

Identify the Problem, Solution and Risk identification – Activity – Business model.

UNIT III VALIDATION AND RESOURCES 6

Build a Minimum Viable Product (MVP) – validation and launching of MVP –activity – MVP Interview.

Cost – Revenue – Pricing – Profitability – Sources of finance – activity – Bootstrap Finance – Leadership – Identifying Co-founders and Hiring a Team – activity –Pitching about a venture

UNIT IV MARKET AND SALES 6

Positioning and branding – network and channels – sales planning – activity – selling skill.

UNIT V SUPPORT 6

Project Management – Project tracking – Basics of Business regulations – Activity – capstone project.

TOTAL: 30 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Acquire knowledge and Practice on Self Discovery and Problem identification.	**2**
CO2	Understand the concept of Identifying the Customer and Business model.	**2**
CO3	Acquire knowledge on various Resource and Practice on validation.	**3**
CO4	Acquire knowledge on marketing and sales.	**4**
CO5	Practice on Project management.	**3**

TEXT BOOKS:

1. S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, " Entreprenuership – Theory, Process and Practice", 9th edition, Cengage Learning 2014

REFERENCES:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Entrepreneurship Theory at Cross Roads: paradigms and Praxis", 2nd Edition Dream Tech, 2005.

E-RESOURCES: (including NPTEL course)

1. https://learnwise.wfglobal.org/#/IN/en/courses

COURSE ARTICULATION MATRIX:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.	3	1	1							2	2	3
2.	3	1	1							2	2	3
3.	3	1	1							2	2	3
4.	3	1	1							2	2	3
5.	3	1	1							2	2	3
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)												

VC22002	ADVANCES IN ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

1. To provide Knowledge on Business model, Business plan and new business model/prototype.
2. To provide Skill set on increasing revenue and funding.
3. To understand the Team building, Measurement of progress and legal matters.

UNIT I BUSINESS MODEL& PRODUCT SERVICE 6

Introduction to the concept of pivoting –Business Model-Types of Business Model-Business Model Evaluation-Refining Business Model-Analyzing Business Model-Adding New customer to Business model.Problem in new product development-New business model/Prototype.

UNIT II BUSINESS PLANNING 6

Business Plan-Sales plan- People plan- Finance plan-understanding finance planning-Forecasting template. **Creating procurement plan-Negotiation role play-Activity.**

UNIT III INCREASING REVENUE AND FUNDING 6

Understanding of primary revenue source-Customer life cycle-Exploring secondary revenue source-Funding option.Exploring funding option-Pitch deck.

UNIT IV BUILDING A TEAM AND BRANDINGS 6

Introduction to building a team-pitching to attract team-Setting a team for success-standardize key process-Branding-Definition of values-Positioning statement-Identification of right channel-Digital marketing.
Brand name and logo activity.

UNIT V MEASUREMENT OF PROGRESS AND LEGAL MATTERS 6

Metrics for customer retention and satisfaction-Metrics dash board-legal and compliance requirement-Identify mentor and advisors.
Project.

TOTAL: 30 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Acquire knowledge and Practice on Business model and Business planning	**2**
CO2	Understand the concept of increasing the revenue and funding.	**2**
CO3	Acquire knowledge on building a team and branding.	**3**
CO4	Acquire knowledge on Measurement of progress and legal matters.	**4**
CO5	Practice on Project management.	**3**

TEXT BOOKS:

1. S.S.Khanka, "Entrepreneurial Development" S.Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, " Entreprenuership – Theory, Process and Practice", 9th edition, Cengage

REFERENCES:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
2. Mathew J Manimala, "Entrepreneurship Theory at Cross Roads: paradigms and Praxis", 2nd Edition Dream Tech, 2005.

E-RESOURCES: (including NPTEL course)

1. https://lms.learnwise.wfglobal.org/IN/en/home

COURSE ARTICULATION MATRIX:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.	3				1				1	2	1	3
2.	3				1				1	2	1	3
3.	3				1				1	2	1	3
4.	3				1				1	2	1	3
5.	3				1				1	2	1	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

MC22001 **Indian Constitution and Society** **0 0 0 0**

OBJECTIVES:

- To know about Indian constitution and fundamental rights.
- To know about central and state government functionalities in India.
- To know about Judicial system and Election commission of India.

UNIT I : INTRODUCTION **[8 hours]**

Historical Background – Philosophical foundations of the Indian Constitution – Preamble – Schedules – Amendments – Discussion about 42nd, 44th, 73rd and 74th Constitutional Amendments.

UNIT II : FUNDAMENTAL RIGHTS AND FUNDAMENTAL DUTIES OF THE CITIZEN

[9 hours]

Union and Territories – Citizenship – Discussion about CAA - Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Schemes related to DPSP, Article relevance to special status given various states in the country.

UNIT III : STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT

[8 hours]

Union Government – Structures of the Union Government and Functions – Powers of President, Vice President, Prime Minister – Cabinet ministers – Parliament – Emergency provisions.

NIT IV : STRUCTURE AND FUNCTION OF STATE GOVERNMENT

[8 hours]

State Government – Structure and Functions – Powers of Governor, Chief Minister, Cabinet ministers – State Legislature.

UNIT V : STRUCTURE OF JUDICIAL SYSTEM AND MAJOR FUNCTIONARIES

[12 hours]

Supreme Court of India - Judicial System in States – High Courts and other Subordinate Courts – Judicial Review – Case studies. Election Commission of India and its functions.

[TOTAL: 45 PERIODS]

OUTCOMES: Upon completion of the course, students will be able to:

CO	CO statement
CO - 1	Enhance human values, create awareness about law enactment and importance of Constitution
CO – 2	To Understand the Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities.
CO - 3	To Understand the powers and functions of Central Government.
CO – 4	To Understand the powers and functions of State Government.
CO - 5	To Understand the powers and functions of Judicial systems and Election commission of India.

TEXTBOOKS:

1. S. R. Bansali (2015), "Text book on Constitution of India (1st Edition) ", Universal Law Publications, New Delhi.
2. K.L. Bhatia, (2016) "Cases and Materials on Constitutional Law of India (1st Edition)", Universal Law Publications, New Delhi.
3. M. Lakshmikant (2020), "Indian Polity ", McGraw Hill., New Delhi.
4. Dr. B.R. Ambedkar, (2020) "The Constitution of India", Sudhir Prakashan.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

COURSE ARTICULATION MATRIX

COs	POs														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.		2		2				3		1		1			
2.		2	1	2	2			3	2	1		1			
3.									2	1		1			
4.									2	1		1			
5.				2				3	2	1	2	1			

MC22002 **ESSENCE OF INDIAN TRADITIONAL KNOWLEDG** **L T P C**

(Common to all branches) **3 0 0 3**

V / VI Semester

CO 1: Identify and discuss the concept of Traditional culture of this country and its importance.

CO 2: Discuss about the need and importance of Languages and Literatures of this country.

CO 3: Elucidate the traditional religion and philosophy of this country.

CO 4: Interpret the various traditional fine arts which exist from ancient days.

CO 5: Explain the importance of Traditional knowledge in Agriculture and Medicine.

UNIT - I **9**

Introduction to Culture: Culture, civilization and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT - II **9**

Indian Languages and Literature: Indian Languages and Literature-I, the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, the literature of south India Indian Languages and Literature-II: Northern Indian languages & literature.

UNIT - III **9**

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (Brahmo Sabha 1828, Satyashodhak Samaj 1873, Arya Samaj 1875, Bhoodan movement 1951 only).

UNIT – IV **9**

Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India.

UNIT – V **9**

Education System in India: Education in ancient, medieval, and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

OUTCOMES: Upon completion of the course, students will be able to:

CO	CO statement
CO - 1	Enhance human values, create awareness about law enactment and importance of Constitution
CO – 2	To Understand the Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities.
CO - 3	To Understand the powers and functions of Central Government.
CO – 4	To Understand the powers and functions of State Government.
CO - 5	To Understand the powers and functions of Judicial systems and Election commission of India.

Reference Book:

1. 'Traditional Knowledge System and Technology in India' by Basanta Kumar Mohanta and Vipin Kumar Singh,
Pratibha Prakashan 2012.
2. Traditional Knowledge System in India' by Amit Jha Atlantic publishers, 2002.
3. Knowledge Traditions and Practices of India' by Kapil Kapoor and Michel. 2002

Text Book:

1. Traditional Knowledge System in India' by Amit Jha, 2009

COURSE ARTICULATION MATRIX

COs	POs												PEOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.		1		2		3		3		2	2	3			
2.		1		2		3		3		2	2	3			
3.		1		2		3		3		2	2	3			
4		1		2		3		3		2	2	3			
5		1		2		3		3		2	2	3			

MC22003 GENDER SENSITIZATION AND SOCIAL IMPACT L T P C

3 1 0 4

COURSE OBJECTIVES:

- Analyze the social construction of gender by defining and differentiating between sex and gender and how various factors shape gender roles, stereotypes.
- Deconstruct the concept of patriarchy and its influence on gender dynamics and analyze legal frameworks and policies addressing women's rights and workplace equality to develop strategies. for challenging gender bias and promoting equal access to resources and positions of power.
- Address different forms of gender discrimination and harassment especially in the workplace by analyzing gender dynamics within professional settings.
- Apply principles of gender-inclusive design in engineering and infrastructure projects.
- Develop strategies for inclusivity in all domains by understanding the experiences and challenges faced by LGBTQ+ individuals by analyzing their rights and supporting advocacy efforts.

UNIT I – Introduction to Gender & Social Impact 9 Hours

Gender as a social construct - sex and gender; influence of culture and tradition on gender, intersection - gender with other identities such as race, class, language and sexuality, gender and media; nature of gender inequalities and its impact on men and women; understanding patriarchy and gender roles stereotypes and their impact - gender equality as liberation of men as well as women.

UNIT II – Gender Advocacy, Action & Policy

9 Hours

Overview of gender advocacy - gender policy and implementation - role of engineers in promoting gender advocacy and policy; understanding the concept of citizenship, breach of women’s rights as citizens and individuals; access to and control over resources and positions of power and their impact.

UNIT III - Workplace Gender Discrimination & Sexual Harassment Prevention

9 Hours

Gender dynamics in the workplace - recognizing and addressing gender discrimination - understanding sexual harassment: types, impact, and prevention - creating safe and inclusive work environments, supreme court judgments, and the provisions in the act of 201; role of society in the prevention of sexual harassment.

UNIT IV - Gender Action in Engineering and Infrastructure Sectors

9 Hours

Gender inclusive engineering and infrastructure design - incorporation of gender sensitive components in rural and urban infrastructure projects (community toilets, safe access to potable water, household level sanitation etc) - gender sensitive solid waste management and disposal (diapers, sanitary napkins) in schools/ colleges/ workplaces/ construction worker camps) - design of disaster proof/ relief centers to handle disaster relief and pandemic related quarantine requirements in tandem with heightened sensitivity for girl children, mother-baby requirements (nursing) and emergency care. - case studies on gender-sensitive engineering projects.

UNIT V – Social Justice and Equality - Inclusiveness of Gender Marginalized Groups

9 Hours

Understand LGBTQ+ identities and experiences; challenges faced by LGBTQ+ individuals in engineering and society; LGBTQ+ - rights and advocacy efforts; creating inclusive spaces for gender marginalized groups in engineering education and practice - inter sectionality: overlapping identities and struggles within the LGBTQ+ community.

TOTAL: 45 PERIODS

Course Outcomes

CO. No.	STATEMENT	RBT LEVEL
At the end of the course, learners will be able to:		
CO1.	Comprehend how culture and tradition influence gender perception and how they promote differences, how gender roles are stereotyped and their impact on women.	6

CO2.	Gain an overview of Gender advocacy policies and implementation and how distribution resources and power control create gender gap and how legal process can be used to halt workplace harassment, domestic violence and bring justice.	6
CO3.	Learn the existence of Gender Discrimination at different levels of Institutions – social, cultural, economic, political, and educational and the use of legal procedure to address workplace harassment and other issues.	3
CO4.	Generate awareness about equality in law, social system and democratic activities and Involve in promoting social justice and human rights through integrating gender sensitiveness in rural and urban infrastructure projects.	6
CO5.	Evaluate the status of Gender Marginalized Groups and need for social justice and equality.	5

REFERENCES

- Agnes, Flavia, *Law and Gender Inequality: The Politics of Women's Rights in India.* Delhi: Oxford University Press, 2001.
- Beauvoir, S. de., *The second sex.* Vintage Classics. 2015
- Chakraborty Tanusree, Nandita Mishra, Ashok Natarajan, Bipasha Chatterjee (editors) Gender Equality from a Modern Perspective
- Chaudhuri, Maitrayee. *Feminism in India (Issues in Contemporary Indian Feminism)* New York: Zed, 2005.
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- Saranta, Moses Kipainoi (and others., Independently published , 2023.
- Sepaha, Priya. Gender Equality Issues And Challenges., Satyam Law International. 2023
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- Skjerven Astrid (Editor), Maureen Fordham Gender and the Sustainable Development Goals: Infrastructure, Empowerment and Education (Routledge/ISDRS Series in Sustainable Development., Taylor & Francis Ltd; 1st edition (1 September 2022
- Coles, A., Gray, L., & Momsen, J. (Eds.). (2015). *The Routledge*
- United Nations. (1980). *Convention to Eliminate All forms of Discrimination (Negligence of Girl child) against Women (CEDAW*).
- *A Guiding Booklet For Perspective on Ensuring Inclusion and Gender Equality In the Implementation of The Project- Society for Elimination of Rural Poverty* (SERP)
- UNESCO (2015*). A Guide for Gender Equality in Teacher Education Policy and Practice*s (PDF). Paris, UNESCO. pp. 9–10, 59–61. ISBN 978-92-3- 100069-0.

Course Articulation Matrix

COs	**POs**														
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.	-	-	-	-	-	-	-	**3**	**3**	**3**	-	**3**	-	-	-
2.	-	-	-	-	-	-	-	**3**	**3**	**3**	-	**3**	-	-	-
3.	-	-	-	-	-	-	-	**3**	**3**	**3**	-	**3**	-	-	-
4.	-	-	-	-	-	-	-	**3**	**3**	**3**	-	**3**	-	-	-
5.	-	-	-	-	-	-	-	**3**	**3**	**3**	-	**3**	-	-	-

3 - strong correlation; 2- moderate correlation ; 1- low correlation; - no correlation

GN22001 Introduction of National Cadet Corps for Engineers

L	T	P	C
3	0	0	2

OBJECTIVES:

- Develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance and dignity of labour in the cadets.
- To create interest in cadets by including and laying emphasis on those aspects of Institutional Training which attract young cadets into the NCC and provides them an element of thrill and excitement.
- To inculcate defence Services work ethos that is characterized by hard work, sincerity of purpose, honesty, ideal of selfless service, dignity of labour, secular outlook, comradeship, spirit of adventure and sportsmanship.
- To create a pool of organized, trained and motivated youth withleadership qualities in all walks of life, who will serve the Nation regardless ofwhich career they choose.
- To provide conducive environment to motivate young Indians to choose the Armed Forces as a career.

UNIT I NCC GENERAL & NATIONAL INTEGRATION AND AWARENESS 12

Aims, Objectives & Organization of NCC, Incentives, Duties of NCC Cadet, NCC Camps - Types & Conduct, National Integration - Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building, Threats to National Security.

UNIT II PERSONALITY DEVELOPMENT, LEADERSHIP & SOCIAL SERIVCE ACTIVITIES 12

Personality Development Capsule -Self Awareness, Empathy, Critical and Creative Thinking, Decision Making, Communication Skills and Public Speaking, Group Discussion - Stress and Emotions, Change your mindset, Inter Personal Relations and Team Work, Time Management, Civic Sense, Career Counseling, SSB Procedure and Interview Skills,Leadership Capsule -Traits, Indicators, Motivation, Ethics, Honour Code, Case Studies -Shivaji, APJ Abdul Kalam, Deepa Malik, Maharana Pratap, Ratan Tata, Kiran Majumdar, Jhasi Ki Rani, Narayan Murty, Prakash Padukone, Tipu Sultan, Rabindra Nath Tagore, Hygiene and Sanitation (Personal & Camp Hygiene)Soch Vichar, First Aid in Common Medical Emergencies, Treatment and Care of Wounds, Introduction to Yoga and Exercises.

UNIT III DISASTER MANAGEMENT&BORDER AND COASTAL AREAS **12**

Disaster Management Capsule - Soch Vichar, Types, Organization, Capability and Role of NCC cdts, Team Composition and Equipment for specific disasters, Fire Service and Fire Fighting, Initiative Trg, Organising Skills, Do's & Don't's - Natural Disasters and Man-Made Disasters, History, Geography and Topography of Border/Coastal Areas, Security Setup and Border/Coastal management in the area, Security Challenges & Role of cadets in Border management.

