

2026-2027

TYUG Engineering Curriculum (Proposed) : NEP-Electrical Engineering

Institute

Vision:

"Transforming Society through Excellence in Education, Innovation and Research."

Mission:

M1: To deliver quality, outcome-based education that provides strong technical knowledge and lifelong learning.

M2: To promote innovation and impactful research addressing real-world and societal challenges.

M3: To develop competent, ethical and socially responsible professionals through industry interaction and holistic development.

Department

Vision:

"To excel in the domain of Electrical Engineering for transformation of Society through indulgence in academics, research and innovation.."

Mission:

M1: Quality Education: To provide outcome based quality technical education in the field of Electrical Engineering for lifelong learning.

M2: Industry Collaboration: To promote industry collaboration for knowledge of Industrial practices and innovations to meet challenges of Modern Society.

M3: Professionalism & Ethics: To develop competent professionals with ethical values and leadership skills for holistic development.

Program Educational Objectives (PEOs):

PEO 1 (Technical Foundation): Graduates of Electrical Engineering shall work in the field of electrical engineering and related areas.

PEO 2 (Professional Growth): Graduates of Electrical Engineering shall work as entrepreneurs, researchers, or professionals, working efficiently in multi-disciplinary fields..

PEO 3 (Lifelong Learning & Ethics): Graduates of Electrical Engineering shall work in global environment for sustainable developments using renewable energy sources while maintaining high ethical standards.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

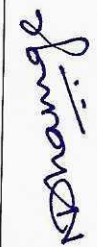
PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1 (Technical Expertise): The department of Electrical Engineering will prepare graduate engineer having ability for application, installation, testing and operation and maintenance of Electrical systems.

PSO 2 (Advanced Applications): Knowledge of renewable energy systems, automation, and smart grid technologies.

B.Tech. Sem-V (Electrical Engineering-Major)

S N	Course Category	Course Code	Name of Course	BoS.	Teaching Scheme (hrs)			Total Credit	Examination Scheme						
					TH	TU	P		Exam Hrs	Theory			Practical		
										MSE	CA	ESE			
1	PCC-V	5BEE01T	Power System-I	Electrical	3	-	-	3	3	30	20	50			
2	PCC-VI	5BEE02T	Signals & Systems	Electrical	3			3	3	30	20	50			
3	PCC -VII	5BEE03T	Control System	Electrical	3	-	-	3	3	30	20	50			
4	PCC -VII	5BEE03P	Control System Lab	Electrical	-	-	2	1					25	25	
5	PEC-I	5BEE04T	Refer Basket Program Elective-I	Electrical	3	-	-	3	3	30	20	50			
6	PEC-I	5BEE04P	Program Elective-I Lab	Electrical			2	1	-				25	25	
7	MDM-III	5BEEMD03T	Refer Basket	Electrical	3	-	-	3	3	30	20	50			
8	OE-III	5BOE03T	Refer Basket Open Elective-III	ASH	3	-	-	3	3	30	20	50			
			Total		18	-	4	20		180	120	300	50	50	
Total Marks (Theory & Practical)									600			100			
Total Marks (V Semester)														700	

			June 2026	1.00	Applicable for AY 2026-27 onwards
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B.Tech. Sem-VI (Electrical Engineering-Major)

SN	Course Category	Course Code	Name of Course	BOS	Teaching Scheme (hrs)			Total Credit	Examination Scheme					
					TH	TU	P		Exam Hrs	Theory			Practical	
										MSE	CA	ESE		CA
1	PCC-VIII	6BEE01T	Power Electronics	Electrical	4	-	-	4	3	30	20	50		
2	PCC-VIII	6BEE01P	Power Electronics Lab	Electrical	-	-	2	1					25	25
3	PCC-IX	6BEE02T	Power System- II	Electrical	3	-	-	3	3	30	20	50		
4	PEC-II	6BEE03T	Refer Basket Program Elective-II	Electrical	3	-	-	3	3	30	20	50		
5	PEC-III	6BEE04T	Refer Basket Program Elective-III	Electrical	3	-	-	3	3	30	20	50		
6	PEC-III	6BEE04P	Program Elective-III Lab	Electrical	-	-	2	1					25	25
7	MDM-IV	6BEEMD04T	Refer Basket	Electrical	3	-	-	3	3	30	20	50		
8	VSEC-IV	6BEE05P	Mini Project	Electrical	-	-	4	2					50	50
Total					16	-	8	20		150	100	250	100	100
Total Marks (Theory & Practical)										500			200	
Total Marks (VI Semester)										700				

Exit option: Award of UG Degree B.Voc/ B.Sc in Electrical Engineering with 120 credits and an additional 8 credits in skill-based courses, internship, mini projects etc.

