

Zeal Education Society's

ZEAL COLLEGE OF ENGINEERING & RESEARCH, PUNE – 41

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

NBA Accredited, NAAC Accredited with A+ Grade, ISO 21001:2018



COMMON TO ALL DEPARTMENT Curriculum Structure and Syllabus of S.Y. B. Tech. – Open Elective – I (Common to all Departments)

**(With effect from - Academic Year 2025 - 26)
(2024 Pattern)**

VISION OF THE INSTITUTE

To be a premier institute in technical education by imparting academic excellence, research, social and entrepreneurial attitude.

MISSION OF THE INSTITUTE

- To achieve academic excellence through innovative teaching and learning process.
 - To imbibe the research culture for addressing industry and societal needs.
 - To inculcate social attitude through community engagement initiatives.
 - To provide conducive environment for building the entrepreneurial skills.

OPEN ELECTIVE

Second Year B. Tech. – Common for all Programs: Semester - III

# - Select any one course from the given Open Elective Courses		
Course Code	Course Type	Open Elective - I
ALOE301A	OEC	Digital Literacy and Applications
ALOE301B		Environmental Studies
ALOE301C		Green Energy and Sustainability
ALOE301D		Basics of Consumer Electronics
ALOE301E		Renewable Energy Systems

Second Year B. Tech. – Common for all Programs: Semester – IV

# - Select any one course from the given Open Elective Courses		
Course Code	Course Type	Open Elective - II
ALOE402A	OEC	Cyber Security and Laws
ALOE402B		Sustainability and Climate Change
ALOE402C		Energy Audit and Electrical Safety
ALOE402D		Digital Marketing
ALOE402E		Entrepreneurship and Innovations

OPEN ELECTIVE

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OPEN ELECTIVE

SYLLABUS
SEMESTER - III

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)						Semester: III			
Course: Open Elective – I (Digital Literacy and Applications)						Code: ALOE301A			
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Basic computer knowledge, Familiarity with using internet and mobile devices									
Course Objectives:									
1. To introduce students to fundamental digital skills and online applications. 2. To enhance understanding of modern information and communication technologies (ICT). 3. To develop practical skills in digital tools, online collaboration, and data management. 4. To promote safe, ethical, and effective use of technology in professional and personal life.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Demonstrate proficiency in using essential digital tools for everyday tasks.								
CO2	Apply safe and secure practices while using the internet and online services.								
CO3	Utilize online collaboration platforms for communication and teamwork.								
CO4	Develop simple digital content (documents, presentations, basic websites).								
CO5	Leverage emerging digital applications for academic, professional, and social needs.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Digital Literacy: Evolution of Digital Technology – Role of ICT in modern life – Hardware and Software basics – Overview of digital devices (Computers, Smartphones, Tablets) – Operating Systems and Applications.								04
2.	Internet and Web Fundamentals: Basics of Internet – Web Browsers – Search Engines – Online Communication Tools (Email, Chat, Video Conferencing) – Netiquette – Cloud Storage and File Sharing.								04
3.	Digital Tools for Productivity: Word Processing (MS Word/Google Docs) – Spreadsheet Fundamentals (MS Excel/Google Sheets) – Presentation Tools (PowerPoint/Canva) – Templates and Online Collaboration (Google Workspace, MS Teams).								05
4.	Cyber Safety and Digital Ethics: Online Security Threats – Password Management – Safe Browsing – Data Privacy								05

OPEN ELECTIVE

	– Cyberbullying – Digital Footprint – Intellectual Property Rights in the digital era.	
5.	Social media and Online Applications: Role of social media in Communication – Online Professional Networking (LinkedIn) – Blogging and Content Sharing Platforms – Basics of Digital Marketing – E-Governance and Online Services (Banking, Payments, Education Portals).	05
6.	Introduction to Web and Mobile Applications: Creating a Simple Blog/Portfolio Website (Using WordPress/Wix) – Overview of Mobile Apps for Education and Productivity – Emerging Technologies (Cloud Computing, IoT, AI) in everyday life.	05
TOTAL		28
Text Books:		
1. Pradeep K. Sinha, Priti Sinha, “Computer Fundamentals”, BPB Publications. 2. Rajaraman, “Fundamentals of Computers”, PHI Learning.		
Reference Books:		
1. Alan Evans, Kendall Martin, Mary Anne Poatsy, “Technology in Action”, Pearson Education. 2. Daniel Scott, “Digital Literacy Unpacked”, Facet Publishing.		
E-Resources:		
1. NPTEL: https://nptel.ac.in 2. Digital Literacy Course, Google: https://learndigital.withgoogle.com 3. Microsoft Learn: https://learn.microsoft.com 4. W3Schools Basics: https://www.w3schools.com		

