Course Title	Technical Management & Entrepreneurship	Semester	V
Course Code	MVJ19TEM51	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4, 2:0:2 (L: T: P)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
- Understand staff recruitment and selection process and explain need of coordination between the manager and staff.
- Explain the social responsibility of business, role and importance of the entrepreneur in economic development.
- Discuss the importance of Small-Scale Industries and the related terms and problems involved.
- Explain project feasibility study and project appraisal and discuss project financing.

Module-1	L1, L2	8Hrs.

Management: Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management &Administration, Management as a Science, Art & Profession.

Planning: Nature, Importance and Purpose of Planning, Types of Plans, Steps in Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.

Laboratory Sessions/ Experimental learning: Case study on decision making process in a corporate.

Applications: Planning in engineering field.

Web Link and Video Lectures:

1. https://nptel.ac.in/courses/110/105/110105146/
2. https://nptel.ac.in/courses/122/108/122108038/

Module-2	L1, L2	8Hrs.

Organizing and Staffing: Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees –meaning,

Types of Committees, Centralization Vs Decentralization of Authority and Responsibility, Span of Control, Nature and Importance of Staffing, Process of Selection and Recruitment. **Directing and Controlling:** Meaning and Nature of Directing-Leadership Styles, Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination, controlling – Meaning and Steps in Controlling. **Laboratory Sessions/ Experimental learning:** Case study of steel plant departmentalization. **Applications:** Effective communication in a corporate. **Web Link and Video Lectures:** 1.https://nptel.ac.in/content/storage2/courses/122106031/slides/3_2s.pdf 2.https://www.slideshare.net/100005130728571/27-nature-of-directing		
Module-3	**L1, L2**	**8Hrs.**
Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance. **Entrepreneurship**: Definition of Entrepreneur, Importance of Entrepreneurship, Concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Problems faced by Entrepreneurs and capacity building for Entrepreneurship. **Laboratory Sessions/ Experimental learning:** Case study of a startup. **Application:** Social auditing in a software company **Web Link and Video Lectures:** 1.https://nptel.ac.in/courses/110/106/110106141/ 2.https://nptel.ac.in/courses/127/105/127105007/		
Module-4	**L1, L2**	**8Hrs.**
Modern Small Business Enterprises: Role of Small-Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small-Scale sector in India, Growth and Performance of Small-Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs.		

Institutional Support for Business Enterprises: Introduction, Policies and Schemes of Central–Level Institutions, State-Level Institutions.

Laboratory Sessions/ Experimental learning: Case study on the growth of small-scale industries.

Application: Setting up and functioning of Small-Scale Industries

Web Link and Video Lectures:

1. https://www.slideshare.net/syedmubarak15/institutional-support-for-business-enterprises
2. https://www.wto.org/english/docs_e/legal_e/gatt47_01_e.htm

Module-5	L1, L2	8Hrs.

Project Management: Meaning of Project, Project Objectives and Characteristics, Project Identification-Meaning and Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Prerequisites for Successful Project Implementation.

New Control Techniques: PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM.

Laboratory Sessions/ Experimental learning: Preparation of detailed project report (DPR).

Application: Preparation of reports for specific project.

Web Link and Video Lectures:

1.https://www.projectmanager.com/project-scheduling

2.https://kissflow.com/project/basics-of-project-scheduling/

Course outcomes:

C301.1	Understand the concept of management
C301.2	Understand the staffing process
C301.3	Explain the social responsibilities of business towards different groups
C301.4	Explain the role of small-scale industries
C301.5	Interpret the project objectives

Text Books:

1	Entrepreneurship Development and Small Business Enterprises, Poornima M.Charanthimath, Pearson, 2nd Edition,2014

2	Tripathy PC & Reddy PN, "Principles of Management", Tata McGraw Hill, 1999
Reference Books:	
1	Stephen A. Robbins & David A. Decenzo & Mary Coulter, Fundamentals of Management, Pearson Education, 7th Edition, 2011.
2	Stephen P. Robbins & Mary Coulter, Management, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C301.1	-	2	-	1	-	-	-	3	3	3	3	3
C301.2	-	1	-	3	-	-	-	3	3	3	3	3
C301.3	-	2	-	2	-	3	-	3	3	2	3	3
C301.4	-	2	-	2	-	2	-	3	3	3	3	3
C301.5	-	2	-	2	-	2	-	3	3	3	3	3

High-3, Medium-2, Low-1

Course Title	Power Electronics	Semester	V
Course Code	MVJ19EE52	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5, 3:1:1 (L:T:P)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand the working of power diodes and power transistor.
- Understand the operation, characteristics and performance parameters of thyristor.
- Explain the working of controlled rectifier for different loads.
- Explain the working of AC voltage controller for different loads.
- Design chopper and pulse width modulated inverter for different applications.

Module-1	L1, L2, L3	10Hrs.

Introduction: Power electronic systems, Application of power electronics, Advantage and disadvantage of power electronics, Types of power electronic converter.

Power Diodes: Introduction, Power Diode Characteristics, Reverse Recovery Characteristics, Types of power diodes.

Power Transistors: Introduction, Power MOSFETs: Steady State Characteristics, Switching Characteristics, Gate Drive, IGBT (Construction and Working), GaN, Isolation of Gate Drives.

Laboratory Sessions/ Experimental learning: Build a circuit for controlling a load by using MOSFET/IGBT.

Applications: Mobile charging unit, switch mode power supply, induction heating, and traction motor control.

Web Link and Video Lectures:

1. https://gansystems.com/design-center/application-notes/
2. https://youtu.be/Z2CORFayCv0
3. https://youtu.be/tNp39_L_HtU

Module-2	L1, L2, L3	8Hrs.