UNIT IVARMED FORCES AND INTRODUCTION TO INFANTRY WEAPONS AND EQUIPMENT'S **12**

Armed Forces – Army, Navy, Air force, Indian Coast Guard, CRPF, CAPF, Police, Home Guard - Modes of entry to above mentioned organizations - Organization of Infantry Battalion – Equivalent ranks in Armed forces - Infrastructure of Indian Armed forces.

UNIT V FIELD CRAFT AND BATTLE CRAFT & MILITARY HISTORY **12**

Introduction to Field Craft, Indication of Landmark, Observation, Camouflage and Concealment, Fire and Move Capsule - Field Signals, Section Formations and Fire Control Orders, NCC camps – Aims and Objectives - Biographies of Renowned Generals, War Heroes - PVC Awardees, Study of Battles – Indo-Pak War 1965, 1971, Kargil war, Indo-China border disputes (Arunachal Pradesh issue, Galwan valley issue), War Movies.

TOTAL: 60 PERIODS

OUTCOMES:

1. Cadets will be able to imbibe the conduct of NCC cadets.
2. Cadets will be able to respect the diversity of different Indian culture.
3. Cadets will be able to practice togetherness and empathy in all walks of their life.
4. Cadets will be able to do their own self-analysis and will work out to overcome their weakness for better performance in all aspects of life.
5. Cadets will be able to think divergently and will try to break functional fixedness.
6. Cadets will be able to make a team and will work together for achieving the common goals.

REFERENCE:

1. R. Gupta, "NCC - A Concise Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations", Ramesh Publishing House, New Delhi.

GN22002	YOGA FOR PHYSICAL AND MENTAL WELL BEING	L	T	P	C
	(Common to all Branches)	0	0	2	1

OBJECTIVES

- To learn the fundamentals of Yoga for harmonizing the body, mind and emotions.
- To demonstrate the value and the practice of holistic living.
- To value the heritage of yoga for self and society.

SIMPLIFIED PHYSICAL EXERCISE

Hand Exercises- Leg Exercises-Benefits- Breathing Exercises- Eye Exercises-Kapalapathi-Benefits,Makarasana Part 1- Makarasana Part-II- Benefits-Body Massage- Acu Pressure- Relaxation Benefits

KAYAKALPAYOGA

Kaya kalpa Exercise-Aswini Mudhra- Moola Bandha- Ojas Breath

Special Asana

Surya Namaskar

Asanas-

Padmasana-Vajrasana, Sukasana,-Chakrasana (side posture)-Viruchasana, Bhujangasana- Yoga mudra,-Ustrasana- Maha Mudra-Vakkarasana.

Breathing Exercise (Pranayama)-Nadi Suddhi-Seettali-Seethkari-Kapalapathi- Mudra and Bandha

Chin-Vaayu-Sonya, Prithvi, Suriya, Varuna, Prana, Abana, Aadi, Linga, Ashwini mudra

Yogasanas

Rules for Asanas- Time, place, Dress, Age, Posture , Food Habits, Breath and methods

Meditation- Shanthi, ThuriyamThuriyatheetham and Nine Centre

Total hours 30

OUTCOMES:

CO	Statements	RBT Level
CO1	Demonstrate and understand a variety of exercises targeting different parts of the body and learn to integrate the relaxation techniques into daily life for stress management and holistic health.	3
CO2	Integrate Kayakalpa Yoga principles into a daily routine for enhanced vitality and longevity and demonstrate various yogic practices such as Surya Namaskar and Asanas.	3
CO3	Apply Mudras and Bandhas into a regular yoga practice for holistic health benefits and for meditation and stress relief	4
CO4	Identify the optimal timings, food habits in relation to yoga practice including recommendations for pre and post-practice meals.	3

References:

1. Brown, F. Y.(2000). How to use yoga. Delhi:Sports Publication.
2. Gharote, M. L. &Ganguly, H. (1988). Teaching methods for yogic practices.LonawalaKaixydahmoe.
3. Rajjan, S. M. (1985). Yoga strengthening ofrelaxation for sports man. New Delhi:AlliedPublishers.
4. Shankar,G.(1998). Holistic approach of yoga. New Delhi:Aditya Publishers.
5. Shekar,K. C. (2003). Yoga for health. Delhi: Khel Sahitya Kendra.

COURSEARTICULATIONMATRIX

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

3-High,2-Medium,1-Low,'-'–nocorrelation

CV22011 **FINANCIAL MANAGEMENT** **L T P C**

3 0 0 3

LEARNING OBJECTIVES

1. To acquire the knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe about capital budgeting and cost of capital.
4. To discuss on how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools on Working Capital Management.

UNIT I INTRODUCTION TO FINANCIAL MANGEMENT **9**

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.

UNIT II SOURCES OF FINANCE **9**

Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc

UNIT III INVESTMENT DECISIONS: **9**

Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital Budgeting –– Payback -ARR – NPV – IRR –Profitability Index.

Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IV FINANCING AND DIVIDEND DECISION **9**

Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure .

Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - -Determinants of Dividend Policy

UNIT V WORKING CAPITAL DECISION 9

Working Capital Management: Working Capital Management - concepts - importance -Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies.

TOTAL: 45 PERIODS

TEXT BOOKS

1. M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill
2. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd

REFERENCES .

1. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,.
2. Prasanna Chandra, Financial Management,
3. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

OUTCOMES:

CO#	Course Outcomes	RBT Level
1	Analyze financial statements to make informed decisions about investments, budgeting, and financial planning	**AN**
2	Explore the different sources of finance available to businesses, including internal and external sources.	**AP**
3	Select appropriate financing options for various business needs and Analyzing the factors that influence dividend policy decisions	**AP**
4	Integrating financial and strategic considerations in the capital decision-making process.	**AP**
5	Evaluate investment opportunities and recommend appropriate investment strategies.	**AN**

COURSE ARTICULATION MATRIX

Cos	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	3	3	1	1	1	1	1	3	1	1	3	3		
2.	3	3	2	2	2	1	1	3	3	3	3	3		
3.	3	3	2	2	2	1	1	3	1	1	3	3		
4.	3	3	2	2	2	1	1	3	1	1	3	3		
5.	3	3	2	2	2	1	1	3	1	1	3	3		

CV22012	FUNDAMENTALS OF INVESTMENT	L	T	P	C
		3	0	0	3

COURSEOBJECTIVES:

- Describe the investment environment in which investment decisions are taken.
- Explain how to Value bonds and equities
- Explain the various approaches to value securities
- Describe how to create efficient portfolios through diversification
- Discuss the mechanism of investor protection in India.

UNIT I THE INVESTMENT ENVIRONMENT 9

The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflationonreturn.

UNIT II FIXED INCOME SECURITIES 9

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

UNIT III APPROACHES TO EQUITY ANALYSIS 9

Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

UNIT IV PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES 9

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India

UNIT V INVESTOR PROTECTION 9

Role of SEBI and stock exchanges in investor protection;Investor grievances and their redressal system, insider trading, investors' awareness and activism

TOTAL : 45 PERIODS

REFERENCES

1. Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14TH Edition, 2019.
2. Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill

education,5th, Edition, 2017.

3. Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.
4. ZviBodie, Alex Kane, Alan J Marcus, PitabusMohanty, Investments, McGraw Hill Education(India), 11 Edition(SIE), 2019

OUTCOMES:

CO#	Course Outcomes	RBT Level
1	Analyze the investment environment, assess its impact on investment opportunities, and make informed decisions considering the broader economic and regulatory context.	**AN**
2	Analyze and value fixed income securities, assess their risks and returns, and integrate them into diversified investment portfolios.	**AN**
3	Perform equity valuation using various methods and metrics	**AP**
4	Evaluating portfolio performance using metrics and employ financial derivatives as part of broader financial strategies, managing risk and enhancing returns	**E**
5	Identify, understand, and apply the principles and regulations designed to protect investors, ensuring they can recognize and advocate for fair and ethical practices in financial markets.	**AP**

COURSE ARTICULATION MATRIX

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	1	1	1	1	1	3	1	1	3	3		
2.	3	3	2	2	2	1	1	3	2	2	3	3		
3.	3	3	2	2	2	1	1	3	1	1	3	3		
4.	3	3	2	2	2	1	1	3	1	1	3	3		
5.	3	3	2	2	2	1	1	3	1	1	3	3		

CV22013 BANKING, FINANCIAL SERVICES AND INSURANCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM 9

Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations inIndian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT II MANAGING BANK FUNDS/ PRODUCTS 9

Liquid Assets - Investment in securities - Advances - Loans.Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes.Designing deposit schemes– Asset and Liability Management – NPA's – Current issues on NPA's – M&A's of banks into securities market

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY 9

Payment system in India – paper based – e payment –electronic banking –plastic money – e-money –forecasting of cash demand at ATM's –The Information Technology Act, 2000 in India – RBI's Financial Sector Technology vision document – security threats in e-banking & RBI's Initiative.

UNIT IV FINANCIAL SERVICES 9

Introduction – Need for Financial Services – Financial Services Market in India – NBFC — Leasing and Hire Purchase — mutual funds. Venture Capital Financing –Bill discounting –factoring – Merchant Banking

UNIT V INSURANCE 9

Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 –IRDA – Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival – settlement of claim

TOTAL : 45 PERIODS

REFERENCES :

1. Padmalatha Suresh and Justin Paul, "Management of Banking and Financial Services, Pearson, Delhi, 2017.

2. Meera Sharma, "Management of Financial Institutions – with emphasis on Bank and RiskManagement", PHI Learning Pvt. Ltd., New Delhi 2010

3. Peter S. Rose and Sylvia C. and Hudgins, “Bank Management and Financial Services”, Tata McGraw Hill, New Delhi, 2017

OUTCOMES:

CO#	Course Outcomes	RBT Level
1	Exploring the evolution and reforms of the Indian banking system and their impact on the economy.	**AP**
2	Manage banking funds and develop innovative products and services that meet customer needs while maximizing returns and minimizing risks.	**AP**
3	Analyze the use of technology in banking operations, propose technology-driven solutions to address industry challenges	**AN**
4	Analyze, and deliver a wide range of financial services tailored to the needs of clients, thereby facilitating financial transactions, risk management, wealth accumulation, and investment growth.	**AN**
5	Analyze, and manage insurance products and risks, both from the perspective of individuals and businesses, to mitigate financial losses and protect against unforeseen events.	**AN**

COURSE ARTICULATION MATRIX

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	1	1	1	1	1	3	1	2	3	3		
2.	3	3	2	2	2	1	1	3	1	2	3	3		
3.	3	3	2	2	2	1	1	3	1	2	3	3		
4.	3	3	2	2	2	1	1	3	1	2	3	3		
5.	3	3	2	2	2	1	1	3	1	2	3	3		

CV22014	INTRODUCTION TO FINTECH	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn about history, importance and evolution of Fintech
- To acquire the knowledge of Fintech in payment industry
- To acquire the knowledge of Fintech in insurance industry
- To learn the Fintech developments around the world
- To know about the future of Fintech

UNIT I INTRODUCTION **9**

Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, BankingIndustry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.

UNIT II PAYMENT INDUSTRY **9**

FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2Plending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT III INSURANCE INDUSTRY **9**

FinTech in Wealth Management Industry-Financial Advice, Automated investing, Socially responsible investing, Fractional Investing, Social Investing. FinTech in Insurance Industry- P2P insurance, On-Demand Insurance, On-Demand Consultation, Customer engagement through Quote to sell, policy servicing, Claims Management, Investment linked health insurance.

UNIT IV FINTECH AROUND THE GLOBE **9**

FinTech developments - US, Europe and UK, Germany, Sweden, France, China, India, Africa, Australia, New Zealand, Brazil and Middle East, Regulatory and Policy Assessment for Growth of FinTech. FinTech as disruptors, Financial institutions collaborating with FinTech companies, The new financial world.

UNIT V FUTURE OF FINTECH **9**

Impact of emerging technologies in financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks

partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

TOTAL : 45 PERIODS

REFERENCES

1. Arner D., Barbers J., Buckley R, The evolution of FinTech: a new post crisis paradigm,University of New South Wales Research Series, 2015
2. Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbookfor Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016
3. Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking andthe Finance Industry, 2016
4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial serviceindustry CRC Press, 2018
5. Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications,2020
6. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback,2018

OUTCOMES:

CO#	Course Outcomes	RBT Level
1	Analyze the fundamentals of fintech, evaluate its impact on financial services, and anticipate future trends and opportunities in the fintech space.	**AN**
2	Analyze, and leverage fintech innovations in the payment industry to enhance transaction efficiency, customer experience, and financial inclusion.	**AN**
3	Evaluating the role of fintech applications, in transforming insurance operations and products.	**E**
4	Developing strategies to leverage fintech innovations for business growth, customer engagement, risk management, and regulatory compliance.	**C**

COURSE ARTICULATION MATRIX

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	1	1	1	1	1	3	1	1	1	2		
2.	3	3	2	2	2	1	1	3	3	3	1	3		
3.	3	3	2	2	2	1	1	3	1	1	1	3		
4.	3	3	2	2	2	1	1	3	1	1	1	3		
5.	3	3	2	2	2	1	1	3	1	1	1	3		

CV22015 FINTECH PERSONAL FINANCE AND PAYMENTS L T P C

3 0 0 3

UNIT I CURRENCY EXCHANGE AND PAYMENT 9

Understand the concept of Crypto currency- Bitcoin and Applications -Cryptocurrencies and Digital Crypto Wallets -Types of Cryptocurrencies - Cryptocurrencies and Applications, block chain, Artificial Intelligence, machine learning. Fintech users, Individual Payments, RTGS Systems, Immediate Page 54 of 90 Payment Service (IMPS), Unified Payments Interface (UPI).Legal and Regulatory Implications of Crypto currencies, Payment systems and their regulations.Digital Payments Smart Cards, Stored-Value Cards, EC Micropayments, Payment Gateways, Mobile Payments, Digital andVirtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues

UNIT II DIGITAL FINANCE AND ALTERNATIVE FINANCE 9

A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity andEquity,. Introduction to the concept of Initial Coin Offering

UNIT III INSURETECH 9

InsurTech Introduction , Business model disruption AI/ML in InsurTech, IoT and InsurTech ,Risk Modeling ,Fraud Detection Processing claims and Underwriting Innovations in Insurance Services

UNIT IV PEER TO PEER LENDING 9

P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of Crowdfunding Crowdfunding Architecture and Technology ,P2P and Crowdfunding unicorns and business models , SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations

UNIT V REGULATORY ISSUES 9

FinTech Regulations: Global Regulations and Domestic Regulations, Evolution of RegTech, RegTech Ecosystem: Financial Institutions, RegTech Ecosystem: StartupsRegTech, Startups: Challenges, RegTech Ecosystem: Regulators, Use of AI in regulation and Fraud detection

TOTAL : 45 PERIODS

REFERENCE

1. Swanson Seth, Fintech for Beginners: Understanding and Utilizing the power of technology, Createspace Independent Publishing Platform,2016.
2. Models AuTanda, Fintech Bigtech And Banks Digitalization and Its Impact On Banking Business, Springer, 2019
3. Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations, Wildfire Publishing, 2016
4. Jacob William, FinTech:TheBeginner's Guide to Financial Technology, Createspace Independent Publishing Platform, 2016
5. IIBF, Digital Banking, Taxmann Publication, 2016
6. Jacob William, Financial Technology, Create space Independent Pub, 2016
7. Luke Sutton, Financial Technology: Bitcoin & Blockchain, Createspace Independent Pub,2016

OUTCOMES:

CO#	Course Outcomes	RBT Level
1	Analyzing the mechanisms of currency trading and the role of major participants in the forex market	**AN**
2	Analyzing the impact of digital finance on traditional financial services and business models.	**AN**
3	Analyzing the benefits and challenges of alternative finance for borrowers and investors.	**AN**
4	Apply insurtech innovations to enhance insurance services, improve risk management	**AP**
5	Assessing the compliance challenges and regulatory risks associated with P2P lending	**AN**
6	Exploring the regulatory requirements and compliance standards applicable to financial products and services	**AN**

COURSE ARTICULATION MATRIX

Cos	Pos												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
1.	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**	**3**	**3**		
2.	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**3**	**3**	**3**	**3**		
3.	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**1**	**1**	**3**	**3**		
4.	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**1**	**1**	**3**	**3**		
5.	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**3**	**1**	**1**	**3**	**3**		

CV22016 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS : THEORY AND PRACTICES

L	T	P	C
2	0	2	3

UNIT I INTRODUCTION TO BLOCKCHAIN 6+6

Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.