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KDK College of Engineering
Department of Electrical Engineering

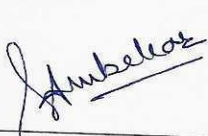
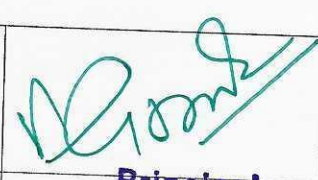
Program Elective Courses (PECs)

Track-I:-Renewable Energy Systems

Offered by Department	Sr. No.	Course category	Title of the MDM Course	Credit	Semester
Electrical Engineering	1	PEC – I	Renewable Energy Sources.	3	V
	2	PEC – I	Renewable Energy Sources Lab.	1	V
	3	PEC – II	Energy Economics	3	VI
	4	PEC – III	Distributed Generation	3	VI
	5	PEC – III	Distributed Generation Lab	1	VI
	6	PEC –IV	Applications of Machine Learning and Artificial Intelligence in Renewable Energy	3	VII
	7	PEC –V	Smart Grid Technologies	3	VII
	8	PEC –VI	MOOC Courses offered by NPTEL/SWAYAM	2	VIII

Track-II:-Sustainable Mobility

Offered by Department	Sr. No.	Course category	Title of the MDM Course	Credit	Semester
Electrical Engineering	1	PEC – I	Energy Storage Systems	3	V
	2	PEC – I	Energy Storage Systems Lab	1	V
	3	PEC – II	Motor Control for Electric Mobility	3	VI
	4	PEC – III	Converters for Electric Vehicles	3	VI
	5	PEC – III	Electric Vehicles Lab	1	VI
	6	PEC –IV	Machine Learning and Artificial Intelligence for Electric Vehicles	3	VII
	7	PEC –V	Deep Learning	3	VII
	8	PEC –VI	MOOC Courses offered by NPTEL/SWAYAM	2	VIII

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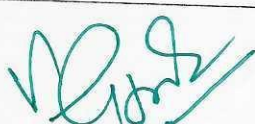
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Department of Electrical Engineering

List of Multi-disciplinary Minor (MDM)

Electrical Engineering & Applications

Offered by Department	Sr. No.	Course category	Course Code	Title of the MDM Course	Credit	Semester
Electrical Engineering	1	Multi-disciplinary Minor - 01	3BEEMD01T	Industrial Instrumentation	3	III
	2	Multi-disciplinary Minor - 02	4BEEMD02T	Transform Techniques and Graph Theory	2	IV
	3	Multi-disciplinary Minor - 03	5BEEMD03T	Introduction to Microprocessors	3	V
	4	Multi-disciplinary Minor - 04	6BEEMD04T	Microcontroller and Interfacing	3	VI
	5	Multi-disciplinary Minor - 05	7BEEMD05T	Internet of Things	3	VII

Offered by Department	Sr. No.	Course category	Course Code	Title of the MDM Course	Credit	Semester
Electrical Engineering	1	Multi-disciplinary Minor - 01	3BEEMD01T	Data Structures and Algorithms	3	III
	2	Multi-disciplinary Minor - 02	4BEEMD02T	Introduction to Data Science	2	IV
	3	Multi-disciplinary Minor - 03	5BEEMD03T	Introduction to Robotics and Automation	3	V
	4	Multi-disciplinary Minor - 04	6BEEMD04T	Programing in PLC and SCADA	3	VI
	5	Multi-disciplinary Minor - 05	7BEEMD05T	Introduction to AI and Machine Learning	3	VII

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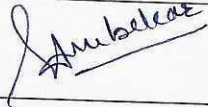
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D.K. CO.

K. D. K College of Engineering, Nagpur
Electrical Engineering Department
Track for Major Courses in Electrical Engineering
 (Applicable to Students of Electrical Engineering)

Domain	No	Course Name	Coordinator	Institute	Course Duration
Power System and Power Electronics (Minimum 72 Weeks)	1	Basic Electrical Circuits	Prof. Gajendranath Chowdary	IIT Hyderabad (IITM)	12 weeks
	2	Network Analysis	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	12 weeks
	3	Electrical machines - I	Prof. D Kastha, Prof. Suman Maiti	IIT Kharagpur	12 weeks
	4	Electrical Machines - II	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	12 weeks
	5	Power System Analysis	Prof. Debapriya Das	IIT Kharagpur	12 weeks
	6	Fundamental of Power Electronics	Prof. L.Umanand	IISc Bangalore	12 weeks
	7	Control Engineering	Prof. Ramkrishna Pasumarthy Prof. Mousumi Mukherjee	IIT Madras IITEST Shibpur	12 weeks
	8	Electrical Measurement and Electronic Instruments	Prof. Avishek Chatterjee	IIT Kharagpur	12 weeks
	9	Computer Aided Power System Analysis	Prof. Biswarup Das	IIT Roorkee	12 weeks
	10	Fundamentals of Electric Drives	Prof. Shyama Prasad Das	IIT Kanpur	8 weeks
	11	High Power Multilevel Converters- Analysis, design and operational issues	Prof. Anandarup Das	IIT Delhi	12 weeks
	12	Design Of Power Electronic Converters	Prof. Shabari Nath	IIT Guwahati	8 weeks
	13	Power System Protection and Switchgear	Prof. Bhaveshkumar R. Bhalja	IIT Roorkee	8 weeks
	14	Smart Grid: Basics to Advanced Technologies	Prof. N.P. Padhy Prof. Premalata Jena	IIT Roorkee	12 weeks
	15	Power Quality	Prof. Bhim Singh	IIT Delhi	12 weeks
	16	Digital Protection of Power System	Prof. Bhaveshkumar R. Bhalja	IIT Roorkee	8 weeks
	17	Digital Control in Switched Mode Power Converters and FPGA-based Prototyping	Prof. Santanu Kapat	IIT Kharagpur	12 weeks
	18	Economic Operations and Control of Power Systems	Prof. Gururaj Mirle Vishwanath, Prof. Narayana Prasad Padhy	IIT Kanpur	12 weeks
	19	A Basic Course on Electric and Magnetic Circuits	Prof. Ashok Kumar Pradhan	IIT Kharagpur	12 weeks
	20	Power Electronics Applications in Power Systems	Prof. Sanjib Ganguly	IIT Guwahati	12 weeks
	21	Advance Power Electronics	Prof. Bhim Singh	IIT Delhi	12 weeks
	22	Charging Infrastructure	Prof. Apurv Kumar Yadav	IIT Roorkee	12 weeks
	23	Advanced Distribution System Analysis and Operation	Prof. N. P. Padhy, Prof. Subho Paul	IIT Roorkee	12 weeks
	24	Power Network Analysis	Prof. Abheejeet Mohapatra	IIT Kanpur	12 weeks