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: III		
Course: Open Elective – I (Environmental Studies)							Code: ALOE301B		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Course Objectives:									
<div><div></div><div>1. To understand the structure and functions of ecosystems and the importance of biodiversity.</div><div>2. To study advanced energy systems and their role in sustainable development.</div><div>3. To learn concepts of natural resource management and disaster management through case studies.</div><div>4. To understand sources, impacts, and control measures of environmental pollution and waste management.</div><div>5. To create awareness about global environmental issues and environmental toxicology.</div><div>6. To gain knowledge of environmental assessment, management systems, and pollution control tools.</div></div>									
Course Outcomes: After the completion of course, students will be able to									
CO1	Understand the structure and functions of major ecosystems and the significance of biodiversity conservation								
CO2	Evaluate various advanced energy systems in terms of their merits, demerits, and global applications								
CO3	Apply concepts of natural resource management and disaster management using relevant case studies.								
CO4	Analyse the sources, impacts, and control measures of environmental pollution and waste management practices.								
CO5	Assess global environmental concerns and suggest sustainable solutions for issues like climate change and groundwater depletion.								
CO6	Utilize environmental management tools and prepare environmental impact assessments following legislative guidelines.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Biodiversity: Types, Value, Hot-spots, Threats and Conservation of biodiversity, Forest Wealth and Deforestation.								05
2.	Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable mining, case studies, and Carbon Trading.								05

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3.	Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Groundwater Pollution, Noise pollution, Soil Pollution and Air Pollution. Waste Management & Public Health Aspects: Bio-medical Wastes, Solid waste, Hazardous wastes, E-wastes, Industrial and Municipal Sludge.	05
4.	Global Environmental Concerns (Concept, policies and case-studies): Groundwater depletion/recharging, Climate Change, Acid Rain, Ozone Depletion, Radon and Fluoride problem in drinking water, Resettlement and rehabilitation of people, Environmental Toxicology.	03
5.	Latest Developments in Environmental Pollution Mitigation Tools (Concept and applications): G.I.S. & Remote Sensing, Environmental Management Systems, ISO14001, Environmental Stewardship- NGOs.	05
6.	Environmental Assessment, Management and Legislation Aims and objectives of Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS). EIA Guidelines, Impact Assessment Methodologies, Procedure for reviewing EIA of developmental project, Life-cycle analysis, cost benefit analysis, Guidelines for Environmental Audit.	05
TOTAL		28

Text Books:

1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., "Environmental Encyclopedia", Jaico Publications House, 1st edition, 2000.
2. Agarwal, K.C, "Environmental Biology", Nidhi Publishers, 2nd edition, 2008.

Reference Books:

1. Erach Bharucha, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., 1st Edition, 2002.
2. Brendan Gleeson and Nicholas Low (Eds.), "Global Ethics and Environment", Routledge, London, 1999.
3. Peter H. Gleick, "Water in Crisis", Pacific Institute for Studies in Development, Environment & Security, Stockholm Environment Institute, Oxford University Press, 1993.
4. Martha J. Groom, Gary K. Meffe, and Carl Ronald Carroll, "Principles of Conservation Biology", Sinauer Associates, Sunderland, 2006.
5. R. Edward Grumbine and M. K. Pandit, "Threats from India's Himalaya Dams", Science, Vol. 339, pp. 36–37, 2013.
6. Patrick McCully, "Rivers No More: The Environmental Effects of Dams", pp. 29–64, Zed Books, 1996.

E-Resources:

1. NPTEL video lecture on Environmental Impact Assessment
<https://www.youtube.com/watch?v=iLdyhgFv1U>
2. Sustainability Concepts - Innovations and Challenges
<https://www.youtube.com/watch?v=A9PGRnkLubE&list=PLbRMhDVUMngd2-jPdQSk3QNBtf2n7FxxU&index=2>
3. Natural Resources Management

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<https://www.youtube.com/watch?v=vsXv3anIBSU&list=PLwdnzlV3ogoV162m7Q1rCQamsvKWT9D08>

4. Biodiversity & conservation

<https://www.youtube.com/watch?v=eJBfZGEzUfA&list=PLwdnzlV3ogoV162m7Q1rCQamsvKWT9D08&index=9>

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: III		
Course: Open Elective – I (Green Energy and Sustainability)							Code: ALOE301C		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Renewable energy, power generation technology									
Course Objectives:									
1. To study cleaner production and life cycle assessment. 2. To understand green fuels. 3. To learn green technology and green engineering. 4. To learn waste management. 5. To study sustainable technologies.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Understand green technology principles, green chemistry, and process intensification for sustainable industries.								
CO2	Evaluate the benefits, challenges, and environmental impact of green fuels compared to conventional fossil fuels.								
CO3	Apply cleaner production principles and life cycle assessment for sustainability.								
CO4	Assess waste types, audits, and management strategies with focus on health and environmental impact.								
CO5	Explain sustainable technologies considering ecological, economic, and social dimensions.								
CO6	Analyze practical challenges, case studies, and laws in implementing green technologies.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Principles of Green Technology and Green Engineering: Processes and products for green safe and economically acceptable to the society, green chemistry and Process intensification. Green Industrial Processes: Pollution statistics from various industries. A greener approach towards all these industries.								05
2.	Green Fuels: Definition of Green Fuels, their benefits and challenges, comparison of green fuels with conventional fossil fuels with reference to environmental, economic and social impacts, public policies and market driven initiatives, Biomass energy: Concept of biomass energy utilization, types of biomass.								05
3.	Cleaner Production: Definition, Importance, Principles of Cleaner Production and its Benefits, Role								04