UNIT II INTRODUCTION TO CRYPTOCURRENCY 6+6

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin– Zcash – Smart Contracts – Ricardian Contracts- Deploying smart contracts on a blockchain

UNIT III ETHEREUM 6+6

Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network

UNIT IV WEB3 AND HYPERLEDGE 6+6

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT V EMERGING TRENDS 6+6

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

TOTAL(L:30+P:30):60 PERIODS

REFERENCE

1. Imran. Bashir. Mastering block chain: Distributed Ledger Technology, Decentralization, andSmart Contracts Explained. Packt Publishing, 2nd Edition, 2018

2. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018

3. ArshdeepBahga, Vijay Madisetti, “Blockchain Applications: A Hands On Approach”, VPT,2017.

OUTCOMES:

CO#	Course Outcomes	RBT Level
1	Explore the fundamentals of blockchain technology, its architecture, and its applications	**AP**
2	Explore the fundamentals of cryptocurrencies, including their creation, functioning, and role in various ecosystem	**AP**
3	Exploring the creation, deployment, and execution of smart contracts on the Ethereum platform	**AP**
4	Explore the principles and technologies underlying Web 3.0, including decentralization, blockchain, and peer-to-peer networks.	**AP**
5	Designing and implementing Hyperledger-based solutions to address specific application operational challenges.	**C**

COURSE ARTICULATION MATRIX

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	1	1	1	1	1	3	1	1	1	2		
2.	3	3	2	2	2	1	1	3	3	3	1	3		
3.	3	3	2	2	2	1	1	3	1	1	1	3		
4.	3	3	2	2	2	1	1	3	1	1	1	3		
5.	3	3	2	2	2	1	1	3	1	1	1	3		

CV22017	DIGITAL PRODUCT DEVELOPMENT AND MANAGEMENT : THEORY AND PRACTICES	L	T	P	C
		2	0	2	3

Objectives:

- Articulate the history and general role of the Product Manager.
- Articulate the role of the Digital Product Manager including the key responsibilities, characteristics and skills for achieving success
- Gain the necessary insights into the planning activity and the dynamics of decision making

Unit 1 Digital Product Development 9

Technology-Powered Products and Services - Startups: Getting to Product/Marketing Fit - Growth-Stage Companies: Scaling to Success - Enterprise Companies: Consistent Product Innovation - The Root Causes of Failed Product Efforts - Beyond Lean and Agile

Unit 2 Development Process and Team 9

Principles of Strong Product Teams - The Product Manager - The Product Designer - The Engineers - Product Marketing Managers - The Supporting Roles - The Role of Leadership - The Head of Product Role - The Head of Technology Role - The Delivery Manager Role - Principles of Structuring Product Teams

Unit 3 The Right Product Development 9

The Problems with Product Roadmaps - The Alternative to Roadmaps - Product Vision and Product Strategy - Principles of Product Vision - Principles of Product Strategy - Product Principles - The OKR Technique - Product Team Objectives - Product Objectives @ Scale - Product Evangelism – Profile

Unit 4 Product Management 9

Principles of Product Discovery - Discovery Techniques Overview - DISCOVERY FRAMING TECHNIQUES - Opportunity Assessment Technique - Customer Letter Technique - Startup Canvas Technique - Story Map Technique - Customer Discovery Program Technique - Customer Interviews - Concierge Test Technique - The Power of Customer Misbehavior - Hack Days - Principles of Prototypes - Feasibility Prototype Technique - User Prototype Technique - Live-Data Prototype Technique - Hybrid Prototype Technique

Unit 5 Product Transformation 9

Testing Usability - Testing Value - Demand Testing Techniques - Qualitative Value Testing Techniques - Quantitative Value Testing Techniques - Testing Feasibility - Testing Business Viability - Discovery Sprint Technique - Pilot Team Technique - Weaning an Organization Off Roadmaps - Case Studies: Profile: Jane Manning of Google - Profile: Lea Hickman of Adobe, Alex Pressland of the BBC, Kate Arnold of Netflix, Martina Lauchengco of Microsoft

TOTAL(L:30+P:30):60 PERIODS

TEXT BOOKS:

1. Inspired: How to create tech products customers love, Marty Cagan, John Wiley & Sons, 2017.
2. Approaches to PRODUCTIZATION PROCESSES: A CASE by Junttan Oy, Amine Bourahli, 2020.

REFERENCES:

1. Everett M. Rogers. (2010). Diffusion of Innovations, 4th Edition. [N.p.]: Free Press. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&site=eds-live&db=edsebk&AN=1976305
2. Anna Cabigiosu, & Diego Campagnolo. (2019). Innovation and growth in KIBS: the role of clients' collaboration and service customisation. Industry and Innovation, (5), 592. https://doi.org/10.1080/13662716.2018.1483823
3. Richard Shearmur, & David Doloreux. (2019). KIBS as both innovators and knowledge intermediaries in the innovation process: Intermediation as a contingent role. Papers in Regional Science, (1), 191. https://doi.org/10.1111/pirs.12354

OUTCOMES:

CO#	Course Outcomes	RBT Level
1	Explore the principles and practices of digital product development and management, focusing on creating innovative digital financial products and services	**AP**
2	Exploring the roles and responsibilities within development teams, including product owners, developers, testers, and stakeholders.	**AP**
3	Identify market opportunities, conceptualize viable products, navigate regulatory requirements, and execute successful product development	**AP**
4	Analyze, and implement effective product management strategies to develop, launch, and manage products and services that meet customer needs and drive business growth.	**AN**
5	Developing strategies for product transformation, including digitization, platformization, and ecosystem integration	**C**

COURSE ARTICULATION MATRIX

Cos	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	3	3	1	1	1	1	1	3	1	1	1	2		
2.	3	3	2	2	2	1	1	3	3	3	1	3		
3.	3	3	2	2	2	1	1	3	1	1	1	3		
4.	3	3	2	2	2	1	1	3	1	1	1	3		
5.	3	3	2	2	2	1	1	3	1	1	1	3		

CV22021	ENTREPRENEURSHIP AND INNOVATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Learn basic concepts in entrepreneurship , develop mind-set and skills necessary to explore entrepreneurship
2. Apply process of problem -opportunity identification and validation through human centred approach to design thinking in building solutions
3. Analyse market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product
4. Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture
5. Prepare and present an investible pitch deck of their practice venture to attract stakeholders

UNIT I ENTREPRENEURSHIP FUNDAMENTALS **9**

Meaning and concept of entrepreneurship, Entrepreneurship in Indian Scenario & Its role ineconomic development, Emerging Trends in Entrepreneurship, Entrepreneur and Entrepreneurship, characteristics of Entrepreneur, Myths about Entrepreneurship, Entrepreneur vsIntrapreneur, Role of Entrepreneurial Teams

UNIT II PROBLEM-OPPORTUNITY IDENTIFICATION AND CUSTOMERS DISCOVERY **9**

Understanding the Problem and opportunity, define problem using Design thinking principles and validate problem, recognizing the market opportunity, environment scanning. Exploring market types and estimating the market size, knowing your customer and consumer, Customer segmentation, identifying niche markets and creating customer personas.

UNIT III CRAFTING A COMPELLING VALUE PROPOSITION- SOLUTION **9**

Importance of Value Proposition, Knowing Customer Job, Pains, and Gains using Value Proposition Canvas, Developing Problem-solution fit, Differentiating features and benefits of the

product/service. Competition analysis, Competitive positioning and understanding unique selling points.

UNIT IV BUSINESS MODEL AND BUILD YOUR MVP **9**

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Prototyping, Building a Minimum viable product, Hypothesis testing and MVP Validation, MVP Iteration-Importance of Build - Measure – Lean approach

UNIT V BUSINESS PLAN AND FINANCIAL FEASIBILITY **9**

Business planning: components of Business plan- Sales plan, People plan and Financial plan, Preparing a business plan. Financial Planning: Types of costs, preparing the financial plan using financial template, understanding basics of Unit economics and analysing Growth and the financial performance

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Develop an entrepreneurial mindset and appreciate the concepts ofentrepreneurship	**2**
CO2	Cultivate essential attributes to become an entrepreneur or Intrapreneur anddemonstrate skills such as problem solving, team building, creativity and leadership	**5**
CO3	Comprehend the process of opportunity identification through design thinking,identify market potential and customers while developing a compelling valueproposition solution	**4**
CO4	Analyse and refine business models to ensure sustainability and profitability	**4**
CO5	Build a validated MVP of their practice venture idea	**5**

TEXT BOOKS:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020).Entrepreneurship ,McGrawHill, 11th Edition.

2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use ContinuousInnovation to Create Radically Successful Businesses. Crown Business.

REFERENCES:

1. Blank, S. G., & Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch.
2. Roy, R. (2017). Indian Entrepreneurship: Theory and Practice. New Delhi: Oxford University Press.
3. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook forVisionaries, Game Changers, and Challengers. John Wiley & Sons.

E-RESOURCES: (including NPTEL course)

1. https://onlinecourses.nptel.ac.in/noc23_mg74/preview

COURSE ARTICULATION MATRIX:

COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.	3				2	1				1	1	3
2.	3				2	1				1	1	3
3.	3				2	1				1	1	3
4.	3				2	1				1	1	3
5.	3				2	1				2	1	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

CV22022	STARTUP FORMATION AND SCALABILITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Understand the fundamental concepts of startup formation and scalability.
2. Analyze successful startup case studies and identify key factors contributing to their growth.
3. Develop skills in ideation, product development, and market validation.
4. Explore different funding options available to startups.
5. Examine the strategies for sustainability and scalability of the startup operations.

UNIT I STARTUP ECOSYSTEM AND STARTUP IDEAS 9

Definition and characteristics of startups – Overview of the startup ecosystemat global, national and regional level – Key players in the startup ecosystem such as incubators, investors, HEIs, innovators, government, mentors, society, etc. – Trends and challenges in startup formation.

Generating startup ideas: problem identification, market research and brainstorming techniques – Lean startup methodology: Minimum Viable Product (MVP) approach – Prototyping and validating ideas through customer feedback and iteration.

UNIT II PRODUCT DEVELOPMENT AND LAUNCH 9

Product development lifecycle: Proof-of-concept, conceptual design, prototype development, testing, and validation – Agile methodology and project management tools – Launch strategies: minimum viable product, beta testing, early adopter programs, and Lab-to-market planning.

UNIT III BUSINESS MODEL AND FUNDING SOURCE 9

Understanding different business models – Value proposition canvas and business model canvas – Revenue streams, cost structures and pricing strategies. Types of funding: seed funding, grant, angel investment, venture capital, crowdfunding, etc.Pitching to investors: crafting an effective pitch deck, elevator pitch, pitchfest – Financial management for startups: budgeting, forecasting, and managing cash flow.

UNIT IV LEGAL AND ETHICAL CONSIDERATIONS 9

Intellectual Property Rights (IPR): patents, trademarks, and copyrights – Legal structures and registrations: sole proprietorship, partnership, private limited, LLP, etc. – DPIIT recognition – Taxation and other compliances – Ethical considerations in entrepreneurship: social responsibility and sustainability. Case Studies and Guest Lectures – Analyzing successful startup case studies – Guest lectures from experienced entrepreneurs and industry experts

UNIT V MARKET GROWTH, OPERATION AND SCALABILITY 9

Digital marketing fundamentals: Search Engine Optimisation, Search Engine Marketing, social media marketing, content marketing, etc.Growth hacking techniques for startups – Customer acquisition and retention strategies. Scaling infrastructure: technology, human resources, capital and processes - Managing growth and quality – expansion and diversification.

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Gain insights into the dynamics of entrepreneurship, develop critical thinking skills for identifying opportunities, and acquire knowledge for launching startups.	**2**
CO2	Manage product development projects efficiently and bring innovative products to market effectively.	**3**
CO3	Apply the knowledge, skills and tools to pitch for raising fund and to manage successful startup ventures in a competitive business environment.	**4**
CO4	Familiar with legal and ethical aspects to mitigate risks, build credibility, foster trust with stakeholders.	**2**
CO5	Analyse the factors to operate the startup successfully and to scale the startup	**5**

TEXT BOOKS:

1. Rashmi Bansal, Stay Hungry Stay Foolish, Westland fourth edition. 2012.
2. Mukesh R. Shah, Fundamentals of Entrepreneurship, Himalaya Publishing House.

3. Rohit Prasad, Startup Sutra: What the Angels Won't Tell You About Business and Life, Westland Publications.

REFERENCES:

1. Alexander Osterwalder and Yves Pigneur, Business Model Canvas: A Simple Tool to Design Innovative Business Models, Synergy Books India.
2. Alejandro Cremades, The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know, Westland Publications
3. Derek Lidow, Startup Leadership: How Savvy Entrepreneurs Turn Their Ideas Into Successful Enterprises, Manjul Publishing House.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc24_de06/course
2. https://www.startupindia.gov.in/content/sih/en/learning-and-development_v2.html

COURSE ARTICULATION MATRIX:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	1						3		3					
2	1	2	3				3		3		3	3		
3	1	2	3				3	3	3		3	3		
4						2	3	3	3		3	3		
5									3		3	3		

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

CV22023	INNOVATIVE TECHNOLOGIES FOR STARTUPS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Understand Technopreneurship and Innovation
2. Understand about technology transfer and expansion opportunities with collaborative approach
3. Develop the process of creating Startup ecosystem
4. Familiarity to commercialize new products, technologies, processes, and arrangements

UNIT I INTRODUCTION TO TECHNOPRENEURSHIP 9

Technopreneurship - Entrepreneurship vs.Technopreneurship-Characteristics of anEntrepreneur &Technopreneur-Importance of Technopreneurship Technology and Entrepreneurship Definition of Technopreneruship Types of Entrepreneur Five Traits of a Technopreneur

Casestudy: Successful Global and Local Technopreneurs

UNIT II TECHNOLOGY ADAPTATION AND BUSINESS MODEL 9

Technology Adaptation, Diffusion, and Technology Diffusion B. Evolution of Technology Five Segments of Technology Adaptation

Business Model Business Model Canvass Five Types of Channel Phases Types of Key Resources Four Types of Partnerships Example of Business Model Cnavas

UNIT III INNOVATION AND IDEA GENERATION 9

Introduction to Innovation- Types of Innovation- The Principles of Innovation- Idea Presentation - Idea Selection - Customer Needs - Market Research and Validation - The Decision- Minimum Value Product(MVP) - Transaction

Case study : Technopreneurship to solve rural / urban issues

UNIT IV VALUE PROPORTION AND FINANCIAL PLANNING 9

Value proportion - Benefits vs features, relation to needs, and high value adding - Four fundamental parts - Creating your own value proportion. Financial Plan and Resource Generation Financial Plan Definition Objectives of Financial Planning Importance of Financial Planning Types of Investory

UNIT V CUSTOMER AND ELEVATOR PITCH 9

The customer profile, persona - Customer needs, pain points and demographics - Market research and validation.