Thyristors: Introduction, Static Characteristics, switching characteristics, turn on methods, Two-Transistor Model, Bidirectional Triode Thyristors, Protection Circuits.

Laboratory Sessions/ Experimental learning: Build a firing circuit for thyristor

Applications: AC voltage stabilizers, light dimmer, AC power control with solid relay. **Web Link and Video Lectures:** 1. https://youtu.be/no1hld5JcCw 2. https://www.electrical4u.com/thyristor-silicon-controlled-rectifier-scr/		
Module-3	**L1, L2, L3**	**12Hrs.**
Controlled Rectifiers: Introduction, Performance Parameters, Single-Phase half wave Converters with R and RL load, Single-Phase Full wave Bridge Converters with R, RL and RLE load (continuous current conduction operation only), Single phase symmetrical semi converter, Single-Phase Dual Converters, Three-Phase Full wave Converters with R and RL Load. Laboratory Sessions/ Experimental learning: Simulation of single phase and three phase full wave rectifier for R, RL and RLE load. Applications: Paper mills, textile mills using DC motor drives and DC motor control in steel mills, AC fed traction system using a DC traction motor, High voltage DC transmission, UPS. Web Link and Video Lectures: 1. https://youtu.be/EpTKSp9611I 2. https://youtu.be/OuyyVgkzKT8 3. https://youtu.be/Q5Yw4Z_Oydc		
Module-4	**L1, L2, L3**	**8Hrs.**
AC Voltage Controllers: Introduction, Single phase half-wave controller with R and RL load, Single-Phase Full-Wave Controllers with R and RL Loads, Three-Phase Full-Wave Controllers with R load. **Laboratory Sessions/ Experimental learning:** MATLAB simulation of AC voltage controller. **Applications:** Adjustable speed drives, Light dimming, industrial heating **Web Link and Video Lectures:** https://youtu.be/6NCml4kY9Jo		
Module-5	**L1, L2, L3**	**12Hrs.**
DC-DC Converters: Introduction, Buck, Boost, Buck Boost regulator, Applications. **DC-AC converters:** Introduction, principle of operation single phase bridge inverters with RL Load, three phase bridge inverters, Current source inverters, PWM techniques -SPWM technique.		

Laboratory Sessions/ Experimental learning: Build a circuit to step up PV output voltage.

Applications: Two stage solar power conversion, Solar PV integration to grid.

Web Link and Video Lectures:

1. https://www.youtube.com/watch?v=rfChSvb8FX0
2. https://www.youtube.com/watch?v=Q7cTuZIH8IA
3. https://www.electrical4u.com/boost-converter-step-up-chopper/
4. https://www.youtube.com/watch?v=QnUhjnbZ0T8
5. https://www.youtube.com/watch?v=zNfbbPobtus
6. https://www.youtube.com/watch?v=-WU3BxOxvII

Course outcomes:

C302.1	Explain types of power diodes and power transistors
C302.2	Explain the operation, characteristics and performance parameters of thyristor.
C302.3	Explain steady state, switching characteristics and gate control requirements of controlled rectifiers
C302.4	Discuss the principle of operation of AC voltage controllers.
C302.5	Design DC – DC and DC –AC converters for different application.

Text Books:

1	Power Electronics: Circuits Devices and Applications Mohammad H Rashid, Pearson 4th Edition,2014
2	Power Electronics, Dr. P S Bimbhra, Khanna Publishers,

Reference Books:

1	Power Electronics: Converters, Applications and Design Ned Mohan et al Wiley 3rd Edition, 2014
2	Power Electronics Daniel W Hart McGraw Hill 1 st Edition, 2011

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C302.1	3	1	1	1	2	3	-	-	3	2	-	3
C302.2	3	1	1	1	2	3	-	-	3	2	-	3
C302.3	3	3	2	1	2	3	-	-	3	2	-	3
C302.4	3	3	2	3	3	3	-	-	3	2	-	3
C302.5	3	3	3	3	3	3	-	-	3	2	3	3

High-3, Medium-2, Low-1

Course Title	Electrical Machines II	Semester	V
Course Code	MVJ19EE53	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	5, 3:1:1 (L:T:P)	Total	100
Credits	4	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand the detailed working of AC machines.
- Discuss the performance characteristics of AC machines.
- Explain the concept of voltage regulation in alternator.
- Explain the construction and working of special machines.

Module-1	L1, L2, L3	10Hrs.

Poly-Phase Induction Machines: Constructional details of cage and wound rotor machines, principle of operation, slip, rotor EMF and rotor frequency, rotor reactance, rotor current and power factor at standstill and during operation.

Laboratory Sessions/ Experimental learning: Assembling of poly-phase induction machines.

Applications: Understanding the detailed analysis of poly-phase induction motors.

Web Link and Video Lectures:

1. https://www.youtube.com/watch?v=dZyO5gcWP-o
2. https://youtu.be/leXNHZM-CZE

Module-2	L1, L2, L3	10Hrs.

Characteristics of Induction Machines: Rotor power input, rotor copper loss, mechanical power developed and their inter relation, torque equation, torque slip characteristic, equivalent circuit, phasor diagram, crawling and cogging, no-load test and blocked rotor test, direct on line starter, star-delta starter, and auto transformer starter, speed control by voltage/frequency, and rotor resistance control methods.

Laboratory Sessions/ Experimental learning: Brake test on slipring induction motor.

Applications: Induction motor drives.

Web Link and Video Lectures:

1. https://www.youtube.com/watch?v=ze8LY4yq9Wk

2. https://youtu.be/eMq9j0KY2Ak

Module-3	L1, L2, L3	10Hrs.