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	of industry, Clean development mechanism, Reuse, Recovery, Recycle, Raw material substitution- Wealth from waste. Role of CP in Achieving Sustainability, Benefits, Role of Industry, Government and Institutions, Environmental Management, Pollution Prevention and Cleaner Production Awareness Plan, Environmental Statement, Carbon credit, Carbon trading. Introduction to Life Cycle Assessment (LCA) and Elements of LCA.	
4.	Waste Management: Waste stream assessment (WSA), Waste generation and composition, Waste characteristics (physical and chemical), Waste audit, Health and Environmental effects (public health and environmental), Comparative assessment of waste generation and Composition of developing and developed nations, a case study results from an Indian city, Handouts on solid waste compositions. E-waste generation.	05
5.	Sustainable Technology: Understand the Sustainable Technology, Three principle dimensions: the ecological, the economic and the social dimension, including intergenerational justice; use a systems perspective, to describe sustainability challenges and possibilities for major technical systems and for their transformation to meet sustainability requirements.	05
6	Challenges and Practical Implementation: Responsibilities and potentials of companies for action. Green Productivity and emerging technologies. Implementation of the practical applications of Green emerging technologies and sustainable development. Case studies in Green Technology. Green laws compliance.	04
TOTAL		28
Text Books:		
<ol style="list-style-type: none"> 1. Matlack A.S., "Introduction to Green Chemistry", Marcel Dekker Publication. 2. Modak P., Visvanathan C. and Parasnis M., "Cleaner Production Audit Environmental System Reviews", Asian Institute of Technology Publication. 3. Anastas P.T. and Warner J.C., "Green Chemistry: Theory and Practice", Oxford University Press. 4. Bishop P. L., "Pollution Prevention: Fundamentals and Practice", McGraw-Hill Publication, Boston. 5. Clark J.H. and Macquarie D.J., "Handbook of Green Chemistry and Technology", Wiley Blackwell Publication. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Sawyer C.N, McCarty P.L and Parkin G.F., "Chemistry for Environmental Engineering and Science", 5th ed. McGraw-Hill Professional Publication. 2. Paul L Bishop, "Pollution Prevention: Fundamentals and practice", McGraw-Hill International Publication. 3. Das A. K, "Environmental Chemistry with Green Chemistry", Books and Allied (P) Ltd. 		

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Publication.

4. V.K. Ahluwalia, "Green Chemistry Environmentally Benign Reactions", springer publication.
5. V.K. Ahluwalia, Ane. "Green Chemistry: Environmentally Benign Reactions", springer publication.
6. Mike Lancaster, "Green Chemistry: An Introductory Text", Royal Society of Chemistry publication.

E-Resources:

1. NPTEL Course on "Energy Resources, Economics and Sustainability", By Prof. Pratham Arora, IIT Roorkee,
https://onlinecourses.nptel.ac.in/noc25_hs86/preview
2. NPTEL Course on "Sustainable Energy Technology", By Prof. Sayak Banerjee, IIT Hyderabad.
https://onlinecourses.nptel.ac.in/noc23_me138/preview

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: III		
Course: Open Elective – I (Basics of Consumer Electronics)							Code: ALOE301D		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Basic understanding current, voltage, and electronics components									
Course Objectives:									
1. Understand principles and components of audio, video, and communication systems.									
2. Develop practical skills in installation, operation, and maintenance of electronics.									
3. Prepare students for technical roles in electronics service and support industry.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Understand the working principles and components of basic audio systems and home theatre setups.								
CO2	Explain the functioning of modern video display technologies and remote-control operations.								
CO3	Identify and describe the types, specifications, and working of projectors and CCTV systems.								
CO4	Describe satellite communication principles and DTH system setup and components.								
CO5	Explain the construction, working, and common issues in basic household appliances like washing machines, mixers, and induction cooktops.								
CO6	Understand the operation and features of kitchen and office equipment such as microwave ovens, printers, and scanners.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Audio Systems: Introduction to audio systems, Audio amplifier, Microphone, Loudspeaker, Public address system, DJ system: concept and components, Audio as Data and Signal, Digital Audio Processes: Time Compression & Expansion, Block diagram and working of home theatre system								05
2.	Video Systems and Display Technologies: Elements of TV communication system, Scanning process and its necessity, Comparison: CRT, LCD, and LED TVs, LCD and LED TV: principles and section-wise working, 3D TV: Basic working principle, IPS panels and features, Interfaces: HDMI, USB, RGB, etc., TV remote control: types, IR code transmission/reception, functions, faults								05
3.	Projectors and Surveillance Systems: LCD vs. LED Projectors: differences and specs, Working principle and faults in								05