Eevator Pitch - The 5-Step Elevator Pitch That Turns Strangers Into Clients - The Three Essential Components In A Pitch - Elevator Pitch Examples

Casestudy: Technology Ventures & Commercialization (Patents, Licensing, Legal services)

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	To demonstrate an understanding of current and emerging technologies relevant to entrepreneurship	**3**
CO2	To identify and evaluate potential business opportunities that leverage technology innovations	**5**
CO3	To create innovative business models that incorporate technological solutions.	**6**
CO4	To develop prototypes or minimum viable products (MVPs) to test their business ideas	**6**
CO5	To pitch their business ideas to investors, stakeholders, and potential customers effectively	**3**

REFERENCES:

1. Introduction to Technopreneurship, Jake R. Pomperada, MAED-IT, Jennifer P. Juaneza, MIT, ISBN: 978-621-427-067-5, 2022
2. Technopreneurship in Small Businesses for Sustainability, Ahmad Rafiki, Baker Ahmad Abdullah Alserhan, Kamola Bayra, 2024
3. Entrepreneurship Development , Abha Mathur,2022

COURSE ARTICULATION MATRIX:												
COs	**POs**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.	**3**	**3**	**3**	**3**	**2**	**3**			**3**	**3**		**3**
2.		**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
3.		**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
4.		**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
5.		**3**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**3**
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)												

COs	**PSOs**				
	ME			**MN**	
	1	**2**	**3**	**1**	**2**
1.					
2.					
3.					
4.					
5.					
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)					

CV22024	FAMILY BUSINESS MANAGEMENT	L	T	P	C
		2	1	0	3

COURSE OBJECTIVES:

1. Understand the unique dynamics of family-owned enterprises
2. Analyze the strategic management of family businesses
3. Develop practical skills for managing family businesses

UNIT I INTRODUCTION TO FAMILY BUSINESS MANAGEMENT 9

Definition and Characteristics - Types (small vs. large, first-generation vs. multi-generational) - Advantages and Challenges - The Evolution and Global Landscape of Family Businesses - Family Business vs. Non-Family Business: A Comparative Analysis - Role of Family Values and Culture in Business Management - Family Governance Structures - Succession Planning and Continuity Impact of Family Dynamics on Business Decision Making -Case Studies of Successful Family Businesses

UNIT II GOVERNANCE AND SUCCESSION PLANNING IN FAMILY BUSINESSES 9

Governance Models in Family Businesses (e.g., family council, board of directors) - Role of Family Constitution and Policies - Leadership Transition Strategies - Conflict Resolution Mechanisms -Balancing Family Interests with Business Objectives - Professionalization vs. Family Control -Managing Non-Family Executives - Challenges in Succession Planning: Communication and Expectations -Legal and Tax Considerations in Succession Planning -Case Studies of Successful Succession Planning in Family Businesses

UNIT III FINANCIAL MANAGEMENT IN FAMILY BUSINESSES 9

Financial Reporting and Analysis in Family Businesses - Capital Structure and Financing Decisions - Cash Flow Management and Working Capital Optimization -Investment and Expansion Strategies -Risk Management in Family Enterprises - Wealth Management: Preservation and Growth - Estate Planning and Wealth Transfer- Tax Planning Strategies for Family Businesses -Inter-generational Wealth Transfer Challenges -Financial Performance Measurement and Benchmarking

UNIT IV HUMAN RESOURCE MANAGEMENT IN FAMILY BUSINESSES 9

Recruitment and Selection Strategies for Family Businesses - Retention and Motivation of Family and Non-Family Employees -Training and Development Programs -Performance Management Systems - Conflict Resolution and Mediation in Family Businesses - Leadership Development for Next-Generation Family Members - Family vs. Professional Managers: Roles and Responsibilities - Family Employment Policies and Practices - Succession Planning for Key Personnel - Case Studies of HRM Practices in Family Businesses

UNIT V INNOVATION AND GROWTH STRATEGIES FOR FAMILY BUSINESSES 9

Importance of Innovation for Family Businesses - Types of Innovation in Family Enterprises (e.g., product, process, organizational) - Developing an Innovation Culture - Entrepreneurship and Intrapreneurship in Family Businesses - Identifying Growth Opportunities and Market Expansion - Strategic Alliances and Partnerships - Family vs. Non-Family Business Innovation Practices - Sustainable Growth Strategies - Managing Risks Associated with Growth and Innovation - Case Studies of Innovative Family Businesses

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Apply knowledge of family business dynamics to assess operational advantages and challenges	**3**
CO2	Evaluate various governance models to family businesses, strategize effective succession planning, and manage communication challenges in succession	**5**
CO3	Utilize financial management techniques specific to family businesses, tackle unique challenges, and devise strategies to manage wealth effectively.	**3**
CO4	Design HRM strategies adapted to family business needs, recognize family dynamics' impact on HRM, and execute talent management programs	**3**
CO5	Examine innovation's role in sustaining multi-generational family businesses, strategize sustainable growth, and cultivate innovative cultures within family enterprises	**4**

REFERENCES:

1. "Family Business" by Ernesto Poza, South-Western College Publishing
2. "Family Wealth: Keeping It in the Family - How Family Members and Their Advisers Preserve Human, Intellectual, and Financial Assets for Generations" by James E. Hughes Jr., Bloomberg Press
3. "Family Business Succession: Your Roadmap to Continuity" by Craig E. Aronoff and Otis W. Baskin, Palgrave Macmillan Publishers
4. "Family Business as Paradox" by John L. Ward and Amy Schuman, Palgrave Macmillan Publishers
5. "Family Wealth Management: Seven Imperatives for Successful Investing in the New World Order" by Mark Haynes Daniell and Tom McCullough, Wiley Publishers
6. The Family Business Map: Assets and Roadblocks in Long-Term Planning" by Craig E. Aronoff, Joseph H. Astrachan, and John L. Ward, Palgrave Macmillan Publishers

COURSE ARTICULATION MATRIX:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.		2	2			2		2		2		
2.		2	2						3	3	3	2
3.	2	2	3			3	2					1
4.		2	2			3			3	3		
5.		2	2			2	2			2		2
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)												

COs	PSOs				
	ME			**MN**	
	1	**2**	**3**	**1**	**2**
1.					
2.					
3.					
4.					
5.					
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)					

CV22025	WOMEN ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To foster entrepreneurship mind-set among women students
2. To offer idea to business journey in a structured way
3. To enable women entrepreneurs to use technology to support their business plans
4. To create financial management awareness amongst women

UNIT I SIGNIFICANCE OF WOMEN ENTREPRENEURSHIP 9

Concept and Meaning of women Entrepreneurs– Functions of Women Entrepreneurs-Entrepreneurial traits-Typologies Of Women Entrepreneurs, evolution of women entrepreneurship in India – Role of women entrepreneurship in the economic development of India - Trends and Patterns of Women Entrepreneurship - Non-Stereotyping Women -Social, Cultural, Economic, Political and other factors influencing women entrepreneurship- Opportunities and challenges in women entrepreneurship

UNIT II PRODUCT DEVELOPMENT PROCESS, BUSINESS PLAN 9

Entrepreneurial skills and competency requirements for women entrepreneur- Classification of New Products – Product Planning and Development Process - Scope and Value of Business Plan – Evaluation of Plan by Potential Innovation – Information Needs — Writing the Business Plan. Entrepreneurship in Sectors like Agriculture, Tourism, Health care, Transport and allied services

UNIT III GENDER,TECHNOLOGY AND EMPOWERMENT 9

Technology for Women empowerment-Technology's Impact on women's development – issues and challenges – Relationship between Entrepreneurship and Empowerment- Role Models of Woman Entrepreneurs- Role of Women Entrepreneurs in various industries-. Case studies- Women in organized & unorganized sector- Women in traditional & modern industries- Women in urban & rural areas- Women in large scale and small scale industries- single women and joint venture- Case studies

UNIT IV SUPPORT OF FINANCIAL INSTITUTION &SELF-HELP GROUPS 9

Self-employment opportunities- State and Central Initiatives-SIDO, DIC, EDI, NAYE, NISIET, SIDBI, SEF, WCFC and commercial banks, Long term and Short term finance. Obstacles in Getting Financial

Assistance by Institutions SHGs and different Programmes Benefit of SHGs to women, Microfinance – An Introduction, Demand and Supply of Microfinance, Microfinance – A Development Strategy .

UNIT V WOMEN ENTREPRENEURS AND RURAL ENTREPRENEURSHIP 9

Gender equality and rural Entrepreneurship- Women Entrepreneurship and Sustainable Rural Development in India- Role of Grameen Banks in Empowerment of Women- NABARD and MSME - Government policies and its impact on Women's Development Programs and measures at International, National and State level

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Understand the role of women entrepreneurship in different facets of society	**3**
CO2	Develop a formalised business plan, taking into account funding and finance	**4**
CO3	Understand the role of technology in Women empowerment	**3**
CO4	Elucidate the role of various developmental schemes supporting women entrepreneurship	**4**
CO5	Know the various livelihood supports for women Employment opportunities	**4**

TEXT BOOKS:

1. SumanKalyanChoudhary, "Role of Women Entrepreneurship in Social Development", 2012, Discovery Publishing House
2. Dr.Y.P.Singh,"Women Entrepreneurship", 2014 GarimaPrakashan.

REFERENCES:

1. Robert D. Hisrich, Mathew, Michael P. Peters, Dean A. Sheperds," Entrepreneurship," 9th Edition, 2014, McGraw Hill Education
2. S.K.Sahani,"Entrepreneurship & Skill development", 2015, Astha Publishers, New Delhi.
3. Dr.Paramjitkaur J. Walia, "Women Entrepreneurship and Empowerment,"2015, Galaxy Book Company

4. DafnaKariv, “Female Entrepreneurship and the new venture creation-An International overview”, 2013 Routledge

COURSE ARTICULATION MATRIX:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.	3					1	1		1	1		
2.	3	3				1	1		1	1		
3.	3					1	1		1	1		
4.	3	2				1	2		1	1		
5.	3	3	3	1	1	1	2		1	1		

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

COs	PSOs				
	ME			**MN**	
	1	**2**	**3**	**1**	**2**
1.				1	1
2.				1	1
3.				1	1
4.				1	1
5.				1	1

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

CV22026	DESIGN THINKING AND HUMAN CENTERED DESIGN	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES:

1. To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and execution of projects using design thinking principles.
2. To prepare the mindset and discipline of systemic inspiration driven by a desire to identify new sources of ideas, and new models especially outside their regular working atmosphere.
3. To propose a concrete, feasible, viable and relevant innovation project/challenge towards social problems.

UNIT I **9**

Design Thinking Skills Principles of Design Thinking, The Basis for Design Thinking, The Design Thinking Team, Design Thinking Workshops and Meetings – Exercises and case based discussions

UNIT II **9**

Empathizing Techniques – observation – structured open ended approach - , Design Thinking Frameworks, Ideation tools – brainstorming, innovation heuristics, behaviour models, overcoming cognitive fixedness – Exercises and case based discussions.

UNIT III **9**

Use of Diagrams and Maps in Design Thinking – Empathy map. Affinity diagram, mind map, journey map, combining ideas into complex innovation concepts. Story telling – improvisation, scenario planning, development of scenarios, evaluation tools, frog design and prototyping - – Exercises and case-based discussions Assess developer and user perspectives for bias – apply frameworks to strengthen communication – sustain a culture of innovation

UNIT IV **9**

Introduction to "Human-Centered Design Methods" (HCDMs) focuses on the iterative- design-research process- design and evaluate social problems and environments issues. HCDMs are not only used to design things, but also to design the interactions between things and the people who use them and live in them. An "Interaction Designer" is the title of a designer who designs things and their relationships with other things, including people.

UNIT V **9**

striving to improve lives- enhance existing places- and support interactions of human beings with their physical and digital surroundings

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and execution of projects using design thinking principles	2
CO2	Prepare the mindset and discipline of systemic inspiration driven by a desire to identify new sources of ideas, and new models especially outside their regular working atmosphere	5
CO3	Propose a concrete, feasible, viable and relevant innovation project/challenge	4
CO4	Demonstrate the ability to develop and evaluate design prototypes responsive to the challenges and opportunities of society.	4
CO5	communicate a design process in a paper and video	3

TEXT BOOKS:

1. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business Press , 2009.
2. HassoPlattner, ChristophMeinel and Larry Leifer (eds), "Design Thinking: Understand – Improve– Apply", Springer, 2011
3. IdrisMootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

REFERENCES:

1. Jeanne Liedtka , Andrew King, Kevin Bennett , “Book - Solving Problems with Design Thinking - Ten Stories of What Works” (Columbia Business School Publishing), 2013
   MaurícioVianna, YsmarVianna, Isabel K. Adler, Brenda Lucena, Beatriz Russo, “Design thinking: Business Innovation” MJV Press, 2011

2. Burgelman, Christensen, and Wheelwright, "Strategic Management of Technology and Innovation"5th Edition, McGraw Hill Publications, 2013

E-RESOURCES: (including NPTEL course)

1. https://archive.nptel.ac.in/courses/110/106/110106124/

COURSE ARTICULATION MATRIX:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.	3				2	1				3	1	3
2.	3				2	1				3	1	3
3.	3				2	1				3	1	3
4.	3				2	1				1	1	3
5.	3				2	1				2	1	3
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)												

COs	PSOs				
	ME			**MN**	
	1	**2**	**3**	**1**	**2**
1.			3		
2.			3		
3.			3		
4.			3		
5.			3		
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)					

CV22027	SOCIAL INNOVATION AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and execution of projects using design thinking principles.
2. To prepare the mindset and discipline of systemic inspiration driven by a desire to identify new sources of ideas, and new models especially outside their regular working atmosphere.
3. To propose a concrete, feasible, viable and relevant innovation project/challenge towards social problems.

UNIT I INTRODUCTION **9**

Meaning, definition: Entrepreneur, Entrepreneurship. Types of Entrepreneurs –Types of Entrepreneurship –Entrepreneurial characteristics-Characteristics of entrepreneur-Entrepreneurship development in India - Scope of entrepreneur development- Concepts of value Creation.

UNIT II SOCIAL ENTREPRENEUR, SOCIAL ENTREPRENEURSHIP AND SOCIAL ENTERPRISES **9**

Private and public sectors and societal problems, need for social entrepreneurship
Meaning-definition- Characteristics of Social Entrepreneurship - Characteristics of Social Entrepreneur- Differences between Business and Social entrepreneur, Entrepreneurship and Social Entrepreneur ship- Social Entrepreneurship in developing countries and in India.

UNIT III THE SOCIAL ENTREPRENEURSHIP PROCESS **9**

The Timmons Model of the Entrepreneurship Process, The PCDO (The People, Context, Deal, and opportunity) frame work, The Case Model, The Social Entrepreneurship Frame work - The Social Entrepreneurship process.
Voices from the field: Bangladesh Rural Advancement Committee (BRAC), The Grameen Bank (GB), The Self Employment Women's Association (SEWA), Aravind Eye Hospital, AzimPremji,

UNIT IV SOCIAL ENTREPRENEURSHIP IN PRACTICE 9

Recognising Social Opportunities – Role of innovation- Developing a strategic plan for a social venture - Funding and legal framework for social ventures- Measuring social Impact – scaling the social venture - Case studies

UNIT V SOCIAL ENTRPRISE AND SUSTAINABLE DEVELOPMENT GOALS 9

Ethical entrepreneurship and sustainable development goals, Challenges in Social Entrepreneurship - Boundaries of Social Entrepreneurship – Social service provision, Social activism-Sustainable Entrepreneurship –Shared values and the triple bottom line -The Future of Social Entrepreneurship-Case studies

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Understand the concept of entrepreneurship, types and phases.	**3**
CO2	Understand the dynamics of entrepreneurial dimensions.	**3**
CO3	Ability to apply tools and techniques in entrepreneurial venture.	**4**
CO4	bring out the practice of Social Entrepreneurship in India.	**4**
CO5	Understand the need for sustainable development	**3**

TEXT BOOKS:

1. Robert A. Philips Margret BonefielRitesh Sharma, Social entrepreneurship, the next big business opportunity Global Vision Publishing House, New Delhi, 2011
2. Jill Kickul and Thomas S.Lyons, Routledge, Understanding social entrepreneurship, the relentless pursuit of mission in an ever changing world, New York, 2012
3. Bornstein, David, how to change the world: social entrepreneurs and the power of new ideas New York, Ny: Oxford University Press, 2004

Dees, j. Gregory, “the meaning of social entrepreneurship” Center for the advancement, of social entrepreneurship 2007, duke university

REFERENCES:

1. S.S.Khanka, Entrepreneurship in India, perspective and practice, Akansha publishing house, New Delhi, 2009
2. Vasanth Desai, Entrepreneurial development, Himalaya Publishing House, 2008,
3. Martin, roger and Osberg, sally, "social entrepreneurship: the case for definition", Stanford social innovation review. 2008

COURSE ARTICULATION MATRIX:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.												3
2.												3
3.					2							
4.												3
5.							3					3
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)												

COs	PSOs				
	ME			**MN**	
	1	**2**	**3**	**1**	**2**
1.					
2.					
3.					
4.					
5.					
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)					

CV22020	BUSINESS PLAN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. Understand the fundamentals of business model design and its importance in startup development.
2. Analyze market opportunities and design value propositions to address customer needs.
3. Develop revenue models and cost structures to ensure financial sustainability.
4. Utilize the Business Model Canvas as a framework for visualizing and iterating business models.
5. Create a comprehensive business plan document that integrates the Business Model Canvas and effectively communicates the startup concept and strategy.

UNIT I BUSINESS PLANNIG **9**

Overview of entrepreneurship - Importance of business planning – Introduction to business model canvas and its key components – Identifying customer pain points and needs – Analysing market trend and opportunity – Design thinking principles - human centric innovation -

UNIT II MARKET **9**

Identifying market opportunity – market analysis – feasibility study – competitor analysis – market segment – unique value proposition – product positioning - IPR

UNIT III FINANCIAL ANALYSIS **9**

Developing financial projections – cost structure – revenue models – pricing strategy – Overview and components of Business model canvass – exercise and case studies – iterations and refinement.

UNIT IV BUSINESS PLAN **9**

Structure and format of a business plan – integrating the business model canvas into business plan Funding options – Writing executive summary, business overview and analysis.

UNIT V FUNDING **9**

Effective communication – Proposal submission to investors – Pitching - Presenting the business plan topotential funding sources – Launching business / startup.