Synchronous Generator: Principle of operation, construction of salient and non-salient pole machines, armature windings, coil span factor, distribution factor, chorded coils and EMF equation.

Voltage Regulation: Significance, EMF, MMF and ZPF method.

Salient Pole Synchronous Machine: Two reaction theory, slip test.

Laboratory Sessions/ Experimental learning: Open Circuit Test to calculate core loss and to draw open circuit curve for Three Phase Alternator

Application: Power generation plant.

Web Link and Video Lectures:

1. https://youtu.be/59Jg5zEguVY
2. https://youtu.be/nu8wtbxKCRM

Module-4	L1, L2, L3	10Hrs.

Synchronization: Parallel operation of alternators -synchronization.

Synchronous Motors: Theory of operation, phasor diagram, variation of current and power factor with excitation, synchronous condenser, mathematical analysis for power developed, hunting and its suppression, methods of starting.

Laboratory Sessions/ Experimental learning: Study the Synchronization of the alternator with infinite bus bar.(https://vp-dei.vlabs.ac.in/Dreamweaver/exp1.html)

Application: Power Factor corrections.

Web Link and Video Lectures:

1. https://youtu.be/b24jORRoxEc
2. https://youtu.be/edJFTap0zYw

Module-5	L1, L2, L3	10Hrs.

Single Phase and Special Machines: Single phase induction motor, constructional features, double revolving field theory, split-phase motors, shaded pole motor, universal motors, reluctance motors.

Laboratory Sessions/ Experimental learning: Brake test on single phase induction motor.

Application: Home Appliances.

Web Link and Video Lectures:

1. https://youtu.be/KPMy_L7oyOk

2. https://youtu.be/dBP3VvKFV84	
Course outcomes:	
C303.1	Understand the concepts of rotating magnetic fields and operation of AC machines.
C303.2	Analyse performance characteristics of induction machines
C303.3	Determine the regulation of an alternator by various methods
C303.4	Describe the importance of Synchronization of Alternator and discuss V and inverted V curves.
C303.5	Understand the working of single-phase induction motors and applications.
Text Books:	
1	P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
2	I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
Reference Books:	
1	B.L Theraja "Electrical Technology" Volume2, S. Chand, 22nd Edition
2	P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.
CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)	
SEE Assessment:	
i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus. ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions. iii. One question must be set from each unit. The duration of examination is 3 hours.	
CO-PO Mapping	

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C303.1	3	2	-	-	-	-	-	-	3	-	-	1
C303.2	3	2	-	-	-	-	-	-	3	-	-	1
C303.3	3	2	-	-	-	-	-	-	3	-	-	1
C303.4	3	2	-	-	-	-	-	-	3	-	-	1
C303.5	3	2	-	-	-	-	-	-	3	-	-	1

High-3, Medium-2, Low-1

Course Title	Signals and Systems	Semester	V
Course Code	MVJ19EE54	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4,2:1:1 (L:T:P)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Explain basic operations on signals and properties of systems.
- Apply continuous Fourier representation to periodic and aperiodic signals.
- Compute DFT for a given time domain signal.
- Design FIR filter by applying appropriate transformation techniques.
- Design IIR filter by applying appropriate transformation techniques.

Module-1	L1, L2, L3	8 Hrs.

Signals Introduction: Definitions of signals and a system, Classification of signals, Basic operations on signals, Elementary signals viewed as interconnections of operations. Relation between the elementary signals, specific systems, Properties of systems.

Laboratory Sessions/ Experimental learning: Verification of Sampling Theorem both in time and frequency domains by using MATLAB.

Application: Speech recognition.

Web Link and Video Lectures: https://www.youtube.com/watch?v=879pXoml0XI

Module-2	L1, L2, L3	8 Hrs.

Impulse response of an LTI system, convolution integral, graphical convolution, solution of differential and difference equations, block diagram representation system.

Laboratory Sessions/ Experimental learning: Evaluate impulse response of a system using MATLAB.

Application: Digital Speedometer.

Web Link and Video Lectures: https://www.youtube.com/watch?v=U8riFeiiu3s

Module-3	L1, L2, L3	8 Hrs.

Z Transform: Introduction Z-transform, Properties of ROC, Properties of z transform. Basic elements of digital signal processing, Advantages of digital signal processing over analog signal processing.

Discrete Fourier Transform: Properties of DFT, DFT as a linear transformation, circular convolution, Use of DFT in linear filtering.

Laboratory Sessions/ Experimental learning: Computation of N point DFT and to plot the magnitude and phase spectrum. **Application:** Image processing. **Web Link and Video Lectures:** 1. https://www.youtube.com/watch?v=gkC7cXa8ewk 2. https://www.youtube.com/watch?v=6spPyJH6dkQ		
Module-4	**L1, L2, L3**	**8 Hrs.**
Design of IIR Filters from Analog Filters: IIR Filter design by impulse invariance, Bilinear transformation. Characteristics of analog filters -Butterworth and Chebyshev, frequency transformation in analog domain **Laboratory Sessions/ Experimental learning:** Design and implementation of IIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) by using MATLAB. **Application:** High-speed telecommunication. **Web Link and Video Lectures:** 1. https://www.youtube.com/watch?v=3QWvi8EC_DI 2. https://youtu.be/ryfaCpTHVtQ		
Module-5	**L1, L2, L3**	**8 Hrs.**
Design of FIR Filters: Introduction to filters, Design of linear phase FIR Filters using rectangular, Hamming and Hanning windows, FIR filter design by frequency sampling method. **Laboratory Sessions/ Experimental learning:** Design and implementation of FIR filters to meet given specification (Low pass, high pass, band pass and band reject filters) using frequency sampling technique in MATLAB **Application:** Radio Astronomy. **Web Link and Video Lectures:** 1. https://www.youtube.com/watch?v=nsK7mmRSTDY 2.https://www.youtube.com/watch?v=Xl5bJgOkCGU		
Course outcomes:		
C304.1	Explain the generation of signals, behaviour of system and the basic operations that can be performed on signals and properties of systems.	
C304.2	Apply convolution in both continuous and discrete domain for the analysis of systems given impulse response of a system.	