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	LED projectors, CCTV Cameras: types and specifications, CCTV setup and components, Digital Video Recorders: types and working	
4.	Satellite Communication and DTH Technology: Basics of satellite communication, Merits, demerits, and applications, Satellite types, orbits, frequency bands, Components of DTH: PDA, LNBC, satellite receiver, dish alignment, Cable types, impedance, MDU design, Set Top Box: block diagram, features, I/O ports, Cable modem termination system, software, CPE	05
5.	Domestic Appliances – Part I: Washing Machines: types, parts, block diagrams, timers, motors, Vacuum Cleaner: block diagram, working, features, motors, circuits, Mixer/Grinder: parts, speed control, auto overload protection, Electric Iron & Steam Iron: principle, thermostat, parts, Water Purifiers: RO/UV principles, components, faults, Immersion Heater: working, insulation, Induction Cooktop: principle, tubes, heat sinking, fault identification	04
6.	Domestic Appliances – Part II and Office Equipment: Microwave Oven: types, block & wiring diagram, microwave generation, Food Processors: parts and working, Printers: dot matrix, inkjet, laser; advantages, disadvantages, connectivity, Digital Electronic Lock, Xerox Machine, Scanner, Fax Machine	04
TOTAL		28
Text Books:		
1. S. P. Bali, "Consumer Electronics", 1st Edition, Paperback, English. 2. B. R. Gupta, "Consumer Electronics", Paperback, English. 3. Dr. J. S. Chitode, "Consumer Electronics – A Conceptual Approach". 4. Douglas Kinney, "A Beginner's Guide to Consumer Electronics Repair: Handbook and Tutorial". 5. Anand, "Consumer Electronics". 6. H. Davidson, "Troubleshooting Consumer Electronics Audio Circuits".		
Reference Books:		
1. Dennis Roddy, "Satellite Communications", McGraw Hill. 2. R. G. Gupta, "Audio Video Systems – Principles, Maintenance and Troubleshooting", Tata McGraw-Hill. 3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press. 4. S. P. Sharma, "Appliance Servicing and Repair Guide", Katson Books		
E-Resources:		
1. Audio System Engineering (IIT Kharagpur), Course page: https://nptel.ac.in/courses/117/105/117105133 2. Satellite Communication & DTH NOC: Satellite Communication Systems (IIT Kharagpur) Course page: https://archive.nptel.ac.in/courses/117/105/117105131/		

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: III		
Course: Open Elective – I (Renewable Energy Systems)							Code: ALOE301E		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Fundamentals of Mechanical Engineering, Physics, Thermodynamics									
Course Objectives:									
<div>1. Discuss the global and national energy scenarios and environmental impacts and sustainability concerns associated with fossil fuel use.</div> <div>2. Identify and explain the working principles of solar radiation measuring instruments including pyrheliometers, pyranometers, and sunshine recorders.</div> <div>3. Classify various types of wind-mills and describe their structural components.</div> <div>4. Introduce biomass as an energy source and describe biomass conversion technologies.</div> <div>5. Describe the construction, working, and applications of various renewable energy sources.</div>									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Identify and describe the main types of renewable energy sources and their respective limitations.								
CO2	Compare various types of solar collectors based on design and performance.								
CO3	Identify and explain factors affecting wind characteristics and wind energy generation.								
CO4	Interpret the advantages and limitations of biomass energy in comparison with other renewable sources.								
CO5	Apply energy conversion principles to assess the feasibility of alternative energy systems.								
CO6	Compare the suitability of renewable energy technologies (like fuel cells) for specific applications.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Renewable Energy: Environmental consequence of fossil fuel, Limits Of Fossil Fuel, Energy Scenario, Classification of Energy Sources, types of renewable energy sources, limitations.								04
2.	Solar Energy: Environmental impacts of solar energy, Solar radiation measurements, Solar constant, Solar Radiation Measuring Instruments (Radiometers): Pyrheliometers, Pyranometers, Sunshine recorder, classification of solar collectors								06
3.	Wind Energy: Factors affecting the wind, Classification of Wind-mills, Main Components of a wind-mill, wind speed prediction, Advantages of Fixed and variable speed								04

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	systems,	
4.	Biomass Energy: Introduction, Biomass Conversion, Types of biogas plants: Floating dome type, Fixed dome type, Biodiesel, Significance of biodiesel	04
5.	Other Forms of Renewable Energy Sources: Introduction, hydro energy, geothermal energy, wave & tidal energy, Energy Conversion Principles, Environmental considerations	04
6.	Applications of Renewable Energy Sources: Photovoltaic (PV) cell, Solar water heater, Crop And Grain Drying, Space And Water Heating, Solar Energy Applications for Agriculture, Fuel Cell	06
TOTAL		28
Text Books:		
<ol style="list-style-type: none"> 1. S. P. Sukhatme and J. K. Nayak, "Solar Energy: Principles of Thermal Collection and Storage", 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008. 2. J. Twidell and Tony Weir, "Renewable Energy Resources", 2nd Edition, Taylor & Francis, 2006. 3. B. H. Khan, "Non-Conventional Energy Resources", 2nd Edition, Tata McGraw-Hill Education Pvt. Ltd., 2009. 4. Prabir Basu, "Biomass Gasification, Pyrolysis and Torrefaction", Academic Press, Elsevier, 2013. 		
Reference Books:		
<ol style="list-style-type: none"> 1. O. P. Gupta, "Energy Technology", Khanna Book Publishing, New Delhi. 2. V. V. N. Kishore, "Renewable Energy Engineering and Technology: Principles and Practice", Routledge, 1st Edition, 2019. 3. N. Jenkins and J. Ekanayake, "Renewable Energy Engineering", Cambridge University Press, 1st Edition, 2017. 4. G. Boyle, "Renewable Energy", OUP Oxford, 2nd Edition, 2009. 		
E-Resources:		
<ol style="list-style-type: none"> 1. https://onlinecourses.nptel.ac.in/noc22_ph44/preview 2. https://nptel.ac.in/courses/103103206 3. https://onlinecourses.swayam2.ac.in/nou22_ge71/preview 4. https://www.coursera.org/specializations/renewable-energy 5. https://www.coursera.org/learn/exploring-renewable-energy 6. https://www.youtube.com/watch?v=VfowJHJz6-s 		