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Identify product / process to start own business / startup.	2
CO2	Analyse the market trend to finalise the product / process for launching.	3
CO3	Analyse the financial aspect of the proposed business	4
CO4	Prepare a business plan for attracting investors	4
CO5	Present the business plan to raise finance.	5

TEXTBOOKS:

1. Alexander Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Wiley, 2010.
2. Rohit Prasad, Start-Up Sutra: What the Angels Won't Tell You About Business and Life, Hachette India, 2013.

REFERENCES:

1. Poornima M. Charantimath, Entrepreneurship Development and Small Business Enterprises, Dorling Kindersley (India) Pvt. Ltd, 2009.

E-RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg63/preview
2. https://onlinecourses.swayam2.ac.in/cec21_ge06/preview
3. https://www.startupindia.gov.in/

COURSE ARTICULATION MATRIX:

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
1	1													
2		3	2	2		1		1	2	1	3	1		
3		1		1		1			1		3	1		
4	1	1		1	1	1		1	1		3	1		
5	1	1				2	3	2	2	1	3	1		

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

CV22090	SOCIAL INNOVATION - FIELD IMMERSION	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES:

1. To observe areas of social entrepreneurship
2. To document the outcome of visits
3. To get practical knowledge on social entrepreneurship

UNIT I INTRODUCTION **9**

Identify the key problems and issues in the case study.

• Formulate and include a thesis statement, summarizing the outcome of analysis in 1–2 sentences. Presentation

UNIT II BACKGROUND **9**

Set the scene: background information, relevant facts, and the most important issues. • Demonstrate that you have researched the problems in this case study. Presentation

UNIT III ALTERNATIVES **9**

Outline possible alternatives (not necessarily all of them) • Explain why alternatives were rejected • Constraints/reasons • Why are alternatives not possible at this time? Presentation

UNIT IV PROPOSED SOLUTION **9**

• Provide one specific and realistic solution • Explain why this solution was chosen • Support this solution with solid evidence • Concepts from class (text readings, discussions, lectures) • Outside research • Personal experience (anecdotes) Presentation

UNIT V SUBMISSION OF REPORT **9**

Recommendations • Determine and discuss specific strategies for accomplishing the proposed solution. • If applicable, recommend further action to resolve some of the issues

TOTAL: 45 PERIODS

CO No.	COURSE OUTCOMES	RBT Level
At the end of the course, students will be able to:		
CO1	Demonstrate sound knowledge of Social Entrepreneurship	3
CO2	Understand the strength and contribution of social entrepreneurship towards development of India	4
CO3	Undertake problem identification and formulation	4
CO4	Design engineering solutions to social problems utilising systems approach	4
CO5	Communicate with community at large in written and oral forms	4

COURSE ARTICULATION MATRIX:

COs	POs											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.												
2.												3
3.			3									
4.				3								
5.										3		

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

COs	PSOs				
	ME			**MN**	
	1	**2**	**3**	**1**	**2**
1.					
2.					
3.					
4.					
5.					

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

CV22031	STATISTICS FOR MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the applications of statistics in business decision making.

UNIT I INTRODUCTION **9**

Basic definitions and rules for probability, Baye‘s theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION **9**

Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT III TESTING OF HYPOTHESIS - PARAMETIRC TESTS **9**

Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV NON-PARAMETRIC TESTS **9**

Chi-square tests for independence of attributes and goodness of fit, Kolmogorov-Smirnov – test for goodness of fit, Mann – Whitney U test and Kruskal Wallis test.

UNIT V CORRELATION AND REGRESSION **9**

Correlation –Rank Correlation – Regression – Estimation of Regression line – Method of Least Squares – Standard Error of estimate.

TOTAL : 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	To facilitate objective solutions in business decision making.	
CO2	To understand and solve business problems.	
CO3	To apply statistical techniques to data sets, and correctly interpret the results.	
CO4	To develop skill-set that is in demand in both the research and business environments.	
CO5	To enable the students to apply the statistical techniques in a work setting.	

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES

1. Richard I. Levin, David S. Rubin, Masood H.Siddiqui, Sanjay Rastogi, Statistics for Management, Pearson Education, 8th Edition, 2017.
2. Prem. S. Mann, Introductory Statistics, Wiley Publications, 9th Edition, 2015.
3. T N Srivastava and Shailaja Rego, Statistics for Management, Tata McGraw Hill, 3rd Edition 2017.
4. Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.
5. David R. Anderson, Dennis J. Sweeney, Thomas A.Williams, Jeffrey D.Camm, James J.Cochran, Statistics for business and economics, 13th edition, Thomson (South – Western) Asia, Singapore, 2016.
6. N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.

CV22302	DATAMINING FOR BUSINESS INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know how to derive meaning form huge volume of data and information.
- To understand how knowledge discovering process is used in business decision making.

UNIT I INTRODUCTION **9**

Data mining, Text mining, Web mining, Data ware house.

UNIT II DATA MINING PROCESS **9**

Datamining process – KDD, CRISP-DM, SEMMA. Prediction performance measures.

UNIT III PREDICTION TECHNIQUES **9**

Data visualization, Time series – ARIMA, Winter Holts.

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES **9**

Classification, Association, Clustering.

UNIT V MACHINE LEARNING AND AI **9**

Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization.

TOTAL : 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Learn to apply various data mining techniques into various areas of different domains.	

CO2	Be able to interact competently on the topic of data mining for business intelligence.	
CO3	Apply various prediction techniques.	
CO4	Learn about supervised and unsupervised learning technique.	
CO5	Develop and implement machine learning algorithms.	

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006.
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
3. W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005.
4. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 3rd edition,2013.
5. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc, 2nd Edition,2011.
6. Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011.
7. G. K. Gupta, Ïntroduction to Data mining with Case Studies, Prentice hall of India, 2011.
8. Giudici, Applied Data mining – Statistical Methods for Business and Industry, John Wiley. 2009.
9. Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 2011.
10. Michalewicz Z., Schmidt M. Michalewicz M and Chiriac C, Adaptive Business Intelligence, Springer – Verlag, 2007.
11. GalitShmueli, Nitin R. Patel and Peter C. Bruce, Data Mining for Business Intelligence – Concepts, Techniques and Applications Wiley, India, 2010.

CV22033	HUMAN RESOURCE ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

UNIT I **INTRODUCTION TO HR ANALYTICS** **9**

People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.

UNIT II **HR ANLYTICS I: RECRUITMENT** **9**

Recruitment Metrics : Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio- Quality of hire.

UNIT III **HR ANALYTICS - TRAINING AND DEVELOPMENT** **9**

Training & Development Metrics : Percentage of employees trained- Internally and externally trained - Training hours and cost per employee - ROI.

UNIT IV **HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION** **9**

Employee Engagement Metrics :Talent Retention index - Voluntary and involuntary turnover- grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

UNIT V HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT 9

Workforce Diversity and Development Metrics : Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix.

TOTAL : 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The learners will be conversant about HR metrics and ready to apply at work settings.	
CO2	The learners will be able to resolve HR issues using people analytics	

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES

1. JacFitzenz , The New HR Analytics, AMACOM , 2010.
2. Edwards M. R., & Edwards K, Predictive HR Analytics: Mastering the HR Metric.London: Kogan Page.2016.
3. Human Resources kit for Dummies – 3 rd edition – Max Messmer, 2003
4. Dipak Kumar Bhattacharyya, HR Analytics, Understanding Theories and Applications, SAGE Publications India ,2017.
5. Sesil, J. C. , Applying advanced analytics to HR management decisions: Methods fo selection, developing incentives, and improving collaboration. Upper Saddle River,New Jersey: Pearson Education,2014.
6. Pease, G., & Beresford, B, Developing Human Capital: Using Analytics to Plan and Optimize Your Learning and Development Investments. Wiley ,2014.
7. Phillips, J., & Phillips, P.P, Making Human Capital Analytics Work: Measuring the ROI of Human Capital Processes and OUTCOME. McGraw-Hill,2014.
8. HR Scorecard and Metrices, HBR, 2001.

CV22034	MARKETING AND SOCIAL MEDIA WEB ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To showcase the opportunities that exist today to leverage the power of the web and social media

UNIT I MARKETING ANALYTICS **9**

Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis.

UNIT II COMMUNITY BUILDING AND MANAGEMENT **9**

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS **9**

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS **9**

Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT V SEARCH ANALYTICS **9**

Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

TOTAL : 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The Learners will understand social media, web and social media analytics and their potential impact.	

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013.
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014.
3. Bittu Kumar, Social Networking, V & S Publishers, 2013.
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007.
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004.
6. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016.

CV22035	OPERATION AND SUPPLY CHAIN ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I INTRODUCTION **9**

Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

UNIT II WAREHOUSING DECISIONS **9**

P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT III INVENTORY MANAGEMENT **9**

Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV TRANSPORTATION NETWORK MODELS **9**

Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Transportation Problems, Set covering and Set Partitioning Problems, Travelling Salesman Problem, Scheduling Algorithms.

UNIT V MCDM MODELS **9**

Analytic Hierarchy Process(AHP), Data Envelopment Analysis (DEA), Fuzzy Logic an Techniques, the analytical network process (ANP), TOPSIS.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	To enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.	

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERCENCES

1. Nada R. Sanders, Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence, Pearson Education, 2014.
2. Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman, Supply Chain Network Design: Applying Optimization and Analytics to the Global Supply Chain, Pearson Education, 2013.
3. Anna Nagurney, Min Yu, Amir H. Masoumi, Ladimer S. Nagurney, Networks Against Time: Supply Chain Analytics for Perishable Products, Springer, 2013.
4. Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian, Analytics in Operations/Supply Chain Management , I.K. International Publishing House Pvt. Ltd., 2016.
5. Gerhard J. Plenert, Supply Chain Optimization through Segmentation and Analytics, CRC Press, Taylor & Francis Group, 2014.

CV22036	FINANCIAL ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- This course introduces a core set of modern analytical tools that specifically target finance applications

UNIT I CORPORATE FINANCE ANALYSIS **9**

Basic corporate financial predictive modelling- Project analysis- cash flow analysis- cost of capital, Financial Break even modelling, Capital Budget model-Payback, NPV, IRR.

UNIT II FINANCIAL MARKET ANALYSIS **9**

Estimation and prediction of risk and return (bond investment and stock investment) –Time series examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III PORTFOLIO ANALYSIS **9**

Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV TECHNICAL ANALYSIS **9**

Prediction using charts and fundamentals – RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.

UNIT V CREDIT RISK ANALYSIS **9**

Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL : 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	The learners should be able to perform financial analysis for decision making using excel, Python and R.	

1- Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

REFERENCES

1. Financial analytics with R by Mark J. Bennett, Dirk L. Hugen, Cambridge university press.
2. Haskell Financial Data Modeling and Predictive Analytics Paperback – Import, 25 Oct 2013 by Pavel Ryzhov.
3. Quantitative Financial Analytics: The Path To Investment Profits Paperback – Import, 11 Sep 2017 by Edward E Williams (Author), John A Dobelman.
4. Python for Finance - Paperback – Import, 30 Jun 2017 by Yuxing Yan (Author).
5. Mastering Python for Finance Paperback – Import, 29 Apr 2015 by James Ma Weiming.

CV22041	SUSTAINABLE INFRASTRUCTURE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I SUSTAINABLE DEVELOPMENT GOALS 9

Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian – Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands – Sustainability indicators - Performance indicators of sustainability and Assessment mechanism - Policy frameworks and practices: global and Indian – Infrastructure Project finance – Infrastructure project life cycle - Constraints and barriers for sustainable development - future directions.

UNIT II SUSTAINABLE INFRASTRUCTURE PLANNING 9

Overview of Infrastructure projects: Housing sector, Power sector, Water supply, road, rail and port transportation sector, rural and urban infrastructure. Environmental Impact Assessment (EIA), Land acquisition -Legal aspects, Resettlement &Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Negotiating with multiple Stakeholders on Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling).

UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES 9

Sustainability through lean construction approach - Enabling lean through information technology – Lean in planning and design - IPD (Integrated Project Delivery) - Location Based Management System - Geospatial Technologies for machine control, site management, precision control and real time progress monitoring - Role of logistics in achieving sustainable construction – Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics - Sustainability in geotechnical practice – Design considerations, Design Parameters and Procedures – Quality control and Assurance - Use of sustainable construction techniques: Precast concrete technology, Pre-engineered buildings.

UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS 9

Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Eco-design strategies –Design for Disassembly - Dematerialization, rematerialization, transmaterialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian Eco mark scheme - Environmental product declarations – Environmental marketing- Life cycle Analysis (LCA), Advances in LCA: Hybrid LCA, Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC – Case studies

UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS 9

Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. – Use of Emerging Technologies – IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the environment sustainability goals at global and Indian scenario.	2
CO2	Enumerate the risks in development of projects and suggest mitigation measures.	3
CO3	Apply lean techniques, LBMS and new construction techniques to achieve sustainability ininfrastructure construction projects.	3
CO4	Explain Life Cycle Analysis and life cycle cost of construction materials	2
CO5	Explain the new technologies for maintenance of infrastructure projects.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition ,Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFERENCES:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2016.
3. New Building Materials and Construction World magazine
4. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher:Belhaven Press,ISBN:1852930039.
5. Munier N, "Introduction to Sustainability", Springer2005
6. Sharma, "Sustainable Smart Cities In India: Challenges And Future Perspectives", SPRINGER, 2022.
7. Ralph Horne, Tim Grant, Karli Verghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing,2009
8. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union;2010
9. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).
10. Greger Lundesjö, Supply Chain Management and Logistics in Construction: Delivering Tomorrow's Built Environment, Kogan Page Publishers, 2015.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	-	-	3	3	-	-	-	-	2		
CO2	2	2	2	-	-	3	3	-	-	-	-	2		
CO3	2	2	2	-	-	3	3	-	-	-	-	2		
CO4	2	2	2	-	-	3	3	-	-	-	-	2		
CO5	2	2	2	-	-	3	3	-	-	-	-	2		

3-High, 2-Medium, 1-Low

CV22042	SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.

UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS **9**

Ecosystem definition - Biotic *Vs.* abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT **9**

Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT **9**

Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

UNIT IV ENERGY AND WASTE MANAGEMENT **9**

Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials

produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

UNIT V EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS 9

Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the concepts, principles and advantages of sustainable agriculture	2
CO2	Discuss the sustainable ways in managing soil health, nutrients, pests and diseases	2
CO3	Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources	3
CO4	Develop energy and waste management plans for promoting sustainable agriculture in non- sustainable farming areas	3
CO5	Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
2. Natural bioactive products in sustainable agriculture, Singh, J. & Yadav, A.N., Springer, 2020.

REFERENCES:

1. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016
2. Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. & Fereres, E., Springer,2016
3. Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press,2021
4. Sustainable Energy Solutions in Agriculture, Bundschuh, J. & Chen, G., CRC Press, 2014

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	-	-	3	3	-	-	-	-	2		
CO2	2	2	2	-	-	3	3	-	-	-	-	2		
CO3	2	2	2	-	-	3	3	-	-	-	-	2		
CO4	2	2	2	-	-	3	3	-	-	-	-	2		
CO5	2	2	2	-	-	3	3	-	-	-	-	2		

3-High, 2-Medium, 1-Low

CV22043	SUSTAINABLE BIOMATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
- To introduce the students about metals as biomaterials and their usage as implants
- To make the students understand the significance of bionanomaterials and its applications.

UNIT I INTRODUCTION TO BIOMATERIALS 9

Introduction: Definition of biomaterials, requirements & classification of biomaterials- Types of Biomaterials- Degradable and resorbable biomaterials- engineered natural materials- Biocompatibility-Hydrogels-pyrolitic carbon for long term medical implants-textured and porous materials-Bonding types- crystal structure-imperfection in crystalline structure-surface properties and adhesion of materials –strength of biological tissues-performance of implants-tissue response to implants- Impact and Future of Biomaterials

UNIT II BIO POLYMERS 9

Molecular structure of polymers -Molecular weight - Types of polymerization techniques–Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Polymethylmethacrylate (PMMA-Polylactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers –Polyurethan- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III BIO CERAMICS AND BIOCOMPOSITES 9

General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites- Polymer Matrix Compsite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)– glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT IV METALS AS BIOMATERIALS 9

Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys-Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals

UNIT V NANOBIOMATERIALS 9

Meatllic nanobiomaterials–Nanopolymers-Nanoceramics- Nanocomposites -Carbon based nanobiomaterials - transport of nanoparticles- release rate-positive and negative effect of nanosize- nanofibres-Nano and micro features and their importance in implant performance-Nanosurface and coats-Applications nanoantibiotics-Nanomedicines- Biochips – Biomimetics-BioNEMs -Biosensor- Bioimaging/Molecular Imaging- challenges and future perspective.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Enumerate on Biomaterials and their importance.	2
CO2	Describe different biopolymers and their properties	2
CO3	Summarise the important Bioceramics and Biocomposite materials	2
CO4	Explain about metals as biomaterials	2
CO5	Summarise the importance of nanobiomaterials in biomedical applications.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani “Introduction to BiomaterialsBasic Theory with Engineering Applications” Cambridge University Press, 2014.
2. Donglu shi “Introduction to Biomaterials” Tsinghua University press, 2006.