C304.3	Introduction to Z transform. Perform Fourier analysis for continuous and discrete time, linear time invariant systems.
C304.4	Design FIR filters by use of window function and frequency sampling method.
C304.5	Develop a digital IIR filter by direct, cascade, parallel, ladder methods of realization.

Text Books:

1	Simon Haykin, Barry Van Veen, "Signals and Systems", John Wiley & Sons,2nd edition 2002
2	Jhon G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing –Principles, Algorithms, and Applications", Pearson, 4th Edition, 2007.

Reference Books:

1	A .Nagoor Kani, "Digital Signal Processing", McGraw Hill Education; 2nd edition, 2017
2	Oppenheim, Willsky and Nawab,"Signals and Systems", Phi Learning, 2nd Edition, 1997.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C304.1	3	2	2	2	2	1	-	1	1	3	3	2

C304.2	3	2	2	2	2	1	-	1	1	3	3	2
C304.3	3	2	2	2	3	-	-	1	2	3	3	3
C304.4	3	2	2	2	3	-	-	1	2	3	3	3
C304.5	3	2	2	2	3	-	-	1	2	3	3	3

High-3, Medium-2, Low-1

Course Title	Solar and Wind Energy Conversion System	Semester	V
Course Code	MVJ19EE551	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4, 2:1:1 (L: T: P)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand the fundamentals of solar energy and solar thermal systems.
- Illustrate the sizing and design of typical solar PV systems and their applications.
- Discuss inverters, system components, cabling used to connect the components and mounting methods of the PV system.
- Discuss wind energy, its applications and wind turbine site selection.
- Explain wind energy conversion systems, operation schemes and environmental effects.

Module-1	L1, L2	08Hrs.

Fundamentals of Energy Resources: Introduction, Classification of energy resources, Environmental aspects of energy, Availability of resources and future trends.

Solar Energy: Introduction, effect of earth atmosphere on solar radiation, quantifying solar radiation, instruments for measuring solar radiation, solar radiation geometry.

Solar Thermal Systems: Solar collectors, classification, performance indices, parabolic dish Stirling engine system, direct solar thermal applications- Solar water heating systems, space cooling, air heating, crop drying, solar cooker and solar pond.

Laboratory Sessions/ Experimental learning: Designing a box type solar cooker

Applications: Estimation of solar energy availability.

Video link: https://nptel.ac.in/courses/121/106/121106014/

Module-2	L1, L2, L3	08Hrs.

Solar Photovoltaic Systems: Introduction, solar cell fundamentals, photoconduction, solar cell characteristics, equivalent circuits: single diode model, solar cell classification, solar cell module and panel construction, current status and future development of solar cells and modules, Basic components in solar PV system, classification of solar PV systems and its applications, Maximum Power Point Tracker.

Laboratory Sessions/ Experimental learning: PV cell simulation using MATLAB/Simulink **Applications:** Designing devices using solar power for heating cooling and drying **Video link:** https://nptel.ac.in/courses/117/108/117108141/#		
Module-3	L1, L2, L3	08Hrs.
Inverters and Other System Components: Introduction, Inverters, Battery inverters, Grid interactive inverters, Transformers, Mainstream inverter technologies, String inverters, Multi-string inverter, Central inverter, Modular inverters, Inverter protection systems, Self-protection, Grid protection, Balance of system equipment: System equipment excluding the PV array and inverter, Cabling, PV combiner box, Module junction box, Circuit breakers and fuses ,PV main disconnects/ isolators, Lightning and surge protection, System monitoring, Metering, Net metering, Gross metering. **Laboratory Sessions/ Experimental learning:** Design of solar photovoltaic array using MATLAB. **Applications:** Maximizing output of a PV system **Video link:** https://nptel.ac.in/courses/117/108/117108141/		
Module-4	L1, L2, L3	08Hrs.
Wind Energy: Introduction, factors affecting distribution of wind energy on the surface of earth, nature of winds, applications of wind power, wind turbine siting, wind turbine types and their construction, speed control strategies for wind turbine, power versus wind speed characteristics of wind turbines. **Laboratory Sessions/ Experimental learning:** Wind turbine blade design using CATIA **Applications:** Choice of proper site for installing wind turbine **Video link:** 1. https://www.youtube.com/watch?v=GExTwRNkQBg, 2. https://www.youtube.com/watch?v=ntk-zX7zz6o		
Module-5	L1, L2, L3	08Hrs.
Wind Energy Conversion System: Introduction, operation schemes, effects of wind speed and grid condition, wind energy storage, environmental aspects, wind energy programme in India. **Laboratory Sessions/ Experimental learning:** Visiting nearest wind power plant **Applications:** Selecting appropriate WEC systems **Video link:** https://youtu.be/UJJLIVNvIVg		