OPEN ELECTIVE

SYLLABUS
SEMESTER - IV

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: IV		
Course: Open Elective – II (Cyber Security & Laws)							Code: ALOE402		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Foundational knowledge in computer science, networking.									
Course Objectives:									
1. To introduce the cyber world and cyber law in general. 2. To enhance the understanding of problems arising out of online transactions and provoke them to find solutions. 3. To know the technologies that stand behind certain cyber rimes. 4. To identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Illustrate and discuss the basic concepts of cyber security, Devices.								
CO2	Understand the aspects related to personal data privacy and security.								
CO3	Understand the main components of cyber security plan.								
CO4	Understand about the type and nature of cyber-crimes.								
CO5	Articulate the well-known cyber-attack incidents, explain the attack scenarios, and explain mitigation techniques.								
CO6	Explain the difference between Systems Cyber Security, Network Cyber Security, and Cryptography, Crypto-Protocols, etc.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Cyber Security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security.								04
2.	Digital Devices Security, Tools and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall, Wi-Fi security, Configuration of basic security policy and permissions.								04

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3.	Cyber security Management, Compliance and Governance: Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.	05
4.	Cybercrimes: Targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach Cybersquatting, Pharming, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft Cyber Police stations, Crime reporting procedure, Case studies	05
5.	Cybercrime: Illustrations, Examples and Mini cases, Real-life examples, Mini Cases- Social Engineering Attacks, Illustration of financial frauds in cyber domain, Digital Signature- Related Crime scenarios, Digital forensics case Illustrations, Online scams.	05
6.	Cyber law: Cybercrime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cybercrime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IOT, Block chain, Dark net and social media, Cyber Laws of other countries.	05
TOTAL		28
Text Books:		
1. Michael E. Whitman, Herbert J. Mattord, (2018), “Principles of Information Security”, 6 th edition, Cenage Learning, N. Delhi. 2. Chris Reed & John Angel, “Computer Law”, OUP, New York, (2007). 3. Prasad R.S., “Cyber Crime an Introduction”. 4. Ed. Kumar Krishna, “Cyber Laws”.		
Reference Books:		
1. Angus M. Marshall, “Digital forensics: Digital evidence in criminal investigation”, John – Wiley and Sons, 2008. 2. Sushma Arora, Raman Arora, “Cyber Crimes & Laws”, 4 th Edition 2021, Publisher: Taxmann, 3. N S Nappinai, “Technology Laws Decoded”, 1 st Edition, Publisher: Lexis Nexis.		
E-Resources:		
1. https://onlinecourses.nptel.ac.in/noc23_cs127/preview 2. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview 3. https://onlinecourses.nptel.ac.in/noc25_cs116/preview		

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: III		
Course: Open Elective – II (Sustainability and Climate Change)							Code: ALOE403		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Students should have knowledge about current environmental issues, various types of pollution and the concept of sustainable development.									
Course Objectives:									
<div>1. To introduce the fundamental concepts and definitions of sustainability</div> <div>2. To equip students with knowledge of sustainable construction solutions.</div> <div>3. To develop an understanding of the Earth's climate system, assess the impacts of climate change, and evaluate the vulnerabilities of natural systems.</div>									
Course Outcomes: After the completion of course, students will be able to									
CO1	Explain the principles, challenges, global agreements, and legislations related to sustainable development and environmental protection.								
CO2	Apply green materials, energy-water efficiency strategies, and green building rating systems to develop sustainable infrastructure solutions.								
CO3	Analyze the earth’s climate system, human influences, and observed trends to understand the fundamentals of climate change.								
CO4	Evaluate the causes, impacts, and physical evidence of climate change at global and regional scales.								
CO5	Assess the sectoral impacts of climate change on natural systems, infrastructure, and human health.								
CO6	Recommend mitigation strategies and policy measures through international frameworks and technological interventions to address climate change.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Sustainable Development: Definitions & Dimensions: sustainability, Brundtland Report, triple bottom line (economic, social, environmental), Global & Local Environmental Challenges: resource depletion, climate change, pollution, Agenda 21, CDM, Paris/Kyoto Protocols, Clean Development Mechanism, Environmental Legislation & Standards: ISO 14000 series, Indian Water & Air Acts.								05