REFERENCES:

1. Joon Park, R.S.Lakes “Biomaterials An Introduction” third edition, Springer 2007.
2. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh “Characterization of Biomaterials” Wood headpublishing, 2013.
3. Buddy D.Ratner and Allan S.Hoffman Biomaterials Science “An Introduction to Material inMedicine” Third Edition, 2013.
4. VasifHasirci, NesrinHasirci “Fundamentals of Biomaterials” Springer, 2018
5. Leopoido Javier Rios Gonzalez. “Handbook of Research on Bioenergy and Biomaterials:Consolidated and green process” Apple academic press, 2021.
6. Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad “Functional Bionanomaterials”springer, 2020.
7. Sujata.V.Bhat Biomaterials; Narosa Publishing house, 2002.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	-	-	2	3	-	-	-	-	2		
CO2	2	2	2	-	-	2	3	-	-	-	-	2		
CO3	2	2	2	-	-	2	3	-	-	-	-	2		
CO4	2	2	2	-	-	2	3	-	-	-	-	2		
CO5	2	2	2	-	-	2	3	-	-	-	-	2		

3-High, 2-Medium, 1-Low

CV22044	MATERIALS FOR ENERGY SUSTAINABILITY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarize the students about the challenges and demands of energy sustainability
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell
- To enable students to appreciate novel materials and their usage in photovoltaic application
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT I SUSTAINABLE ENERGY SOURCES 9

Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II ELECTROCHEMICAL DEVICES 9

Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO2, LiFePO4, LiMn2O4) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT III FUEL CELLS 9

Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) – Thermodynamics of fuel cell – Fuel utilization – electrolyte membrane (proton conducting and anion conducting) – Catalysts (

Platinum, Platinum alloys, carbon supported platinum systems and metal oxide supported platinum catalysts) – Anatomy of fuel cells (gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and monopolar plates).

UNIT IV PHOTOVOLTAICS 9

Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application - Crystalline silicon solar cells – thin film silicon solar cells - multijunction solar cells – amorphous silicon based solar cells – photovoltaic concentrators – Cu(InGa)Se2 solar cells – Cadium Telluride solar cells – dye sensitized solar cells – Perovskite solar cells – Measurement and characterization of solar cells - Materials used in solar cells (metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule-based solar cells materials - copper-phthalocyanine and perylenetetracarboxylicbis - benzine – fullerenes - boron subphthalocyanine- tin (II) phthalocyanine)

UNIT V SUPERCAPACITORS 9

Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite- conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain about energy sustainability.	2
CO2	Enumerate the principles of different electrochemical devices.	2
CO3	Describe the working of fuel cells and their application.	2
CO4	Summarise various Photovoltaic applications and the materials used.	2
CO5	Explain about the different types of supercapacitors and the performance of various materials	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Functional materials for sustainable energy applications; John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards.
2. Hand Book of Fuel Cells: Fuel Cell Technology and Applications, Wolf Vielstich, Arnold

REFERENCES:

1. Lamm, Hubert Andreas Gasteiger, Harumi Yokokawa, Wiley, London 2003.358
2. B.E. Conway, Electrochemical supercapacitors: scientific fundamentals and technological applications, Kluwer Academic / Plenum publishers, New York, 1999.
3. T.R. Crompton, Batteries reference book, Newners, 3rd Edition, 2002.
4. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh
5. Electrode Materials for Supercapacitors: A Review of Recent Advances, Parnia Forouzandeh, Vignesh Kumaravel and Suresh C. Pillai, catalysts 2020.
6. Recent advances, practical challenges, and perspectives of intermediate temperature solid oxide fuel cell cathodes Amanda Ndubuisi, Sara Abouali, Kalpana Singh and VenkataramanThangadurai, J. Mater. Chem. A, 2022.
7. Review of next generation photovoltaic solar cell technology and comparative materialistic development Neeraj Kant, Pushpendra Singh, Materials Today: Proceedings, 2022.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	2	-	2	3	-	-	-	-	2		
CO2	2	2	2	2	-	2	3	-	-	-	-	2		
CO3	2	2	2	2	-	2	3	-	-	-	-	2		
CO4	2	2	2	2	-	2	3	-	-	-	-	2		
CO5	2	2	2	2	-	2	3	-	-	-	-	2		

3-High, 2-Medium, 1-Low

CV22045	GREEN TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
- To provide green engineering solutions to energy demand, reduced energy footprint.

UNIT I PRINCIPLES OF GREEN CHEMISTRY 9

Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT II POLLUTION TYPES 9

Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS 9

Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

UNIT IV DESIGNING GREEN PROCESSES 9

Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention

UNIT V GREEN NANOTECHNOLOGY 9

Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the principles of green engineering and technology.	2
CO2	Explain the pollution types and methods of waste minimization and recycling.	2
CO3	Explain the processes and products modification to make them green and safe.	2
CO4	Design processes and products using green technology.	3
CO5	Describe the advanced technology in green synthesis.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Green Technology and Design for the Environment, Samir B. Billatos, Nadia A. Basaly, Taylor & Francis,Washington,DC,1st Edition, 1997.
2. Green Chemistry–An Introductory Text, M. Lancaster, RSC Publishing, 2016.

REFERENCES:

1. Green Chemistry Metrics, Alexi Lapkin and David Constable (Eds), Wiley Publications, 2008.
2. Environmental Chemistry, Stanley Manahan, CRC Press; 10th Edition, 2017.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	-	-	2	3	-	-	-	-	2		
CO2	2	2	2	-	-	2	3	-	-	-	-	2		
CO3	2	2	2	-	-	2	3	-	-	-	-	2		
CO4	2	2	2	-	-	2	3	-	-	-	-	2		
CO5	2	2	2	-	-	2	3	-	-	-	-	2		

3-High, 2-Medium, 1-Low

CV22046	ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
- To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.

UNIT I ENVIRONMENTAL MONITORING AND STANDARDS **9**

Introduction- Environmental Standards- Classification of Environmental Standards- Global Environmental Standards- Environmental Standards in India- Ambient air quality standards- water quality standard- Environmental Monitoring-Need for environmental monitoring- Concepts of environmental monitoring- Techniques of Environmental Monitoring.

UNIT II MONITORING OF ENVIRONMENTAL PARAMETERS **9**

Current Environmental Issues- Global Environmental monitoring programme-International conventions- Application of Environmental Monitoring- Atmospheric Monitoring - screening parameters – Significance of environmental sampling- sampling methods – water sampling - sampling of ambient air-sampling of flue gas.

UNIT III ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING **9**

Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods -Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution

measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

UNIT IV ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISK ASSESSMENT **9**

Water quality monitoring programme- national water quality monitoring- Parameters for National Water Quality Monitoring- monitoring protocol; Process of risk assessment- hazard identification- exposure assessment- dose-response assessment; risk characterization.

UNIT V AUTOMATED DATA ACQUISITION AND PROCESSING **9**

Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks -Sensors and transducers- classification of transducers- data acquisition system- types of data acquisition systems- data management and quality control; regulatory overview.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe basic concepts of environmental monitoring and standards.	2
CO2	Explain the environmental monitoring conventions and environmental sampling methods.	2
CO3	Explain the analytical methods for environmental monitoring.	2
CO4	Describe the environmental monitoring programme and risk assessment.	2
CO5	Explain the automated data acquisition for process monitoring and control.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Environmental Monitoring Handbook, Frank R. Burden, The McGraw-Hill Companies, 2002.
2. Handbook of Environmental Analysis: Chemical Pollutants in the air, water, soil, and solid wastes, Pradyot Patnaik, CRC Press, 1997

REFERENCES:

1. Environmental Monitoring, G.Bruce Wiersma, CRC Press, 2004.
2. Instrumental Methods of Analysis, H.H.Willard, L.L. Merit, J.A. Dean and F. A. Settle, CBP Publishers and Distributors, New Delhi, 1988.
3. Environmental Data Handling, Heaslip,G. JohnWiley. & Sons, NewYork, 1975.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	-	-	2	3	3	-	-	-	2		
CO2	2	2	2	-	-	2	3	-	-	-	-	2		
CO3	2	2	2	-	-	2	3	-	-	-	-	2		
CO4	2	2	2	-	-	2	3	3	-	-	-	2		
CO5	2	2	2	-	2	2	3	-	-	-	-	2		

3-High, 2-Medium, 1-Low

CV22047	INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To create awareness on the energy scenario of India with respect to world
- To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation
- Familiarisation on the concept of sustainable development and its benefits
- Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development
- Acquainting with energy policies and energy planning for sustainable development

UNIT I ENERGY SCENARIO 9

Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT II ENERGY AND ENVIRONMENT 9

Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III SUSTAINABLE DEVELOPMENT 9

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG) - Social development: Poverty, conceptual issues and measures, impact of poverty. Globalization and Economic growth - Economic development: Economic inequalities, Income and growth.

UNIT IV RENEWABLE ENERGY TECHNOLOGY 9

Renewable Energy – Sources and Potential – Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans – Principle of operation, relative merits and demerits

UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT 9

National & State Energy Policy - National solar mission - Framework of Central Electricity Authority National Hydrogen Mission - Energy and climate policy - State Energy Action Plan, RE integration, Road map for ethanol blending, Energy Efficiency and Energy Mix

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the world and Indian energy scenario.	2
CO2	Explain the energy sources, its impact on environment and control strategies.	2
CO3	Explain the need of Sustainable development and its impact on human resource development.	2
CO4	Describe the energy technologies for sustainable development.	2
CO5	Describe the energy policies and planning for sustainable development.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Energy and the Environment, Robert Ristirer and Jack P. Kraushaar, Willey, 2005.
2. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 2012

REFERENCES:

1. Energy Manager Training Manual (4Volumes) available at http://www.em-ea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004
2. Renewable Energy Resources, Twidell, J.W. & Weir A., EFNSpon Ltd., UK, 2015.
3. Energy Security in India Current Scenario, Dhandapani Alagiri, The ICFAI University Press, 2006.
4. Environment and Sustainable Development, M.H. Fulekar,Bhawana Pathak, R K Kale, Springer,2016
5. https://www.niti.gov.in/verticals/energy

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	-	-	2	3	-	-	-	-	2		
CO2	2	2	2	-	-	2	3	-	-	-	-	2		
CO3	2	2	2	-	-	2	3	-	-	-	-	2		
CO4	2	2	2	-	-	2	3	-	-	-	-	2		
CO5	2	2	2	-	-	2	3	3	-	-	-	2		

3-High, 2-Medium, 1-Low

CV22048	ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation
- To create awareness on energy audit and its impacts
- To acquaint the techniques adopted for performance evaluation of thermal utilities
- To familiarise on the procedures adopted for performance evaluation of electrical utilities
- To learn the concept of sustainable development and the implication of energy usage

UNIT I ENERGY AND ENVIRONMENT 9

Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II ENERGY AUDITING 9

Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES 9

Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV ENERGY CONSERVTION IN ELECTRICAL UTILITIES **9**

Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

UNIT V SUSTAINABLE DEVELOPMENT **9**

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG). Globalization and Economic growth. Economic development: Economic inequalities, Income and growth. Social development: Poverty, conceptual issues and measures, impact of poverty

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the types of energy sources, energy efficiency and environmental implications of energy utilization.	2
CO2	Explain the energy audit and its relevance.	2
CO3	Describe the concept of energy audit on thermal utilities.	2
CO4	Describe the relevant techniques for energy improvement in electrical utilities.	2
CO5	Explain the sustainable development and its impact on human resource development	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Energy Efficiency for Engineers and Technologists, Eastop.T.D& Croft D.R, Logman Scientific & Technical, ISBN-0-582-03184, 1990.
2. Energy Management, Butterworths W.R. Murphy and G. McKay, London 1987.

REFERENCES:

1. Energy Manager Training Manual (4 Volumes) available at http://www.em-

ea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004

2. Pratap Bhattacharyya, “Climate Change and Greenhouse Gas Emission”, New India Publishing Agency- Nipa,2020
3. Matthew John Franchetti, Defne Apul “Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies” CRC Press,2012
4. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, “Energy and the Environment”, 4th Edition,Wiley,2022
5. M.H. Fulekar,Bhawana Pathak, R K Kale,“Environment and Sustainable Development” Springer,2016
6. Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**		
CO1	2	2	2	-	-	2	3	-	-	-	-	2		
CO2	2	2	2	-	-	2	3	3	-	-	-	2		
CO3	2	2	2	-	-	2	3	-	-	-	-	2		
CO4	2	2	2	-	-	2	3	-	-	-	-	2		
CO5	2	2	2	-	-	2	3	-	-	-	-	2		

3-High, 2-Medium, 1-Low

SE22001	FINANCIAL STATEMENT ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES

This course is designed to help the students understand the basics of financial statements and to have a basic understanding of fundamental analysis. It also gives insights into various valuation methodologies.

UNIT I FOUNDATIONS OF FINANCIAL STATEMENTS 10

Introduction to Financial Statement Analysis - Understanding Financial Statements: Income Statement, Balance Sheet, Cash Flow Statement - Accounting Principles and Standards - Key Financial Ratios and Metrics - Common Size Analysis and Vertical Analysis

UNIT II ANALYSING THE INCOME STATEMENT 10

Revenue Recognition and Sales Analysis - Cost of Goods Sold (COGS) and Gross Profit Margin - Operating Expenses and Operating Income - Earnings Per Share (EPS) and Net Income Analysis - Quality of Earnings and Adjustments

UNIT III UNDERSTANDING THE BALANCE SHEET 10

Assets: Current and Non-current Assets - Liabilities: Current and Non-current Liabilities - Equity and Shareholder's Equity Analysis - Debt Analysis and Leverage Ratios - Liquidity and Solvency Ratios.

UNIT IV CASH FLOW STATEMENT AND FINANCIAL PLANNING 10

Operating, Investing, and Financing Activities - Free Cash Flow Analysis - Cash Conversion Cycle - Forecasting Financial Statements - Sensitivity Analysis and Scenario Planning.

UNIT V ADVANCED TOPICS IN FINANCIAL STATEMENT ANALYSIS 10

Earnings Quality and Accruals - Intangible Assets and Goodwill Impairment - Mergers & Acquisitions Analysis - Accounting for Income Taxes - Corporate Governance and Financial Statement Fraud.

Total: 50 Periods

Outcomes:

After completing this course, students should be able to:

• Understand the basic concepts of Time Value of Money

• Get the reports and statements from various sources

• Analyze financial statements

• Apply the knowledge in valuation methodologies while buying assets

Text Book:

- NCFM- Fundamental Analysis Module, NSE

Reference Books:

• Parag Parikh (2016), Value Investing and Behavioral Finance, Mc Graw Hill Education

• M.Y. Khan, P.K. Jain (2017), Financial Management. Bangalore: McGraw Hill Education

• Raghu Palat (2016), Fundamental Analysis for Investors, New Delhi: Vision Books

• Aswath Damodaran (2012), Investment Valuation: Tools and Techniques for Determining the Value of Any Asset, New Delhi: Wiley India

SE22002	INTRODUCTION TO SECURITIES MARKET	L	T	P	C
		3	0	0	3

OBJECTIVES

This course is designed to help the students in understanding the various products, participants, and functions of the securities market. It also makes students understand the market design of Primary Market & Secondary Market.

UNIT I MARKETS AND FINANCIAL INSTRUMENTS 10

Types of Markets: Equity Debt, Derivatives Commodities - Meaning and features of Private, Public Companies - Types of Investment Avenues

UNIT II PRIMARY MARKET 10

Initial Public Offer (IPO) - Book Building through Online IPO - Eligibility to Issue Securities - Pricing of Issues - Fixed Vs Book Building Issues - Allotment of Shares - Basis of Allotment - Private Placement.

UNIT III SECONDARY MARKET 10

Roles and Functions of Securities and Exchange Board of India (SEBI) - Depositories - Stock Exchanges - Intermediaries in the Indian Stock Markets - Listing - Membership - Trading - Clearing and Settlement - Risk Management - Investor Protection Fund (IPF) - Do's and Don'ts for Investors | Equity and Debt Investment.