Course outcomes:	
C305.1.1	Explain fundamentals of solar energy and solar thermal systems.
C305.1.2	Discuss the sizing and design of typical solar PV systems and their applications
C305.1.3	Discuss inverters, system components, cabling used to connect the components and mounting methods of the PV system.
C305.1.4	Explain wind energy, its applications and wind turbine site selection.
C305.1.5	Explain wind energy conversion systems, operation schemes and environmental effects.
Text Books:	
1	B. H. Khan, "Non-Conventional Energy Resources" , McGraw Hill, 2nd Edition 2017
2	Geoff Stapleton, Susan Neill "Grid Connected Solar Electric Systems: The Earthscan Expert Handbook for Planning, Design and Installation", Earthscan Expert Series, 1st Edition, 2012
Reference Books:	
1	Shobh Nath Singh, "Non-Conventional Energy Resources", Pearson, 1st Edition, 2015
2	Ahmad Hemami, " Wind Turbine Technology", Cengage, 1st Edition, 2012

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

C305.1.1	3	3	3	3	-	2	3			1		-
C305.1.2	3	3	3	1	3	3	3			1		1
C305.1.3	3	3	3	1	3	3	3			1		1
C305.1.4	3	3	3	1	3	3	3			1		1
C305.1.5	3	3	3	1	-	3	3			1		1

High-3, Medium-2, Low-1

Course Title	Sensor and Transducers	Semester	V
Course Code	MVJ19EE552	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4, 2:1:1 (L: T:P)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand the working of different types of sensors.
- Discuss recent trends in sensor technology and their selection.
- Explain basics of smart sensors
- Discuss need of transducers, their classification, advantages and disadvantages.
- Explain basics of signal conditioning and signal conditioning equipment

Module-1	L1, L2	08Hrs

Introduction to sensors: Capacitance, magnetism, Induction, Resistance, Piezoelectric Effect, Hall effect, Thermoelectric effect, Sound waves, Temperature and thermal properties of materials. Different types of sensors-Displacement and Level Sensors: Inductive, Magnetic and Optical

Acceleration: Accelerometers, Seismic Sensors.

Force and Strain: Strain Gauge, Pressure sensors.

Laboratory Sessions/ Experimental learning: Measurement of level in a tank using capacitive type level probe in virtual lab

Applications: Automation.

Web Link and Video Lectures: https://www.youtube.com/watch?v=onNkjSbcSWc

Module-2	L1, L2, L3	10Hrs

Acoustic sensor: Resistive and Fiber-optic microphones, Humidity and Moisture sensor: capacitive, resistive and thermal conductivity, Light Detectors: Photodiode, Phototransistor, Photo resistor, Radiation Detectors: Scintillating Detectors and Ionization Detectors

Temperature sensor: Pyroelectric Effect, Coupling with object, Static & Dynamic heat exchange, RTD, Thermistors, Thermocouple circuits, proximity sensors-inductive,

optical, capacitive, magnetic and ultrasonic, Hall effect sensors **Gas sensors**: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors **Laboratory Sessions/ Experimental learning:** Characteristics the temperature sensor (RTD) in virtual lab **Applications:** Medical applications, temperature control, position control. **Web Link and Video Lectures:** https://nptel.ac.in/courses/108/108/108108147/		
Module-3	**L1, L2**	**06Hrs**
Basics of smart sensors: Introduction, Mechanical-Electronic transitions in sensing, nature of sensors, types of smart sensors, overview of smart sensing and control systems. Interfacing sensors with microprocessors and micro controllers, Emerging fields of sensor technologies **Laboratory Sessions/ Experimental learning:** Interfacing of sensors through micro controller. **Application:** Sensor array **Web Link and Video Lectures:** https://www.youtube.com/watch?v=q8UuRkOQ9A0		
Module-4	**L1, L2,L3**	**08Hrs**
Introduction to Transducers: Introduction, Different types of transducers Resistive transducers: Potentiometers, metal, and semiconductor strain gauges. Strain gauge applications: Load and torque measurement. Self and mutual inductive transducers-capacitive transducers, eddy current transducers, tacho generators and stroboscope. Piezoelectric transducers, photoelectric transducers, Magneto strictive transducers, Basics of Gyroscope. **Laboratory Sessions/ Experimental learning:** Strain gauge characteristics using virtual lab. **Application:** Torque measurement, vibration measurement, velocity measurement. **Web Link and Video Lectures:** https://www.youtube.com/watch?v=1uPTyjxZzyo		
Module-5	**L1, L2**	**08Hrs**

Signal Conditioning: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers. **Data Acquisition Systems and Conversion:** Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion. **Laboratory Sessions/ Experimental learning:** Signal amplification. **Application:** Automation. **Web Link and Video Lectures:** https://www.youtube.com/watch?v=MGC2LWeNKSI	
Course outcomes:	
C305.2.1	Explain working of different types of transducers and sensors.
C305.2.2	Describe different type of sensors and its application.
C305.2.3	Explain basics of smart sensors
C305.2.4	Identify need of transducers, their classification, advantages and disadvantages.
C305.2.5	Discuss basics of signal conditioning and signal conditioning equipment
Text Books:	
1	R.K Rajput, "Electrical and Electronic Measurements and instrumentation", S. Chand, 3rdEdition, 2013.
2	Daniel E. Suarez, "Smart Sensors and Sensing Technology", Nova Science Publishers, 2011
Reference Books:	
1	Murthy D. V. S, "Transducers and Instrumentation", Prentice Hall, New Delhi, 2nd Edition, 2008.
2	Patranabis, "Sensors and Transducers", Prentice Hall India Pvt. Ltd, 2nd Edition, 2003.
CIE Assessment:	
CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests - Quizzes/mini tests (4 marks) - Mini Project / Case Studies (8 Marks) - Activities/Experimentations related to courses (8 Marks)	
SEE Assessment:	

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C305.2.1	3	3	3	1	1	-	-	-	-	-	-	3
C305.2.2	3	3	3	3	3	-	-	-	-	-	-	3
C305.2.3	3	3	3	3	3	-	-	-	-	-	-	3
C305.2.4	3	3	3	3	3	-	-	-	-	-	-	3
C305.2.5	3	3	3	3	3	-	-	-	-	-	-	3

High-3, Medium-2, Low-1

Course Title	Embedded Systems	Semester	V
Course Code	MVJ19EE553	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	4, 2:1:1 (L: T:P)	Total	100
Credits	3	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand the concepts of embedded system design such as ROM variants, RAM.
- Learn the technological aspects of embedded system such as signal conditioning, Sample &Hold.
- Understand the design trade-offs.
- Explain the software aspects of embedded system.
- Understand the subsystem interfacing.