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2.	Sustainable Solutions: Green Materials & Techniques: low-VOC paints, agro-waste bricks, bamboo, ferro-cement, stabilized soil blocks. Energy & Water Efficiency: passive design, renewable/solar/wind energy, rainwater harvesting, EIA in construction. Green Building Systems: LEED, GRIHA, ECBC, BREEAM rating frameworks for sustainable infrastructure.	05
3.	Climate & Climate Change Fundamentals: Earth's Climate System: Atmosphere structure, energy balance, greenhouse effect, climate zones, monsoons, El Niño/La Niña Human Influence: Greenhouse gas emissions, global warming trends, carbon cycle, RCP/SSP scenarios, Indian climate observations	04
4.	Climate Change Impact: Climate Change Impact: Temperature shifts, sea-level rise, extreme weather, glacier melt, urban heat islands, Natural vs. anthropogenic causes; Milankovitch cycles, anthropogenic emissions. Physical evidence: rising global temperatures, melting glaciers, sea-level rise, extreme weather trends in India and globally.	05
5.	Impacts on Natural System: Sectoral impacts: agriculture, water resources, infrastructure, coastal zones, urban systems including heat islands, flooding, human health	04
6.	Mitigation & Policy Measures: International policy processes: UNFCCC, IPCC, Kyoto/Montreal Protocols, CDM & carbon trading Technological and engineering mitigation: renewable energy, CCS, reflective surfaces (cool roofs), bioengineering (e.g., slope stabilization)	05
TOTAL		28
Text Books:		
1. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science", Pearson Education. 2. D. N. Murty, "Sustainable Development", Himalaya Publishing House. 3. Peter P. Rogers, Kazi F. Jalal, and John A. Boyd, "An Introduction to Sustainable Development", Routledge, Earthscan Series. 4. N. H. Ravindranath and Jayant Sathaye, "Climate Change and Developing Countries", Springer.		
Reference Books:		
1. K. S. Jagadish et al., "Alternative Building Materials & Technologies", New Age International Publishers. 2. P. T. Anastas and J. B. Zimmerman, "Principles of Green Engineering", Oxford University Press. 3. David T. Allen and David R. Shonnard, "Sustainability Engineering: Concepts, Design & Case Studies", Pearson Education.		

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4. S. Kumar Dash, "Climate Change – An Indian Perspective", Cambridge University Press, 2007.
5. John M. Wallace and Peter V. Hobbs, "Atmospheric Science: An Introductory Survey", Elsevier Academic Press, 2006.
6. IPCC Assessments, Intergovernmental Panel on Climate Change (IPCC), as referenced in Anna University syllabus.

E-Resources:

1. UNEP (United Nations Environment Programme)
<https://www.unep.org/resources>
2. IPCC (Intergovernmental Panel on Climate Change) Reports
<https://www.ipcc.ch/reports/>
3. edX - Sustainability Courses
<https://www.edx.org/learn/sustainability>
4. Coursera - Climate Change Courses
<https://www.coursera.org/courses?query=climate%20change>
5. NASA Global Climate Change: Vital Signs of the Planet
<https://climate.nasa.gov/>
6. World Bank Open Knowledge Repository
<https://openknowledge.worldbank.org/>
7. UC Berkeley Environmental Courses (Search for PDFs)
<https://nature.berkeley.edu/classes/>
8. MIT Open Courseware - Environmental Topics
<https://ocw.mit.edu/courses/find-by-topic/#cat=environment>

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: IV		
Course: Open Elective – II (Energy Audit and Electrical Safety)							Code: ALOE402C		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	PR	OR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Concept of power & energy in three phase & single phase, Various electrical equipment & specifications									
Course Objectives:									
<div><div></div><div><div>1. To Study the importance of energy security for sustainable development and the fundamentals of energy conservation.</div><div>2. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management</div><div>3. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities</div><div>4. Understand the key terms and definitions related to electrical safety.</div><div>5. Learn about preliminary preparations and preconditions necessary before starting installation work.</div></div></div>									
Course Outcomes: After completion of this course, students will able to -									
CO1	Illustrate present state of energy security and its importance.								
CO2	Identify and describe the basic principles and methodologies adopted in energy audit of utility.								
CO3	Illustrate and analyze the Financial Analysis Techniques.								
CO4	Evaluating the performance of some common thermal installations and list the energy saving opportunities.								
CO5	Demonstrate awareness of the scope and significance of electrical safety in reducing risk and ensuring safe practices in electrical systems.								
CO6	Identify and assess the potential risks and hazards associated with the installation process of electrical equipment.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, Energy Conservation Act-2001 and its features, Re-structuring of the energy supply								05

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	sector, energy strategy for the future, air pollution, climate change, Electricity Act, 2003.	
2.	Energy Management & Audit: Definition, 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, Facility as an energy system, Energy analysis and the Sankey Diagram, Organizing - location of energy management, top management support, managerial function, roles and responsibilities of energy manager, force field analysis, Energy policies and its purpose.	05
3.	Financial Management: Investment-need, appraisal and criteria, financial analysis techniques-simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of ESCOs, Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques -energy consumption, production, cumulative sum of difference (CUSUM).	05
4.	Energy Efficiency in Electrical Utilities: Electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors, energy conservation opportunities in Fans, Blower, Pumps, Lighting System.	05
5.	Introduction to Electrical Safety, Shocks And Their Prevention: Terms and definitions, objectives of safety and security measures, Hazards associated with electric current and voltage, principles of electrical safety, Primary and secondary electrical shocks, causes of electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns in residential buildings and shops.	04
6.	Safety During Installation of Plant and Equipment: Introduction, preliminary preparations, preconditions for start of installation work, risks during installation of electrical plant and equipment, safety aspects during installation, field quality and safety during erection, personal protective equipment for erection personnel, installation of a large oil immersed power transformer, installation of outdoor switchyard equipment, safety during installation of electrical rotating machines.	04
TOTAL		28
Text Books:		
1. Energy Audit and Management, Volume-I, IECC Press.		