Note:- 1. Ascertain the credits for each course
 2. Total minimum credits to be acquired is 18.

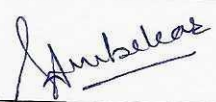
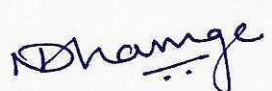
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K. D. K College of Engineering, Nagpur
Electrical Engineering Department
Track for Minor Courses in Electrical Engineering
 (Applicable to Students of other Disciplines)

Domain	No	Course Name	Coordinator	Institute	Course Duration
Power System and Power Electronics (Minimum 72 Weeks)	1	Basic Electrical Circuits	Prof. Gajendranath Chowdary	IIT Hyderabad (IITM)	12 weeks
	2	Network Analysis	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	12 weeks
	3	Electrical machines - I	Prof. D Kastha, Prof. Suman Maiti	IIT Kharagpur	12 weeks
	4	Electrical Machines - II	Prof. Tapas Kumar Bhattacharya	IIT Kharagpur	12 weeks
	5	Fundamental of Power Electronics	Prof. L.Umanand	IISc Bangalore	12 weeks
	6	Control Engineering	Prof. Ramkrishna Pasumarthy Prof. Mousumi Mukherjee	IIT Madras IITEST Shibpur	12 weeks
	7	Electrical Measurement and Electronic Instruments	Prof. Avishek Chatterjee	IIT Kharagpur	12 weeks
	8	Fundamentals of Electric Drives	Prof. Shyama Prasad Das	IIT Kanpur	8 weeks
	9	Design Of Power Electronic Converters	Prof. Shabari Nath	IIT Guwahati	8 weeks
	10	Power System Protection and Switchgear	Prof. Bhaveshkumar R. Bhalja	IIT Roorkee	8 weeks
	11	Smart Grid: Basics to Advanced Technologies	Prof. N.P. Padhy Prof. Premalata Jena	IIT Roorkee	12 weeks
	12	Power Quality	Prof. Bhim Singh	IIT Delhi	12 weeks
	13	Digital Protection of Power System	Prof. Bhaveshkumar R. Bhalja	IIT Roorkee	8 weeks
	14	Economic Operations and Control of Power Systems	Prof. Gururaj Mirle Vishwanath, Prof. Narayana Prasad Padhy	IIT Kanpur	12 weeks
	15	A Basic Course on Electric and Magnetic Circuits	Prof. Ashok Kumar Pradhan	IIT Kharagpur	12 weeks
	16	Power Electronics Applications in Power Systems	Prof. Sanjib Ganguly	IIT Guwahati	12 weeks
	17	Advance Power Electronics	Prof. Bhim Singh	IIT Delhi	12 weeks
	18	Charging Infrastructure	Prof. Apurv Kumar Yadav	IIT Roorkee	12 weeks
	19	Advanced Distribution System Analysis and Operation	Prof. N. P. Padhy, Prof. Subho Paul	IIT Roorkee	12 weeks
	20	Power Network Analysis	Prof. Abheejeet Mohapatra	IIT Kanpur	12 weeks

- Note:** - 1. Ascertain the credits for each course
 2. Total minimum credits to be acquired is 18.

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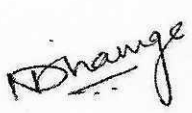
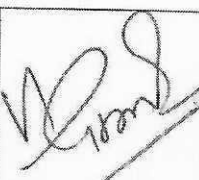


K.D.K. College of Engineering, Nagpur
Faculty of Engineering and Technology

Courses offered by Applied Science and Humanities Board

Open Elective Courses for V Sem. B. Tech.

Sr. No.	Semester	Course Code	Subjects	Credits
1	V	5BOE03T - A	Principles of Management	3
2	V	5BOE03T - B	Professional Practices & Ethics	3
3	V	5BOE03T - C	Insurance & Banking Management	3
4	V	5BOE03T - D	Total Quality Management	3
5	V	5BOE03T - E	Campus Sustainability	3
6	V	5BOE03T - F	Indian Stock Market	3
7	V	5BOE03T - G	Climate Change	3

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. V Semester Electrical Engineering

Semester V	Subject Code: 5BEE01T	Name of Subject: Power System-I		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs.		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives

Students will develop the ability to:-

1. Model and represent the power system components
2. Calculate the transmission line parameter, evaluate its performance.
3. Apply the methods of load flow analysis, and the concept of voltage stability.