Module-1	L1, L2, L3	08Hrs

Concept of Embedded System Design: Components, classification, skills required. Embedded Microcontroller cores: Architecture of 6808 and 6811, Embedded Memories ROM variants, RAM.

Laboratory Sessions/ Experimental learning: Assembly Language Program for addition of 8-bit numbers stored in an array.

Application: Digital electronics.

Web Link and Video Lectures: https://nptel.ac.in/courses/106/105/106105193/

Module-2	L1, L2, L3	08Hrs

Technological Aspects of Embedded System: Applications of embedded system: Examples of Embedded systems SOC for bar code scanner. Interfacing between analog and digital blocks, Signal conditioning, digital signal processing, DAC & ADC interfacing, Sample & hold, Multiplexer interface Internal ADC interfacing (excluding 6805 & 6812).

Laboratory Sessions/ Experimental learning:

1. Interfacing of 8-bit ADC 0809 with 8051 Microcontroller.
2. Interfacing of 8-bit DAC 0800 with 8051 Microcontroller and Waveform generation using DAC.

Application: Telecommunications. **Web Link and Video Lectures:** https://nptel.ac.in/courses/108/102/108102169/		
Module-3	**L1, L2, L3**	**08Hrs**
Design Trade Offs Due to Process Incompatibility, Thermal Considerations: Data Acquisition System and Signal conditioning using DSP. Issues in embedded system design. Design challenge, design technology, trade-offs. Thermal considerations. Laboratory Sessions/ Experimental learning: 1. Temperature control interfacing with 8051 microcontrollers. 2. Implementation of Digital FIR filters on 8051 microcontrollers. **Application:** Computer networks. **Web Link and Video Lectures:** https://nptel.ac.in/courses/106/103/106103182/		
Module-4	**L1, L2, L3**	**08Hrs**
Software aspects of Embedded Systems: Real time programming Languages, operating systems. Programming concepts and embedded programming in C. Round Robin, Round Robin with interrupts, function queue-scheduling architecture. Laboratory Sessions/ Experimental learning: Implementation of Hopfield network in C to recognize a simple ASCII character. Application: Systems with artificial intelligence and robotics. **Web Link and Video Lectures:** https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-ee98/		
Module-5	**L1, L2, L3**	**08Hrs**
Subsystem interfacing: With external systems user interfacing, Serial I/O devices, Parallel port Interfaces: Input switches, Keyboards and Memory interfacing. Laboratory Sessions/ Experimental learning: 1. Implementation of Serial Communication by using 8051 serial ports. 2. Simple test program usingARM 9 mini 2440 kit (Interfacing LED with ARM 9 mini-2440 kit). **Application:** Military defence systems. **Web Link and Video Lectures:** https://www.youtube.com/watch?v=csttt3VHxf8		
Course outcomes:		
C305.3.1	Identify the Embedded system components.	
C305.3.2	Apply technological aspects to various interfacing with devices.	

C305.3.3	Elaborate various design trade-offs.
C305.3.4	Apply software aspects and programming concepts to the design of Embedded System.
C305.3.5	Explain how to interface subsystems with external systems.
Text Books:	
1	Shibu K V," Introduction to Embedded Systems", Second Edition, McGraw Hill Education India Private Limited, 2017.
2	Raj Kamal, "Embedded System, Architecture, Programming and Design Operational Amplifiers", McGraw Hill Education, 2nd Edition, 2008
Reference Books:	
1	Embedded Microcomputer systems: Real time interfacing Valvano, J.W Cengage Learning India Private Limited, 2nd edition, 2011.
2	Embedded System Design: A Unified Hardware / Software Introduction, Wiley, Student edition, 2006.

CIE Assessment:

CIE is based on quizzes, tests, assignments/seminars and any other form of evaluation. Generally, there will be: Three Internal Assessment (IA) tests during the semester (30 marks each), the final IA marks to be awarded will be the average of three tests

- Quizzes/mini tests (4 marks)
- Mini Project / Case Studies (8 Marks)
- Activities/Experimentations related to courses (8 Marks)

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C305.3.1	2	1	2	1	2	-	-	-	-	-	-	3
C305.3.2	2	1	2	2	2	-	-	-	-	-	-	3

C305.3.3	2	2	2	1	1	-	-	-	-	-	-	3
C305.3.4	2	3	3	2	3	-	-	-	-	-	-	2
C305.3.5	2	2	2	2	3	-	-	-	-	-	-	3

High-3, Medium-2, Low-1

Course Title	Electrical Machines-II Laboratory	Semester	V
Course Code	MVJ19EEL56	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	4,0:2:2 (L:T:P)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to: This course will enable students to

- Understand the operation and performance of synchronous machines.
- Understand the analysis of power angle curve of a synchronous machine
- Understand the equivalent circuit of single-phase induction motor and three phase induction motor.
- Understand the circle diagram of an induction motor by conducting a blocked rotor test.