UNIT IV DERIVATIVES 10

Types of Derivatives - Commodity and Commodity Exchanges - Commodity Vs Financial Derivatives - Equity Derivatives - Currency Derivatives - Commodity Derivatives - Interest Rate Derivatives - Hedging, Speculation and Arbitrage.

UNIT V MUTUAL FUNDS 10

Concept of Mutual Funds - Structure of Mutual Funds - SEBI Categorization of Mutual Funds - Mutual Fund Offer Documents - Investing in Mutual Funds.

Total: 50 Periods

Outcomes:

Students completing this course will be able to

• Define various constituents of Securities market

• Explain the basic concepts relating to different avenues of investment,

• Distinguish between the primary and the secondary market

• Gain knowledge related to derivatives market

• Analyze financial statement

Text Book:

- NCFM - Securities Markets: Beginners Module, NSE

Reference Books:

- H.R. Machiraju (2019). Indian Financial System, Vikas Publishing
- M.Y. Khan, P.K. Jain (2017), Financial Management, McGraw Hill Education
- Joydeep Sen, Abhishek Apte (2013), Fixed Income Markets in India, Shroff Publishers & Distributors Pvt Ltd

SE22003	OPTION TRADING STRATEGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

This course is designed to help the students understand the basics of derivatives, Option contracts, Pricing of Options, and Option Trading Strategies.

UNIT I INTRODUCTION TO DERIVATIVES 10

Types of Derivatives – Forwards, Futures and Options, Types of Derivatives – based on the Underlying, History of Financial Derivatives, Participants in Derivatives Market, Economic Function of the Derivative Market, Comparison between Futures and Options

UNIT II OPTIONS, CONTRACTS, MECHANISM AND APPLICATIONS 10

Option Terminologies – Strike Price, Premium, Expiry etc., In-the-Money, Out-of-Money, On-the-Money, Option Chain, Pay-off Matrix for Basic Option Positions – Long Call, Short Call, Long Put, Short Put, Pay-off Matrix for Position in the Share – Long Stock, Short Stock, Assumptions, A Few Option Contract Intricacies, Application of Options

UNIT III PRICING OF OPTIONS CONTRACTS, OPTION GREEKS 10

Black-Scholes Option Pricing Model, European Call Option, European Put Option, Dividends, American Options, Option Greeks – Delta, Gamma, Theta, Vega, Rho

UNIT IV OPTION TRADING STRATEGIES- SINGLE OPTION, SINGLE STOCK 10

Single Option, Single Stock: Protective Put, Covered Put, Covered Call, Protective Call

UNIT V OPTION TRADING STRATEGIES-MULTIPLE OPTIONS OF SAME & DIFFERENT TYPES 10

Multiple Options of same type: Bull Spread, Bear Spread, Butterfly Spread, Calendar Spread, Multiple Options of different type: Straddle, Strangle, Collar, Condor

Total: 50 Periods

Outcomes:

Students will be able to

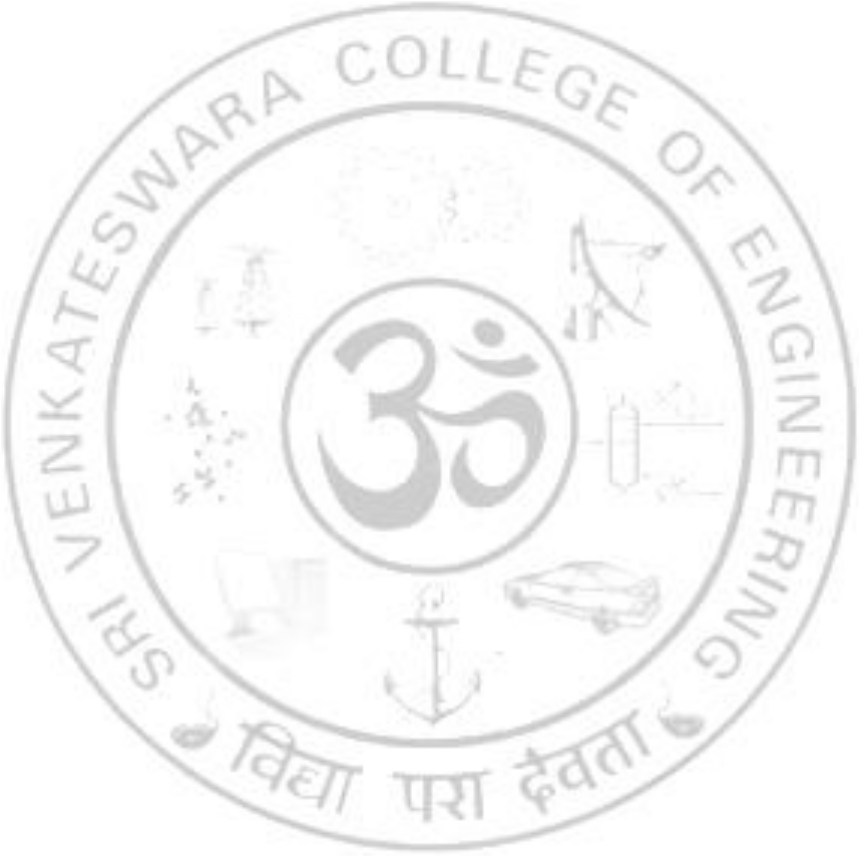
- Understand various option strategies.
- Understand payoff concepts.
- Understand the objectives and risks of each different strategies.

Text Book:

NCFM- Option Trading Strategies

Reference Books:

1. NCFM- Option Trading Strategies
2. NCFM- Option Trading (Advanced)



SE22004	CORPORATE FINANCE	L	T	P	C
		3	0	0	3

OBJECTIVES

This course is designed to help the students understand the basics of financial management decisions, management of working capital, cost of capital and valuation of securities, capital budgeting, techniques and applications etc.

UNIT I INTRODUCTION TO CORPORATE FINANCE 10

Goals and Functions of Finance - Applications of Time Value of Money - Finding the Risk and Return of Securities – Ex-post and Ex-ante - Risk and Return on a Portfolio - 2 Security Case and 3 -Security Case - Capital Assets Pricing Model (CAPM).

UNIT II WORKING CAPITAL MANAGEMENT 10

Nature of Working Capital - Planning of Working Capital - Computation of Working Capital and Management - Constituents of Working Capital - Cash, Inventory, and Receivables.

UNIT III COST OF CAPITAL AND VALUATION OF SECURITIES 10

Finding the Cost of Capital for various Sources of Finance - Cost of Debt - Cost of Equity - Weighted Cost of Capital: Book Value and Market Value Proportions - Equity and Bond Valuation.

UNIT IV CAPITAL BUDGETING 10

Determination of Relevant Cash Flows - Capital Budgeting Techniques and their Applications - Capital Budgeting under Conflicting Situations - Capital Rationing - Investment Decision under Risk and Uncertainty.

UNIT V CAPITAL STRUCTURE AND DIVIDEND POLICY 10

Operating, Financial, and Total Leverage - FBIT-FPS Analysis - Capital Structure Theories - MM Hypothesis with and without Taxes - Capital Structure Decision Making - Dividend Policy - Theories - Mechanics and Practices of Dividend Payment.

Total: 50 Periods

Outcomes:

- Students completing this course will be able to understand the basics of financial management decisions, understand the concepts of working capital also, they will be able to calculate the cost of capital. This course will provide an understanding of capital budgeting and the capital structure of an organization.

Text Book:

- Fundamentals of Corporate Finance by Ross

Reference Books:

- Corporate finance by Ahuja Narender L., Dawar Varun, et al.
- Principles of Corporate Finance (SIE) | 12th Edition, by Richard A. Brealey, Stewart C. Myers, et al.

SE22005	MANAGERIAL ECONOMICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To familiarise the students with a rigorous foundation in microeconomics, and basic macroeconomics and their applications in the planning and decision-making of a firm.
- To develop students' capacity to analyze the economic environments in which business entities operate and understand how managerial decisions can vary under different constraints that each economic environment places on a manager's pursuit.
- To focus on analysing the functioning of markets, the economic behaviour of firms and other economic agents under various market structures, and the economic and social implications of the outcomes.

10

UNIT I ECONOMICS AND MANAGEMENT

Introduction - Market Economy and Managerial Economics - Functions of Managerial Economics - Motivations to Study Microeconomics - Understanding Markets - Economic Cost - Opportunity Cost - Implicit Cost and Explicit Cost - Economic Profit versus Accounting Profit

UNIT II PRODUCTION AND COST ANALYSIS

10

Production - Production function – Isoquant - Equilibrium production - Diminishing rates of return - Laws of production - Cost of Production: Fixed and Variable Costs - Which Costs Matter? - Short Run Costs curves: TC, TVC, TFC, MC, ATC, AVC, and AFC - Relation between SR and LR Costs - Revenue Curves - Economies of Scope - Learning Curves.

UNIT III MARKETS AND PRICING AND OUTPUT DECISIONS 10

Introduction - Characteristics of Perfect Competition - Profit Maximization and Optimal Output - Decision in Perfect Competition - Sources and Measurement of Monopoly Power - Monopolist's Output Decision and Pricing Rule - Price Discrimination - Bilateral Monopoly - Characteristics of Monopolistic Competition - Short Run and Long Run Equilibrium in a Monopolistic Competition - Economic Efficiency of Monopolistic Competition - Characteristics of Oligopoly - Collusive and non-collusive oligopoly.

UNIT IV NATIONAL INCOME 10

Introduction to National Income - National Income Concepts - National Income Determination - Green National Income Accounting - National Income Accounting Reflecting Social Welfare - Business Cycles - Phases of Business Cycles.

UNIT V ECONOMIC MANAGEMENT 10

Money and Inflation - Fiscal and Monetary Policies - Public versus Private Sectors - Economic Transition in India - Liberalization, Privatization, and Globalization - Business and Government - Public-Private Participation (PPP) - Disinvestment - Foreign Direct Investment.

Total: 50 Periods

Outcomes:

Learners' appreciation of the analytic strength and practical applicability of microeconomic theory in managerial uses of all types of entrepreneurs. The paper is accordingly scheduled with both theory and applications. The theory serves to construct a rigorous framework of principles and techniques, and the applications bring real aspects into the classroom through multiple cases and examples from everyday sources.

Text Books:

1. Dwivedi D.N., Business & Economics, Vikas Publishing House

2. Dr. Atmanand, Managerial Economics, Excel Books, Delhi.

3. R.L.Varshney, K.L. and Maheshwari, Managerial Economics, Sultan Chand &Sons

Reference Books:

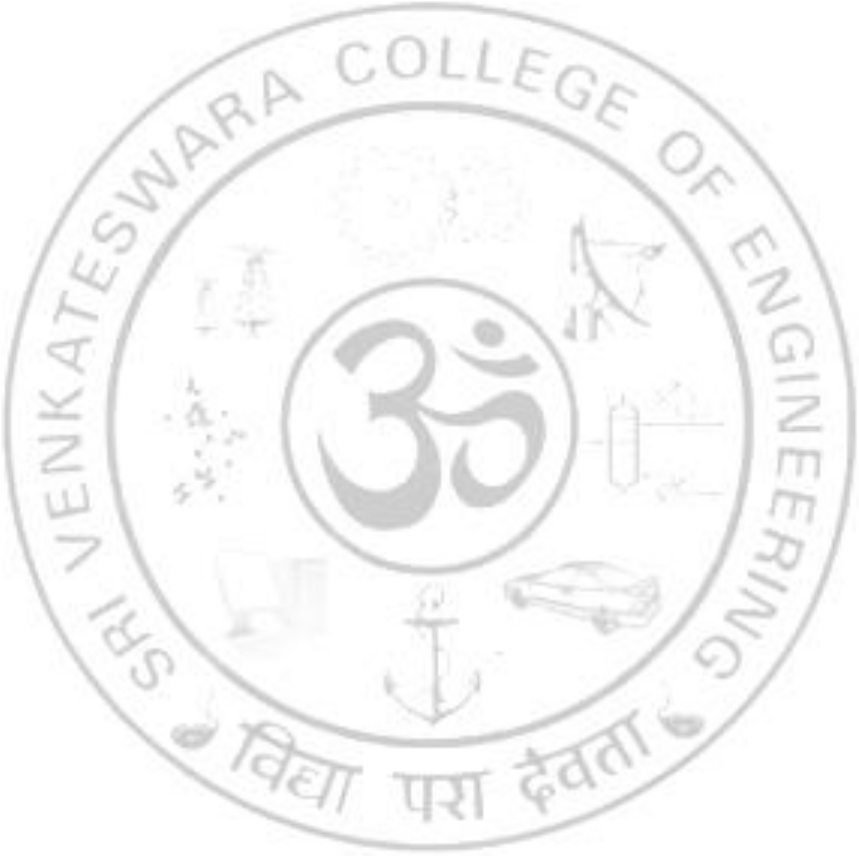
1. Haynes, Mote and Paul, Managerial Economics — Analysis and Cases,

2. Vakils. Feffer and Simons Private Ltd., Bombay.

3. Hague, D.C., Managerial Economics.

4. Introduction to Managerial Economics, Hutchinson University Library.

5. Malcolm P. McNair and Richard S. Meriam, Problems in Business Economics, McGrawHill Book Co., Inc.



SE22006	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

To understand the concepts of Project Management through Project Network Diagrams; Time, Cost, and Resource management and control, project cost control; project monitoring and information systems and implementation of projects.

UNIT I INTRODUCTION 6

Projects: Definitions and characteristics; dimensions of project management – project diagrams – networks – network techniques.

UNIT II PROJECT TIME MANAGEMENT 14

Time management under certainty – CPM – slackness in projects – time management under uncertainty – PERT – event orientation – simulation.

UNIT III COST AND RESOURCE MANAGEMENT 10

Crashing of Projects – time-cost trade-off – projects with limited resources – resource allocation and levelling - project organisation.

UNIT IV COST CONTROL AND INFORMATION SYSTEMS 10

Project cost control – types of costs – cost codes – cost budgeting – cost control – project information systems: Project control, project monitoring – reports.

UNIT V PROJECTS UNDER IMPLEMENTATION 10

Implementation of projects – monitoring of projects and control – reporting and information systems – multi-project environment - case studies.

Total 50 Periods

Outcomes:

1. Understanding the concepts and dimensions of managing projects and the dynamics involved
2. Student will be able to conceptualise a project and create networks.

3. Student will be able to apply network techniques such as PERT/CPM for time management.
4. Student will be able to apply cost and resource management principles.
5. Student will be able to do cost control techniques
6. Student will be able to design an effective information system for managing projects.

Text Books:

1. Harold Kerzner, Project Management: A system approach to planning, scheduling, and controlling, CBS Publishers and Distributors
2. S.Choudhary, Project Management, Tata McGraw Hill

Reference Books:

1. John M. Nicholas, Project Management for Business and Technology, Prentice Hall of India.
2. Prasanna Chandra, Project Planning, Analysis, Selection, Implementation. Tata McGraw Hill

SE22007	MATHEMATICS FOR AI & ML	L	T	P	C
		3	0	0	3

OBJECTIVES

To familiarize with the mathematics that is required to understand various models and algorithms in AI, ML, and high dimensional data.

UNIT I BASICS OF PROBABILITY 10

Random Experiment, Sample space, Outcomes and Events, Axioms of Probability, Counting techniques, Conditional Probability, Independent Events, Bayes' Theorem, Random Variables, PMF, PDF, Joint and Marginal distributions, Expectation and Variance of Random Variables, IID Random Variables and their relation to ML training data, Curse of Dimensionality

UNIT II PROBABILITY DISTRIBUTIONS 10

Discrete Uniform, Bernoulli, Binomial, Geometric, Negative Binomial, Poisson, Hypergeometric, Categorical, Multinomial distributions, Poisson as an approximation of the Binomial, Continuous Uniform, Exponential, Normal, Beta, Gamma distributions, Memoryless property of Geometric and Exponential distributions, Applications of distributions to AI, ML and Big data problems

UNIT III LIMIT THEOREMS AND SAMPLING DISTRIBUTIONS 10

Moment Generating functions, Probability Generating Function, Strong and Weak Law of Large Numbers, Central Limit Theorem, Sampling with and without Replacement, Statistic, Student's t, Chi-square, F distribution, Markov and Chebyshev Inequality, Chernoff Bound, Convexity, Caratheodory Theorem, Hoeffding's Inequality

UNIT IV STATISTICAL INFERENCE AND ESTIMATION 10

Method of Moments, Maximum Likelihood Estimation, Point Estimation, Confidence Intervals, Bias Variance properties of estimators, Consistency of estimators, Cramer Rao lower bound, Hypothesis Testing, Null and Alternative Hypothesis, Type I and Type II errors, p-value, Likelihood Ratio Tests, Rao-Blackwell Theorem, Median-of-Means Estimator, Random Graphs

UNIT V LINEAR REGRESSION AND PREDICTION 10

Simple Linear Regression model, Method of Least Squares, Matrix formulation, Projection to the Column Space, Normal Equations, Probabilistic framework of Linear Regression, Weighted Least Squares, Covariance and Correlation, Conditional Expectation and Variance, Algorithms for the linear regression problem, Principal Component Analysis

Total: 50 Periods

Outcomes:

1) The student will have an in-depth understanding of the various statistical concepts that are used in AI and ML.
2) This course will prepare the student to understand advanced mathematical models and algorithms in AI and ML.
3) Students will be able to mathematically formulate and study various engineering problems using statistical techniques.
4) This course will introduce students to the mathematics behind big and high-dimensional data.