Course Outcomes

After successful completion of the course, students will be able to:-

CO1	Explain the structure of electrical power systems
CO2	Determine the inductance, capacitance, and other parameters of transmission lines under different configurations.
CO3	Analyze transmission line parameters, line performance, and voltage regulation transmission lines.
CO4	Analyze string efficiency, capacitance, dielectric losses, and heating effects of cables, and suggest methods for improving system performance
CO5	Apply load flow analysis techniques and evaluate voltage stability of power systems using suitable methods.

Course Competencies:

On successful completion of the course, students will attain the following competencies:

1. Analyze the structure and operational characteristics of transmission lines, cables, insulators, substations, and distribution systems.
2. Evaluate voltage regulation, efficiency, losses, and reliability of power transmission systems.
3. Perform load flow studies and evaluate voltage stability for secure and reliable power system operation.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	2	1	-	2	2	1	-	-	2	2	1
CO2	3	3	2	3	2	2	2	1	-	-	2	2	1
CO3	3	3	2	3	2	2	2	1	-	-	2	2	1
CO4	3	2	2	2	2	2	2	1	-	-	2	2	2
CO5	3	3	2	3	2	2	2	1	-	-	2	2	1

SYLLABUS

Details of Topic	Hours	Mapped with CO
UNIT- I: Evolution of Structure of Power Systems		
Structure of power systems, Introduction to Smart Grids, Micro-grids and their components. Overhead and Underground transmission system, distribution connection scheme (radial, ring main and interconnected), Feeders and distributors, Substation and its equipment's.	7	CO1
Unit II: Transmission line parameters		
Inductance of single phase line, inductance of three phase line with symmetrical and unsymmetrical spacing, concept of GMD and GMR. Inductance of composite conductor systems – stranded conductors, bundle conductor and Double circuit lines. Capacitance of single phase line, capacitance of three phase lines with symmetrical and unsymmetrical spacing, capacitance calculation for double circuit line and bundle conductor. Effect of earth on capacitance calculation. Skin effect and proximity effect. Interference between power and communication lines.	10	CO2
Unit III: Performance of Transmission line		
Line representation – Representation of short, medium and long lines, Pi and T models. A, B, C, D constants of transmission lines and their measurement. Travelling wave interpretation of long line equations, tuned lines.	9	CO3
Unit IV: Insulators & Cables		
Insulators – Materials of insulators, types of insulators – Pin and Disc type – their applications String efficiency, Method to improve string efficiency. Cables – Construction of cables, single and multicore cables, different types, capacitance of belted cables, dielectric loss in cables, heating of cables.	7	CO4
Unit V: Load Flow Studies		
Introduction to load flow studies, Classification of buses, Formation of bus admittance matrix, Static load flow equations, Gauss Seidel and Newton-Raphson method for solution, Concept of Voltage Stability, P-V and V-Q curves, Methods to improve voltage stability.	7	CO5

Text Books

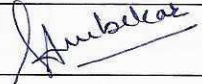
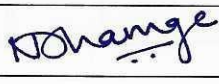
1. I.J. Nagrath, D. P. Kothari, Power System Engineering, Tata McGraw-Hill publications, 2008
2. Ashfaq Husain, Electrical Power System, CBS Publication, 5th Edition
3. C. L. Wadhwa, Electrical Power Systems, New Age International Publisher, 6th Edition
4. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand Publication, 2008

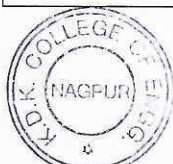
References Books

1. W.D. Stevenson, Elements of power system analysis, McGraw-Hill publications, 3rd Edition
2. O. I. Elgerd, Electric Energy Systems Theory: An Introduction, McGraw-Hill publications
3. Hadi Saadat, Power System Analysis, TMH, 2002
4. James A Momoh, Smart Grid : Fundamentals of Design and Analysis, Wiley 2012
5. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, "Smart Grid: Technology and Applications", Wiley 2012

NPTEL Link:

- | | |
|---|--|
| 1 | https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ee17 Power System Engineering |
| 2 | https://nptel.ac.in/courses/117105140 Power System Analysis |

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. V Semester Electrical Engineering

Semester Electrical Engineering				
Semester V	Subject Code: 5BEE02T	Name of Subject: Signal & System		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs.	Tutorial (T) : -		Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours
Course Objectives				

Course Objectives

Students will develop the ability to:-

1. Provide fundamental knowledge of continuous-time and discrete-time signals and systems, along with techniques for their analysis using convolution, Fourier analysis, and Z-transform.
2. Analyze signal processing and engineering system applications.

Course Outcomes

After successful completion of the course, students will be able to:-

CO1	Classify signals based on their characteristics and perform basic operations on signals.
CO2	Interpret system characteristics and analyze LTI systems.
CO3	Analyze the spectral properties of signals using Fourier analysis for continuous signals
CO4	Analyze discrete-time signals and systems using Fourier Series and Fourier Transform techniques
CO5	Apply Z- transform to study discrete-time signals and systems.