Sl No	Experiment Name	RBT Level	Hours
1	Load test on three phase Induction Motor	L3	2
2	Conduct suitable test to draw the equivalent circuit of single-phase induction motor	L3	2
3	Load test on a single-phase induction motor.	L3	2
4	No-load & Blocked rotor test on three phase Induction motor	L3	2
5	Brake test on three phase Induction Motor.	L3	2
6	Regulation of a three –phase alternator by synchronous impedance & m.m.f. methods	L3	2
7	Determination of Xd and Xq of a salient pole synchronous machine.	L3	2
8	V and Inverted V curves of a three-phase synchronous motor	L3	2
Along with mandatory experiments students are advised to complete two open ended experiments. The following are some suggestions for open ended experiments.			
1	Efficiency of a three-phase alternator	L3	2
2	Speed control of 3 phase slip ring Induction motor- rotor Resistance control, stator voltage control.	L3	2
3	Regulation of three-phase alternator by Z.P.F. method	L3	2

Course outcomes:

C306.1	Assess the performance of Induction machines using different testing methods

C306.2	Assess the performance of synchronous machines using different testing methods
C306.3	Analyse the active and reactive power flows in synchronous machines
C306.4	Illustrate starting and control of AC machines.

Scheme of Evaluation

SEE :

Examinations will be conducted for 100 marks and scaled-down to 50. The weight age shall be,

Write-up : 20 marks

Conduction : 40 marks

Analysis of results : 20 marks

Viva : 20

CIE :

Regular Lab work :20

Record writing :5

Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)

Viva 10 marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C306.1	3	2	3	2	-	1	-	1	3	2	-	3
C306.2	3	2	3	2	-	1	-	1	3	2	-	3
C306.3	3	2	3	2	-	1	-	1	3	2	-	3
C306.4	3	2	3	2	-	1	-	1	3	2	-	3

High-3, Medium-2, Low-1

Course Title	Power Electronics Laboratory	Semester	V
Course Code	MVJ19EEL57	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	4,0:2:2 (L: T:P)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to: This course will enable the students to

- Conduct experiments on semiconductor devices to obtain their static characteristics.
- Demonstrate the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
- Control the speed of a DC motor and universal motor.
- Demonstrate the working of single phase full bridge inverter connected to resistive load.

Sl No	Experiment Name	RBT Level	Hours
1	Static Characteristics of SCR	L3	2
2	Static Characteristics of MOSFET and IGBT	L3	2
3	Single phase controlled full wave rectifier with R load, R – L load, R-L-E load with and without freewheeling diode	L3	2
4	AC voltage controller with R and RL loads.	L3	2
5	Speed control of universal motor using ac voltage regulator.	L3	2
6	Speed control of DC motor using single semi converter.	L3	2
7	Speed control of a separately excited D.C. Motor using chopper.	L3	2
8	Single phase MOSFET/IGBT based PWM inverter	L3	2
Along with mandatory experiments students are advised to complete two open ended experiments. The following are some suggestions for open ended experiments.			
1	Speed control of stepper motor	L3	2
2	Study of charging and discharging of capacitor in snubber circuit.	L3	2

3	SCR digital triggering circuit for a single-phase controlled rectifier and ac voltage regulator	L3	2

Course outcomes:	
C307.1	Obtain static characteristics of semiconductor devices to discuss their performance.
C307.2	Verify the performance of single phase controlled full wave rectifier and AC voltage controller with R and RL loads.
C307.3	Illustrate the speed control of a DC motor and universal motor
C307.4	Verify the performance of single-phase full bridge inverter connected to resistive load.

Scheme of Evaluation

SEE :

Examinations will be conducted for 100 marks and scaled-down to 50. The weight age shall be,

Write-up : 20 marks

Conduction : 40 marks

Analysis of results : 20 marks

Viva : 20

CIE :

Regular Lab work :20

Record writing :5

Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)

Viva 10 marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C307.1	3	-	-	-	3	2	-	2	3	-	-	3
C307.2	3	-	-	-	3	2	-	2	3	-	-	3
C307.3	3	3	3	1	3	2	-	2	3	-	-	3
C307.4	3	3	3	1	3	2	-	2	3	-	-	3

High-3, Medium-2, Low-1

Course Title	Control System Laboratory	Semester	V
Course Code	MVJ19EEL58	CIE	50
Total No. of Contact Hours	20	SEE	50
No. of Contact Hours/week	4,0:2:2 (L:T:P)	Total	100
Credits	2	Exam. Duration	3 Hours

Course objective is to: This course will enable the students to

- Understand the performance characteristics of ac and DC servomotors and synchro-transmitter receiver pair.
- Design and analyze Lead, Lag and Lag – Lead compensators for given specifications.
- Determine the time and frequency domain responses of a given second order system using software package or discrete components.
- Study the DC position and feedback control system and the effect of P, PI, PD and PID controller on the step response of the system.
- Determine effect of addition of poles and zeros and pole location on stability of a system.