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2. W.R. Murphy, G. McKay Butter worth, "Energy management", Elsevier/bsp Books Pvt. Ltd., 2003.
3. Gupta B. R.: Generation of Electrical Energy, Eurasia Publishing House Pvt. Ltd., New Delhi, 2001
4. Prasanna Chandra, "Financial management", Tata McGraw Hill, 10th Edition, 2019.
5. Rao, S. and Saluja, H.L., "Electrical Safety, Fire Safety Engineering and Safety Management", Khanna Publishers, 1988.
6. Pradeep Chaturvedi, "Energy Management Policy, Planning & Utilization", Concept Publishing.

Reference Books:

1. Albert Thumann, P.E., C.E.M. William J. Younger, "Handbook of Energy Audits", River Publishers,
2. Paul O'Callaghan, "Energy management", McGraw-Hill Education, 1992.
3. CB Smith, "Energy Management Principles", Pergamon Press, New York.
4. W. C. Turner, "Energy Management Hand Book". John Wiley and sons.

E-Resources:

1. NPTEL course on Basic Principles of Energy Management & Energy Audit, By Dr. R. N. Patel & Dr. Akhilesh Kumar Tiwari, Chhattisgarh Swami Vivekanand Technical University, Bhilai.
[Basic Principles of Energy Management & Energy Audit - Course](#)
2. NPTEL course on Building Energy Systems and Auditing, By Prof. Shankha Pratim Bhattacharya, IIT Kharagpur.
[Building Energy Systems and Auditing - Course](#)

OPEN ELECTIVE

Program: B. Tech. (Common to all Programs)							Semester: IV		
Course: Open Elective – II (Digital Marketing)							Code: ALOE402D		
Teaching Scheme (Hrs/week)				Evaluation Scheme (Marks)					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Fundamentals of Business, Digital Tools									
Course Objectives:									
1. To understand digital marketing & process of website design. 2. To identify the keywords for a website & understand the SEO. 3. To Study the various Digital Marketing Tools. 4. To learn the use of social media websites for Digital Marketing. 5. To be Conversant with Linked In platform. 6. To know the recent trends in Digital Marketing.									
Course Outcomes: After completion of this course, students will able to -									
CO1	Design websites using free tools like wordpress and explore it for digital marketing.								
CO2	Apply various keywords for a website & to perform SEO.								
CO3	Understand the various SEM Tools and implement the Digital Marketing Tools.								
CO4	Illustrate the use of Facebook, Instagram and YouTube for Digital Marketing in real life.								
CO5	Use Linked in platform for various campaigning.								
CO6	Understand the importance of recent trends in digital marketing.								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Digital Marketing Planning and Structure: Importance of Digital Marketing, Digital Marketing Vs. Traditional Marketing, Inbound vs Outbound Marketing, Understanding Demographics. WWW, Buying a Domain, Core Objective of Website and Flow, One Page Website, Strategic Design of Products & Services Page, Strategic Design of Landing Page, Segmentation & Targeting and Positioning to Digital Marketing, Portfolio, Gallery and Contact Designing Wordpress Website.								04
2.	Search Engine Optimization (SEO): Fundamentals; Keywords and SEO Content Plan; SEO & Business Objectives; Writing SEO Content; On-site & off-site SEO; Optimize Organic Search Ranking, Website SEO Auditing.								04

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	Introduction to Web Analytics	
3.	Search Engine Marketing: Importance of Adwords, Google Ad Types, PPC Cost Formula, Ad Page Rank, Billing and Payments, Adwords User Interface, Keyword Planner, Creating Ad Campaigns, Creating Text Ads, Creating Ad Groups, Search Engine Marketing (SEM) Tools, Bidding Strategy for CPC. Case Studies. Conversion Tracking Code, Designing Image Ads, Creating Video Ads, Youtube Video Promotion	05
4.	Social Media Marketing (SMM) Part 1: B to C Perspective, B to B Perspective: Introduction; Major Social Media Platforms for Marketing; Developing Data-driven Audience & Campaign Insights; Social Media for Business. Facebook & Instagram Marketing: Understanding of Facebook Marketing, Types of Facebook Advertising, Creating first ad on Facebook, Setting Campaign and optimization, Facebook Power Editor, Facebook Video Marketing, Facebook App & Shopping Marketing. Youtube Marketing: YouTube Account Setup (Create a business account with a personal account), YouTube Monetization, YouTube Ads, YouTube Analytics.	05
5.	Social Media Marketing (SMM) Part 2: LinkedIn Advertising: How to use LinkedIn Professionally, Types of LinkedIn Advertising, LinkedIn New feed Advertising, LinkedIn Message Pitching, Traffic and Leads Generation, Billing and Report. Email Marketing: Email Software and Tools, Importing Email Lists, Planning Email Campaign, Email Templates and Designs, Sending HTML Email Campaigns, Web Forms Lead Importing, Integrating Landing Page Forms, Campaign Reports and Insights, Segmentation Strategy, Responder Tracker.	05
6.	Upcoming Trends in Digital Marketing: Podcast, OTT Platforms, Mob-Ad, No Click Searches, Google Verified Listing, Voice Search, Visual Search, Online Reviews, Automated and Smart Bidding, Chatbots, Affiliate Marketing.	05
TOTAL		28
Text Books :		
1. Cory Rabazinsky, "Google-Ad words for Beginners: A Do-It-Yourself Guide to PPC Advertising". 2. Ian Brodie, "Email Persuasion: Captivate and Engage Your Audience, Build Authority and Generate More Sales With Email Marketing". 3. Jan Zimmerman and Deborah, "Social Media Marketing All-In-One for Dummies". 4. Dave Chaffey, Fiona Ellis-Chadwick, Kevin Johnston, Richard Mayer, "Internet Marketing", Pearson Education.		