Course Competencies:

On successful completion of the course, students will attain the following competencies:-

1. Ability to classify, represents, and manipulates continuous-time and discrete-time signals.
2. Ability to analyse properties and behaviour of linear time-invariant (LTI) systems using convolution and system equations.
3. Ability to apply Fourier Transform and Z-Transform techniques for analysis of signals and systems.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	2	2	1	-	-	2	2	1
CO2	3	3	2	3	2	2	2	1	-	-	2	2	1
CO3	3	3	2	3	2	2	2	1	-	-	2	2	1
CO4	3	3	2	3	2	2	2	1	-	-	2	2	1
CO5	3	2	2	2	2	2	2	1	-	-	2	2	1

SYLLABUS

Details of Topic	Hour	Mapped with CO
UNIT- I: Introduction to Signals	7	CO1
Definition of Signals, Classification of Signals, elementary signals, basic operations on signals		
Unit II: System Classification and Properties	8	CO2
Introduction to Systems, Classification of Systems, Properties of Systems, Impulse response characterization and convolution for CT- LTI and DT-LTI systems, LTI systems characterized by Differential and difference equations.		
Unit III: Fourier analysis of Continuous Time Signals	8	CO3
Fourier analysis for Continuous time signals, Continuous time Fourier Transform, its properties, frequency response		
Unit IV: Fourier Analysis of Discrete Time Signals	8	CO4
Discrete time Fourier series and its convergence, discrete time Fourier Transform, its properties, frequency response.		
Unit V: Z-Transform	9	CO5
Representation of Signals Using Discrete-Time Complex Exponentials: Z-Transform, Significance and Properties of Region of Convergence, Properties of Z-Transform, Inverse Z-Transform, relationship of z-transform with Fourier transform, applications of Z-transform to solutions of difference equations, Properties of Z transform.		

Text Books

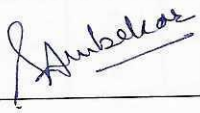
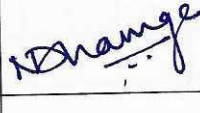
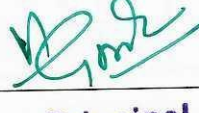
1. Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley and sons
2. Michael J. Robert, "Introduction to Signals and Systems", TMH, Second ed., 2003

References Books

1. Alan V Oppenheim, Alan S Willsky, "Signals and systems" PHI, Second ed. 2009
2. Shaila Dinkar Apte "Signals and Systems: Principles and Applications", Cambridge. University Press.

NPTEL Link:

1	https://www.youtube.com/watch?v=TrgfP7QD3Nk Linear and Circular Convolution in DSP/Signal and Systems - (linear using circular, zero padding)
2	https://onlinecourses.nptel.ac.in/noc21_ee28/preview ,Signals and Systems, By Prof. Kushal K. Shah,IISER Bhopal

			June 2026	1.00	Applicable for AY 2026-27 onwards
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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. V Semester Electrical Engineering

Semester V	Subject Code: 5BEE03T	Name of Subject: Control System		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3Hrs	Tutorial (T) : -	Practical (P): -	
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours
Course Objectives:				

Course Objectives:

Students will develop the ability to-

1. Represent physical systems (mechanical, electrical) using transfer functions, block diagrams, and signal flow graphs.
2. Analyze transient and steady-state performance of first and second-order systems.
3. Determine system stability using Routh-Hurwitz criterion, Root Locus, Bode plots, and Polar plot.

Course Outcomes

After successful completion of the course, students will be able to:

CO1	Explain the fundamentals of feedback control systems and determine transfer functions using block diagram reduction and signal flow graph techniques.
CO2	Determine and investigate the performance of a given system in transient and steady state time response of a simple control system.
CO3	Analyze the absolute stability and relative stability through Routh's stability and root locus technique.
CO4	Determine the relationship between time-domain and frequency domain response of second order system and analyze the systems using frequency-domain techniques.
CO5	Construct the state-space models.

Course Competencies:

On successful completion of the course, students will attain the following competencies:

1. Develop mathematical models of dynamic systems using transfer functions, block diagrams, signal flow graphs, and state-space representations.
2. Evaluate transient and steady-state responses of first-order and second-order control systems.
3. Analyze the stability of control systems using time-domain and frequency-domain techniques.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	1	-	-	-	-	-	1	2	2
CO2	3	3	2	2	1	-	-	-	-	-	1	2	2
CO3	3	3	2	3	1	-	-	-	-	-	1	2	2
CO4	3	3	2	3	2	-	-	-	-	-	1	2	2
CO5	3	3	2	2	2	-	-	-	-	-	1	2	2
											2	2	2