Text Books:

1. R.V. Hogg, J. McKean and A.T. Craig, Introduction to Mathematical Statistics, Pearson Education Limited, 2014.
2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
3. O. C. Ibe, Fundamentals of Applied Probability and Random Processes, Elsevier, 2005.
4. S. M. Ross, Probability Models for Computer Science, Elsevier, 2002.
5. S. M. Ross, A First Course in Probability, 6th edition, Englewood Cliffs Prentice- Hall, 2001.
6. R. Vershynin, High-Dimensional Probability: An Introduction with Applications in Data Science, 1st edition, Cambridge Series in Statistical and Probabilistic Mathematics, 2018

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its applications, 7th edition. New York, McGraw Hill, 2012.
2. David C. Lay, Judi J. McDonald and Steven R. Lay, Linear Algebra and its applications, 5th edition, Pearson, 2015.
3. W. Feller, An Introduction to Probability Theory and Its Applications, 2nd edition, John Wiley & Sons Inc., 1957.
4. S. M. Ross, Simulation, 5th edition, Elsevier, 2013.
5. R. A. Johnson and D. W. Wichern, Applied Multivariate Statistical Analysis, 5th edition, PHI Learning Private Limited, 2009.

OC22002	FUEL CELL CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

On Completion of the course the students are expected to;

- To gain knowledge on fundamentals of fuel cell technology
- To make the students to understand the importance of Chemical Thermodynamics.
- To make the students to understand the importance of electrochemistry.
- To gain knowledge of in relation to Applications and Challenges of fuel cell.

To reduce the production cost of fuel cell systems to be used in transport applications.

Unit 1 ELECTROCHEMISTRY 9

Nernst equation and open circuit potential, pressure effect, temperature effect - Stoichiometric coefficients and reactants utilization - Mass flow rate calculation – voltage and current in parallel and serial connection - Over- potentials and polarizations - Activation polarization .

Unit 2 CHEMICAL THERMODYNAMICS 9

Basic Reactions, Heat of reaction,– Enthalpy change of a reacting system - Gibbs free energy of substances - Gibbs free energy change of a reacting system - Efficiency - Power, heat due to entropy change.

Unit 3 BASICS OF FUEL CELL 9

Basics, History of Fell Cell Technology, Open Circuit Voltage, Efficiency, Basic Principles, Components Reactions for Alkaline, Proton Exchange Membrane, Direct Methanol.

Unit 4 FUEL SYSTEM DESIGN & OPTIMISATION 9

Geometries of fuel cells and fuel cell stacks - Fuel Delivery and Crossover Prevention– Water flooding and water management, Thermal Management, Mass Transport/Concentration Losses and current collection - Bipolar plates and cooling plate design - Flow uniformity consideration.

Unit 5 APPLICATIONS AND CHALLENGES 9

Automotive applications & issues - Micro fuel cells & portable power - Distributed & Stationary power. Cost Reductions, System Integration, Reliability, Technical Issues.

TOTAL: 45 PERIODS

OUTCOMES:

- To foundational knowledge of the fuel cell.
- Understand the way to Fuel system design &optimization.
- Apply their learned knowledge to develop conventional technologies.
- Understand the importance of fuel cell applications.
- The students will acquire knowledge on various fuel cell techniques and their mechanism.

TEXT BOOKS:

1. James Larminie and Andrew Dicks, “Fuel Cell Systems Explained”, John Wiley & Sons Inc., 2nd Edition, 2000.
2. B. Viswanathan and Aulice M. Scibioh, “Fuel Cells: Principles and Applications”, Universities Press, 1st Edition 2006.

REFERENCES:

1. Shripad T. Revankar, Pradip Majumdar, “Fuel Cells: Principles, Design, and Analysis (Mechanical and Aerospace Engineering Series)”, CRC Press, May 2014
2. Frano Barbir, “PEM Fuel Cells Theory and Practice”, Elsevier Academic Press, 2005.
3. Matthew M. Mench, “Fuel Cell Engines”, Wiley; 1st Edition, March 2008.
4. EG & G Services. Fuel Cell Handbook. Parsons, Inc., Morgantown, West Virginiak, 2000.

OP22006	Opto Electronics and Applications	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enhance the fundamental knowledge in Semiconductors and opto electronics and its applications relevant to various Streams of Engineering and Technology.

Unit 1 SEMICONDUCTING MATERIALS 9

Structure and bonding Schrodinger's equation - Partical in a box Density of states-Intrinsic Conductivity-Extrinsic semiconductors-PN junction theory LED-Materials used in computers and communication system-PIN photo diodes- Frequency response of silicon photo diodes-High speed and long wavelength photo diodes.

Unit 2 MODERN ENGINEERING MATERIALS 9

Super conducting materials - High Tc super conductors-Applications : Liquid crystals-Liquid crystal display systems-Merits and demerits - Metallic glasses and their applications-Shape memory alloys and applications-IC packaging materials.

Unit 3 OPTOELECTRONIC SWITCHING DEVICES 9

Analog and digital modulators - Franz keldysh and strak effect modulators-Quantum well-Electro absorption modulators-Electro optics modulators-Optical switching and logic devices.

Unit 4 FIBER OPTICAL COMMUNICATIONS 9

Principles of light transmission through fiber-fiber index profiles-Modes of propagation-Losses in fibers Dispersion-Light sources for fiber optics-Fiber optic communication link-Modulators and detectors-Fiber optic communication link-Modulators and detectors-Fiber amplifiers-Soliton based coherent optical fiber communication.

Unit 5 MAGNETIC & OPTICAL DATA STORAGE MATERIALS 9

Magnetic material parameters-Bubble materials-rare earth garnets--Charge coupled devices(CCD)-Optical data storage-Disk data storage-Recording and read out of information-CD ROM-Magneto-optical recording and read out-Different storage and retrieval techniques-Holographic optical data storage.

TOTAL: 45 PERIODS

OUTCOME

CO	CO statements Upon successful completion of the course, the students should be able to	RBT LEVEL
CO1	Apply the principals of Quantum mechanics to study the properties of electrons in semiconducting materials	**3**
CO2	Explain different types of New Engineering Materials used in Various applications	**2**
CO3	Apply the principles of electro-optics, modulators, switches and their uses..	**3**
CO4	Apply fundamentals law of optics in Optic fiber communication	**3**
CO5	Apply a basic process which show how the memory storage devices function and magnetic data storage and its growth with the advent of time and advancements in technologies.	**3**

REFERENCES:

1. John Allison, " Electronic Engineering Materials and Devices ", Tata McGraw Hill, 1985.
2. Arumugam M.," Material Science ", Anuradha ublishers, 1997.
3. Gerd Geiser, " Optical Fiber Communications ", McGraw Hill, 1993.
4. Pallab Bhattacharya, " Semiconductors Optolectronic Devices ", Prentice Hall of India, 1995.
5. Thomas C.Bartee, " Computer Architecture and Logic Design ", McGraw Hill, 1991.

OP22008	BASICS OF ENVIRONMENTAL SAFETY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To motivate and create awareness in every engineering student in maintaining and protecting the environment and effect of technology on the environment.
2. To inspire students to find ways to reduce work place hazards and to encourage the standard of safety health and environment program.

Unit 1 Environmental Impact Assessment 9

Scope and Importance; need for public awareness about our environment; Environmental impact assessment (EIA) — purpose, procedure and benefits of EIA.

Unit 2 Environment Safety Management System 9

Sources of information on Safety, Occupational Safety, Health and Environment Safety Management, Compilation and collation of information, Analysis & use of modern methods of programming, storing and retrieval of Management Information System (MIS) for Safety, Health and Environment Status and future goals of computer utilization in Safety, Health and Environment (SHE) Services in Industries.

Unit 3 Environmental Pollution and Protection 9

Environmental pollution — causes, Effects and control measures of air pollution, water pollution, soil pollution, marine pollution, noise pollution and nuclear hazards, Solid waste management-urban and industrial waste-causes, effects and control measures- Role of Government in environment protection, legal aspects of environment protection, NGO initialization, National Committee on environmental Planning (NCP), disaster management: floods, earthquake, cyclone, tsunami and landslides.

Unit 4 Industrial Safety 9

Accidents (Causes & Factors, Cost of Accidents, Accident Prevention, Investigation of Accidents, Reporting and Recording Systems for Accidents. First Aid (Basics of First Aid, How injuries are caused in lifting, falls etc.) Fire Fighting: Fundamentals of Fire, Fire Fighting Equipments and Systems, Fire Extinguishing Methods, Demonstration of various Fire.

Unit 5 Occupational Health Hazards 9

Protective Clothing and Equipment, Safe Working Practices in Power Plant, Permit to work system, Safety in Movement and storage of Materials, House Keeping, Safety Rules, Adverse health effects of noise, vibration, cold, heat stress, improper illumination, thermal radiation, ionizing and Non-ionizing radiations.

TOTAL: 45 PERIODS

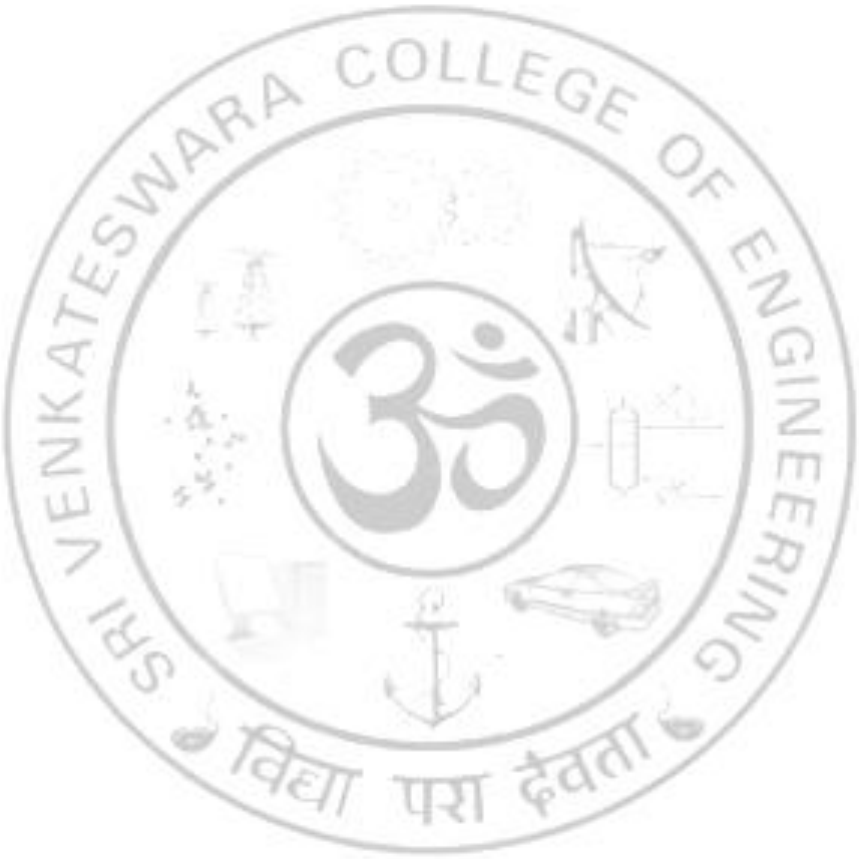
CO	Course Outcomes	RBT LEVEL
Students will be able to:		
CO1	Understand and evaluate the scope, importance and impacts of human activities through Environment impact Assessment.	2
CO2	Develop an effective Environment Safety management system by implementing modern methods of data programming and management, for enhancing safety, health, and environmental practices in industries.	3
CO3	Inculcate environmental awareness and sustainability and emphasizes the roles of government, legal aspects, NGO involvement, and national committees in environmental protection.	3
CO4	Enhances industrial safety by comprehensively addressing the causes and factors of accidents and also provides foundational knowledge on first aid and fire-fighting fundamentals and equipment.	2
CO5	Advocates effective housekeeping, adhering to safety rules, and addressing adverse health effects associated with noise, vibration, temperature extremes, illumination, thermal radiation, ionizing, and non-ionizing radiations.	2

TEXT BOOKS:

1. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
2. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London.
3. Allen D. T and Shonnard D.R., Sustainability Engineering Concepts, Design and Case Studies, Pearson 2011.
4. G. Tyler Miller Jr. and Scott Spoolman (2011), Environmental Science, 13th Edition, Brooks/Cole.
5. Anubha Kaushik and C.P. Kaushik (2010), Environmental Science and Engineering, 3rd Edition, New Age International.
6. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, 2nd edition, Pearson Education.
7. Bradley A.S, Adebayo, A.O. Maria P. Engineering applications in sustainable design and development, CL Engineering 2015.

REFERENCES:

1. Energy Management/Murphy WR, Mc Kay G/Butterworth Heinamn/2009
2. Environmental Engg: A Design Approach / Sincereo & Arcadio P/ PHI
3. Environmental Engineering: Water Supply, Sanitary Engineering and Pollution/ Kamala A Rao/TMH
4. Environmental Engineering/Dean J, Horward S/McGraw Hill/1985
5. Dharmendra S.Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
6. Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
7. R.K.Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards,' Vol. I and II, Enviro Media 38.



OM22001	STATISTICAL METHODS FOR ENGINEERS	L	T	P	C
		2	1	0	3

OBJECTIVES:

The students should be made to:

- Understand the basic concepts of Application of Statistics.
- Acquire skills in handling situations involving Engineering and Managerial problems.
- Understand and characterize phenomena about variance, proportion and Goodness of fit.
- Learn how to plan design and conduct experiments effectively and analyse the resulting data to obtain objective conclusions.
- Understand the concepts of statistical Quality control and apply those concepts to construct and interpret a mean and range chart.

Unit 1 DESCRIPTIVE STATISTICS 9

Introduction and Applications of Statistics-Measures of central tendency-Mean-Median-Mode-Geometric Mean - Harmonic Mean- Measures of Dispersion- Range – Quartiles -Variance Moments-Skewness and Kurtosis- Coefficient of variation and its applications.

Unit 2 TESTING OF HYPOTHESIS-LARGE SAMPLES 9

Sampling distributions – Estimation of parameters – Statistical hypothesis – Large sample test based on Normal distribution for single mean, difference of means, single proportion and difference of proportions.

Unit 3 TESTING OF HYPOTHESIS – SMALL SAMPLES 9

Tests based on t, F and Chi-square distributions for mean, variance and proportion – Contingency table (test for independence) – Goodness of fit- Non parametric test (concept only)

Unit 4 ANALYSIS OF VARIANCE 9

One way and two-way classifications – completely randomized design- Randomized block design-Latin square design.

Unit 5 STATISTICAL QUALITY CONTROL 9

Control charts for measurements (Mean and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

- Have a fundamental knowledge of the concepts of Statistics
- Have a notion of sampling distributions and statistical techniques used in Engineering problems.
- Analyse and interpret the data based on the sample tests
- Apply the basic concepts of classification of design of Experiments in the field of Engineering.
- Design and interpret control charts for variables and attributes.

TEXT BOOKS:

1. J. Susan Milton and Jesse C. Arnold, "Introduction to Probability and Statistics", Tata McGraw-Hill, 4th edition, 2007.
2. Richard A. Johnson, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, 9th edition, 2018.
3. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand, 11th edition, 2005.

REFERENCES:

1. J. Medhi, "Statistical Methods- An Introductory Text", New Age International, 1992.
2. Irwin Miller and Marylees Miller, "John E. Freund's Mathematical Statistics with Applications", Pearson Education, 7th edition, 2004.
3. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Press, 3rd edition, 2005.

WEBLINKS:

1. **https://online.stat.psu.edu/statprogram/reviews/statistical-concepts/hypothesis-testing**
2. **https://online.stat.psu.edu/stat503/lesson/1**

COURSE ARTICULATION MATRIX:

	P	P	P	P	P	P	P	P	P	PO	PO	PO	PS	PS
C	3	3	3											
C	3	3	3	3							2			
C	3	3	3	3	3									
C	3	3	3	2	2						2	2		
C	3	3	3								2	2		