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| 5. Oliver J Rich, “Digital Marketing”.
6. Gerry T. Warner and Joe Wilson Schaefer “Online Marketing”. |
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Reference Books:

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| <ol style="list-style-type: none">1. Prof. Seema Gupta, “Digital Marketing”, McGraw Hill Publications.2. Judy Strauss, Adel Ansary, Raymond Frost, Prentice Hall, “E- Marketing”.3. Dr. Andy Williams, “WordPress for Beginners 2020: A Visual Step-by-Step Guide to Mastering WordPress”.4. Cecilia Figueroa, “Introduction To Digital Marketing 101”, BPB Publications.5. The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns by Ian Dodson, Wiley; 1st edition (2016).6. Digital Marketing For Dummies by Ryan Deiss and Russ Henneberry, For Dummies |
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E-Resources:

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| <ol style="list-style-type: none">1. Digital Tools Certification- By Google.
Link of the Course: https://skillshop.exceedlms.com/student/catalog2. Swayam Certification course on, “Digital Marketing”, by Dr. Tejindarpal Singh Panjab University Chandigarh.
Link of the Course: https://swayam.gov.in/nd2_ugc19_hs26/preview |
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OPEN ELECTIVE

Program: B. Tech. (Robotics & Automation Engineering)							Semester: IV		
Course: Open Elective – II (Entrepreneurship and Innovations)							Code: ALOE402		
Teaching Scheme				Evaluation Scheme					
Lecture	Practical	Tutorial	Credit	CIE	ETE	TW	OR	PR	Total
02	-	-	02	40	60	-	-	-	100
Prerequisites:									
Professional Development, Quality Management System									
Course Objectives:									
1. To learn the students various aspects of innovation and methods of fostering Innovation									
2. To appreciate the importance of embarking on self-employment and has developed the confidence and personal skills for the same.									
3. To start a small business enterprise by liaising with different stake holders.									
4. To effectively manage small business enterprise.									
Course Outcomes: After completion of this course, students will be able to -									
CO1	Understand the key concepts of innovation								
CO2	Identify and analyze opportunities for innovation								
CO3	Recognize the potential and value of self-employment								
CO4	Develop a viable business plan for a small enterprise								
CO5	Apply financial principles to plan and structure engineering and automation projects effectively								
CO6	Apply fundamental principles of management								
Course Contents:									
Unit	Description								Duration (Hrs.)
1.	Introduction to Innovation: Creativity, Invention and innovation, Types of Innovation, Relevance of Technology for Innovation, The Indian innovations and opportunities, Promoting and managing innovation, Innovators and Imitators, Patents, Trademarks, Intellectual Property, Exploring, Executing, Leveraging and renewing innovation, Enhancing Innovation Potential & Formulating strategies for Innovation								04
2.	Strategy for Commercializing Innovation: Innovation Process, Risks and barriers for introducing products and services, selecting a Strategy, setting up the Investment and establishing organisation, Evaluating the Costs and impact of the Project								04
3.	Entrepreneurship: Definition. Growth of industries in developing countries; role of industries in the national economy; characteristics; demand based and resources based ancillaries and sub-control types. Government policies, stages in starting an industry, types								04

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	(family business/start-ups etc.), Sources of finance	
4.	Project Identification and Accountancy: Assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, Accountancy: Preparation of balance sheets and assessment of economic viability, decision making, expected costs, planning and production control, preparation of financial reports, accounts and stores studies.	04
5.	Project Planning and Control: The financial functions cost of capital approach in project planning and control. Economic evaluation, risk analysis, capital expenditures, policies and practices in public enterprises. Profit planning and programming, planning cash flow, capital expenditure and operations. Control of financial flows, control and communication.	06
6	Laws: Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries.	06
TOTAL		28
Text Books:		
1. Rabindra N. Kanungo, "Entrepreneurship and Innovation", Sage Publications, New Delhi, 1998. 2. Donald F. Kuratko, "Entrepreneurship – Theory, Process and Practice", 9 th Edition, Cengage Learning, 2014. 3. Peter F. Drucker, "Innovation and Entrepreneurship", Butterworth-Heinemann.		
Reference Books:		
1. Robin Lowe and Sue Marriott, "Enterprise: Entrepreneurship and Innovation – Concepts, Contexts and Commercialization", Butterworth-Heinemann. 2. S. S. Khanka, "Entrepreneurial Development", S. Chand & Co. Ltd., Ram Nagar, New Delhi, 2013. 3. Joseph L. Massie, "Essentials of Management", Prentice Hall of India.		
E-Resources:		
1. https://ocw.mit.edu/collections/entrepreneurship/ 2. https://onlinecourses.nptel.ac.in/		