SYLLABUS

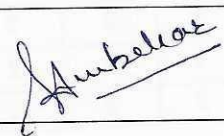
Details of Topic	Hours	Mapped with CO
Unit 1: Introduction to Control System:	10	CO1
Open loop and closed loop systems – examples-Differential equation and transfer function model of systems - Development of models for Electrical, Mechanical, Electromechanical etc-force voltage and force-current analogy - Block diagram representation of systems-Block diagram reduction. Signal flow graph-signal flow graph from equations. Mason's gain formula. Control system components: Synchros, DC and AC servomotor, Stepper motor, potentiometer.		
Unit 2: Time Response Analysis:	10	CO2
Concept of transient response, steady state response and time response, standard test signals-type and order of system, steady state error analysis, static error constants, Time response of first and second order system, Time response specifications of second order system, Different types of controllers (PD,PI,PID).		
Unit 3: Stability Analysis & Root Locus Technique:	9	CO3
Stability of control systems, condition of stability, characteristic equation, Routh Hurwitz criterion, special cases for determining relative stability. Root location and its effect on time response, elementary idea of root locus, effect of addition of pole and zero on proximity of imaginary axis.		
Unit 4: Frequency Response Analysis:	9	CO4
Concept of frequency response specifications. Construction of Bode plot, the stability margin on Bode plot and assessing close- loop stability. Construction of polar plot for a system.		
Unit 5: State Variable Analysis:	10	CO5
Concept of state, state variable and state model, System state model with phase variable and Canonical variables with Block diagram. Transfer function from state model, Stability of state space model. Controllability and Observability.		

Text Books

1. M.Gopal, "Control Systems Engineering", 3/e, Wiley Eastern Ltd., TMH, 2008.
2. Benjamin C.Kuo, "Automatic Control Systems", 7/e, Prentice Hall of India, 1997.
3. Control System Analysis by Nagrath/Gopal, publisher-Newage International.
4. Control System Engineering by SK Bhattacharya, publisher- Pearson

References Books

1. Ogata, "Modern Control Engineering", 2/e, Prentice Hall of India, 2011
2. Control Systems Engg., Nise- John Wiley, 3rd Edition 2000.
3. Control System Engineering by Samarajit Ghosh, publisher- Pearson

			June 2026	1.00	Applicable for AY 2026-27 onwards
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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. V Semester Electrical Engineering

Semester V				Subject Code: 5BEE03P		Name of Subject: Control System Lab	
Total Hours Distribution per week							
Total Credit: 1		Lecture (L): -		Tutorial (T) : -		Practical (P): 2 Hrs	
Examination Scheme							
Continuous Assessment		Ehd Sem Examination		Total Marks		Examination Duration:	
25 Marks		25 Marks		50Marks			

Course Objectives

Students will develop the ability to-

1. Determine the characteristics of different control system components, including transfer functions, time constants, and frequency response.
2. Use the simulation software and modern engineering tools for the analysis and design of control systems.
3. Perform experiments, interprets results, and validating theoretical concepts.

Course Outcomes

After completing the practical course, students will be able to:-

CO1	Analyze the transient and steady-state response characteristics of first-order and second-order control systems using experimental and simulation techniques.
CO2	Design the mathematical models and obtain transfer functions of electrical and electromechanical systems using laboratory experiments and simulation tools.
CO3	Interpret results, prepare technical reports.

Course Competencies:

On successful completion of the course, students will attain the following competencies:

1. Analyse transient and steady-state responses.
2. Determine transfer functions and system characteristics.
3. Utilize MATLAB/Simulink and Python for simulation and analysis.

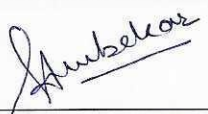
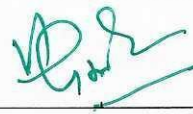
CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	2	2	-	-	-	-	-	1	3	2
CO2	3	3	2	3	3	-	-	-	-	-	1	3	3
CO3	2	2	1	3	2	-	-	2	3	3	1	2	2

LIST OF PRACTICALS:

Pr. No.	List of Practical's
1	To study the torque-speed characteristics and determine the transfer function of a d.c. motor.
2	To study the performance characteristics of an angular position error detector using two potentiometers.
3	To study the characteristics of a Synchro Transmitter Receiver pair and use these as torque-synchro and angular error detector.
4	To study the performance characteristics of a D.C. motor speed control system with options for (a) PWM type and (b) SCR type power driver.
5	To study the transient and frequency response of a second order network.
6	To study the characteristics of an a.c servomotor and determine its transfer function.
7	To study the D.C. servo motor angular position control system.
8	To study an A.C. servo motor angular position control system.
9	To measure basic step angle of stepper motor.
10	To study PID controller in different modes.
11	To study performance of various types of controllers used to control the temperature of the oven.
12	To study the time response of a variety of simulated linear systems and to correlate the studies with theoretical results.
13	To design, implement and study the effects of different cascade compensation networks for a given system.
14	Theoretical and experimental study of magnetic levitation system.
15	To study the response of a control system using MATLAB for various standard test inputs (step, ramp, impulse, and parabolic).
16	To obtain Root Locus, Bode Plot, and time response characteristics using MATLAB/Simulink.
17	Analyze step, ramp, impulse, and parabolic responses using Python.
18	Time Response Analysis of First-Order Systems: Obtain step and impulse responses using Python .Evaluate rise time and settling time.
19	To Design and simulate lead compensators using Python.
20	To Obtain Polar plots of transfer functions using Python.

(List is indicative. Minimum 8 practical's based on above syllabus covering all topics are expected.)