Sl No	Experiment Name	RBT Level	Hours
1	Speed torque characteristics of (i) AC servo motor (ii) DC servo motor	L3	2
2	Synchro pair characteristics	L3	2
3	Determine frequency response of a second order system	L3	2
4	Frequency response of a passive RC lead compensating network for the given specifications	L3	2
5	Frequency response of a passive RC lag compensating network for the given specifications	L3	2
6	Frequency response characteristics of the lag – lead compensating network for the given specifications.	L3	2
Perform the experiments using standard simulation package			
7	(a) Simulate a typical second order system and determine step response and evaluate time response specifications. (b) Evaluate the effect of adding poles and zeros on time response of second order system. (c) Evaluate the effect of pole location on stability	L3	2

8	Study a second order system and verify the effect of (a) P, (b) PI, (c) PD and (d) PID controller on the step response.	L3	2
Along with mandatory experiments students are advised to complete two open ended experiments. The following are some suggestions for open ended experiments.			
1	Examine the open-loop frequency response, stability and transient response. Compare with close loop system.	L3	2
2	Simulate a D.C. Position control system and obtain its step response	L3	2
3	Simulate a DC Servomotor and study its stability.	L3	2

Course outcomes:

C308.1	Determine the performance characteristics of AC and DC servomotors and synchro-transmitter receiver pair used in control systems.
C308.2	Design, analyse and simulate Lead, Lag and Lag – Lead compensators for given specifications.
C308.3	Utilize software package and discrete components in assessing the time and frequency domain response of a given second order system.
C308.4	Simulate the DC position and feedback control system and study the effect of P, PI, PD and PID controller on the step response of the system.
C308.5	Determine effect of addition of poles and zeros and pole location on stability of a system.

Scheme of Evaluation

SEE :
Examinations will be conducted for 100 marks and scaled-down to 50. The weight age shall be,
Write-up : 20 marks
Conduction : 40 marks
Analysis of results : 20 marks
Viva : 20

CIE :
Regular Lab work :20
Record writing :5
Lab Tests(Minimum 2 tests shall be conducted for 15 marks and average of two will be taken)
Viva 10 marks

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C308.1	3	3	1	2	2	-	-	-	3	2	-	3

C308.2	3	3	1	3	2	-	-	-	3	2	-	3
C308.3	3	3	1	3	2	-	-	-	3	2	-	3
C308.4	3	3	2	3	2	-	-	-	3	2	-	3
C308.5	3	3	2	3	2	-	-	-	3	2	-	3

High-3, Medium-2, Low-1

Course Title	ENVIRONMENTAL STUDIES	Semester	V
Course Code	MVJ19ENV59	CIE	50
Total No. of Contact Hours	15 L: T: P :: 1 : 0 :0	SEE	50
No. of Contact Hours/week	1	Total	100
Credits	1	Exam. Duration	2 Hrs.

Course objective is to: This course will enable the students to

- Relate to interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo-systems, biology, chemistry, economics, political science and international processes; Study drinking water quality standards and to illustrate qualitative analysis of water.
- Critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation and societal stability.

Module-1	L1, L2	4 Hrs

Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development.

Ecosystems (Structure and Function): Forest, Desert, Rivers, Ocean

Biodiversity: Types, Hot spots; Threats and Conservation of biodiversity, Deforestation.

Video link: https://nptel.ac.in/courses/127/106/127106004/

Module-2	L1,L2	4 Hrs.

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.

Natural Resource Management (Concept and case-study): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

Video link: https://nptel.ac.in/courses/121/106/121106014/

Module-3	L1	4 Hrs.

Environmental Pollution (Sources, Impacts, Corrective and Preventive measures,

Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.

Waste Management & Public Health Aspects: Bio-medical Waste; Solid waste; Hazardous waste; E-waste.

Video link:

- https://nptel.ac.in/courses/122/106/122106030/
- https://nptel.ac.in/courses/105/103/105103205/
- https://nptel.ac.in/courses/120/108/120108005/
- https://nptel.ac.in/courses/105/105/105105160/

Module-4	L1,	4 Hrs.

Global Environmental Concerns (Concept, policies, and case-studies): Global Warming Climate Change; Acid Rain; Ozone Depletion; Fluoride problem in drinking water.

Video link:

- https://nptel.ac.in/courses/122/106/122106030/
- https://nptel.ac.in/courses/120108004/
- https://onlinecourses.nptel.ac.in/noc19_ge23/preview

Module-5	L1,L2	4 Hrs.

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO 14001.

Video link:

- https://nptel.ac.in/courses/105/102/105102015/
- https://nptel.ac.in/courses/120/108/120108004/

Course outcomes:

C309.1	Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
C309.2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
C309.3	Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.

C309.4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

Text Books:

1	Environmental Studies Benny Joseph Tata Mc Graw – Hill. 2nd Edition, 2012
2	Environmental Studies S M Prakash Pristine Publishing House, Mangalore 3rd Edition, 2018.

Reference Books:

1	Principals of Environmental Science and Engineering, Raman Siva kumar, Cengage learning, Singapur, 2nd Edition, 2005
2	Environmental Science – working with the Earth G.Tyler Miller Jr. Thomson Brooks /Cole, 11th Edition, 2006
	Textbook of Environmental and Ecology, Pratiba Singh, Anoop Singh & Piyush Malaviya , ACME Learning Pvt. Ltd. New Delhi, 1st Edition.

CIE Assessment:

Details		Marks
Average of three Internal Assessment (IA) Tests of 30 Marks each i.e. Σ (Marks Obtained in each test) / 3	CIE (50)	40
Quizzes		10
Semester End Examination	SEE (50)	50
Total		100

SEE Assessment:

i. Question paper for the SEE consists two parts i.e. Part A and Part B. Part A is compulsory and consists of objective type or short answer type questions of 1 or 2 marks each for total of 20 marks covering the whole syllabus.

ii. Part B also covers the entire syllabus consisting of five questions having choices and may contain sub-divisions, each carrying 16 marks. Students have to answer five full questions.

iii. One question must be set from each unit. The duration of examination is 3 hours.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C309.1	3	1	1	1	2	3	-	-	3	2	-	3
C309.2	3	1	1	1	2	3	-	-	3	2	-	3

C309.3	3	3	2	1	2	3	-	-	3	2	-	3
C309.4	3	3	2	3	3	3	-	-	3	2	-	3