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. V Semester Electrical Engineering

Semester V	Subject Code: 5BEE04T	Name of Subject: Renewable Energy Sources.		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs.	Tutorial (T) : --	Practical (P): -	
Examination Scheme				
Mid Sem Examination	Continual Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives

Students will develop the ability to:-

1. Explain the fundamentals of solar radiation, its measurement, and solar energy availability.
2. Describe the operating principles and performance characteristics of solar photovoltaic systems, and various wind energy conversion systems.
3. Explore hydrogen energy technologies and green energy solutions for sustainable development.

Course Outcomes

After successful completion of the course, students will be able to:-

CO1	Analyze Solar radiation & measurement.
CO2	Identify and analyze the process of power generation through solar photovoltaic.
CO3	Impart working of wind energy conversion process and applications.
CO4	Explain the operating principles of fuel cells and identify their applications in energy systems
CO5	Acquire the basic knowledge of hydrogen energy and its application.

Course Competencies:

On successful completion of the course, students will attain the following competencies:

1. Assess solar energy measurement techniques.
2. Evaluate the performance of solar photovoltaic and wind energy conversion systems for power generation applications..
3. Analyze fuel cell technologies, hydrogen-based energy systems and green energy solutions and their applications.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	3	-	-	-	1	3	2	3
CO2	3	3	2	2	2	3	-	-	-	1	3	2	3
CO3	3	3	2	2	2	3	-	-	-	1	3	2	3
CO4	3	3	2	2	2	3	-	-	-	1	3	2	3
CO5	3	3	2	2	2	3	-	-	-	1	3	2	3

SYLLABUS

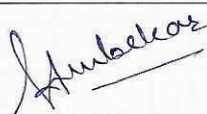
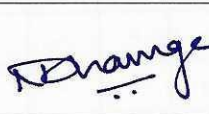
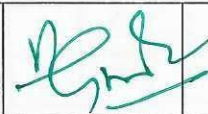
Details of Topic	Hours	Mapped with CO
Unit 1: Solar Radiation & its Measurement	8	CO1
Solar Constant, Solar radiation at earth's surface, solar radiation geometry, solar radiation measurement.		
Unit 2: Solar Photovoltaic power generation	9	CO2
Introduction, Physics of solar cells, Characteristic of solar cell, series and parallel connection, types of solar cell, module manufacturing.		
Unit 3: Types of Wind Machines & Generating Systems	8	CO3
Introduction, Horizontal-Axial Machines, Vertical Axis machines, Performance of winds Machines, Schemes for electric generation, generator control, load control, Safety systems and Environmental aspects and applications.		
Unit 4: Fuel cells	9	CO4
Design and principles of operation of a fuel cells, classification of fuel cells, types of fuel cells, advantages and disadvantages of fuel cells, conversion efficiency of fuel cells, types of electrodes, Applications of fuel cells.		
Unit 5: Green Energy	6	CO5
Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy.		

Text Books

1. Non-Conventional Energy Sources G.D. Rai, Khanna publishers
2. Non-Conventional Energy Resources B. H. Khan 2nd, The McGraw Hill Companies
3. Solar Energy: Principles of thermal collection and storage, S. P. Sukhatme 2nd edition, Tata McGraw Hill Publishing Company Ltd.
4. Solar Photo voltaics: Fundamental, Technologies and Applications, Chetan Singh Solanki, 3 rd Edition, PHI Learning Pvt. Ltd.
5. Non-Conventional Energy Sources and Utilization, R.K. Rajput, S. Chand Publications.

References Books

1. Fundamentals of Renewable Energy Processes, Aldo Vieira da Rosa, Juan Carlos Ordóñez, Fourth Edition, Elsevier Academic Press
2. Wind and Solar Power Systems: Design, Analysis, and Operation, Mukund R. Patel and Omid Beik, THIRD EDITION CRC PRESS(TAYLOR & FRANCIS)
3. Renewable & Efficient Electric Power Systems, Gilbert Masters John,, Wiley and son's publications.

			June 2026	1.00	Applicable for AY 2026-27 onwards
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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. V Semester Electrical Engineering

Semester Electrical Engineering			
Semester V	Subject Code: 5BEE04P	Name of Subject: Renewable Energy Lab.	
Total Hours Distribution per week			
Total Credit: 1	Lecture (L):	Tutorial (T) : -	Practical (P): 2 Hr
Examination Scheme			
Continuous Assessment		End Sem Examination	Total Marks
25 Marks		25 Marks	50Marks

Practical Course Objectives

Students will develop the ability to

1. Analyze the conversion processes involved in solar, wind, fuel cell, and hydrogen energy technologies.
2. Test, simulation, and evaluation of renewable energy systems.
3. Apply modern engineering tools to solve problems related to renewable energy applications.

Practical Course Outcomes

After completing the practical course, students will be able to

- | | |
|---|--|
| 1 | Measure and analyze solar radiation parameters using appropriate techniques and instruments. |
| 2 | Evaluate the characteristics and performance of solar photovoltaic systems & wind energy conversion systems. |
| 3 | Simulate and analysis of hydrogen energy production, storage, and utilization technologies. |

Course Competency

Students completing this course will develop the competency to:

1. Evaluate renewable energy systems using modern engineering tools and sustainable engineering practices for efficient energy conversion and utilization.

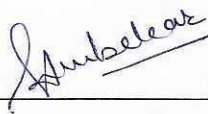
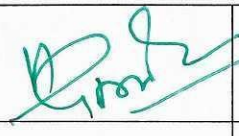
CO-PO Articulating Matrix:

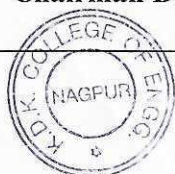
CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	1	-	-	-	1	2	3
CO2	3	3	2	1	2	-	2	-	2	1	1	3	3
CO3	3	3	3	2	3	-	1	-	1	2	2	3	3

LIST OF PRACTICALS:

Pr. No.	List of Practical's
1	To Study solar radiation measurement instruments and determination of solar radiation parameters.
2	To determine solar angles and estimation of solar radiation on tilted surfaces.
3	To Study and plotting of I-V and P-V characteristics of a solar photovoltaic module under varying irradiance conditions.
4	To perform analysis of series and parallel connected PV modules
5	Simulation of solar photovoltaic systems using MATLAB/Simulink
6	To Study the construction and performance characteristics of horizontal-axis and vertical-axis wind turbines.
7	To determine power coefficient and performance characteristics of wind energy conversion systems.
8	To Study generator control, load control, and safety systems used in wind energy systems.
9	To Study fuel cell characteristics and determination of fuel cell efficiency.
10	Comparative study of different fuel cell technologies and their applications.
11	To Study hydrogen production through electrolysis and evaluation of hydrogen generation efficiency.
12	To Study hydrogen storage methods and applications of hydrogen energy systems.

(List is indicative. Minimum 8 practical's based on above syllabus covering all topics are expected.)

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K. D. K. College of Engg.
NAGPUR

KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. V Semester Electrical Engineering

Semester V					Semester Electrical Engineering				
Semester V		Subject Code: 5BEEMD03T		Name of Subject: Introduction to Microprocessor					
Total Hours Distribution per week									
Total Credit: 3		Lecture (L): 3 Hrs			Tutorial (T) : -		Practical (P): -		
Examination Scheme									
Mid Sem Examination		Continuous Assessment		End Sem Examination		Total Marks		Examination Duration:	
30 Marks		20 Marks		50 Marks		100 Marks		3 Hours	
Course Objectives									

Course Objectives

Students will develop the ability to:-

1. Understand microprocessor architecture and operation (8085 focus)
2. Develop assembly language programming skills
3. Analyze timing diagrams and interrupt mechanisms.
4. Interface memory and I/O devices (8255 & 8253)
5. Study 8085 with 8086 and explore embedded systems basics.

Course Outcomes

After successful completion of the course, students will be able to:-

CO1	Explain the pin diagram, architecture, and operation of the Intel 8085.
CO2	Apply instruction set to develop and debug assembly language programs.
CO3	Analyze timing diagrams, machine cycles, and interrupt mechanisms.
CO4	Design memory organization and I/O interfacing using the Intel 8255 & 8253/54.
CO5	Compare 8085 with Intel 8086 and explain embedded system concepts.

Course Competencies:

Students completing this course will develop the competency to:

1. Understand microprocessor and microcontroller architectures.
2. Develop assembly programs and debug systems.
3. Apply knowledge to design interfacing with peripherals.
4. Learn Microprocessor and describe embedded systems.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	-	1	-	3	1
CO2	3	3	3	2	3	-	-	1	2	2	1	2	1
CO3	3	3	2	3	2	-	-	-	-	2	1	2	1
CO4	3	3	3	3	3	1	2	1	2	2	2	3	1
CO5	3	2	2	1	2	1	2	1	1	3	2	2	1

Syllabus

Details of Topic	Hours	Mapped with CO
Unit-I INTRODUCTION TO 8 BIT MICROPROCESSOR:		
Evolution and concept of Microprocessors, Microprocessor based system organization and data flow, concept of Buses: address, data, control, Introduction to 8085 - Functional pin diagram and Internal architecture, Memory & Interfacing, Memory organization and address decoding	8	CO1
Unit-II 8085 PROGRAMMING IN ASSEMBLY LANGUAGE		
Instruction Syntax & Instruction classification, Addressing modes, Instructions: Data transfer, arithmetic, logical, branching, machine control instructions, Assembler Directives, Simple Programs: (Addition/subtraction, Largest / smallest number. Sorting numbers, BCD addition/ Conversion)	12	CO2
Unit-III Timing Diagram		
T-states, machine cycles, instruction cycle, Opcode fetch cycle, Memory read/write cycles, I/O read/write cycles, Timing diagram examples, READY signal and wait states. Interrupt structure: TRAP, RST7.5, RST6.5, RST5.5, INTR, Software interrupts and masking	8	CO3
Unit-IV I/O Interfacing:		
Memory-mapped vs I/O-mapped I/O, Pin diagram and architecture of 8255 PPI, Modes of Operations, Interfacing 8255 with 8085 Pin diagram and architecture of 8253/54 PIT, Modes of Operations, Interfacing 8253/54 with 8085.	10	CO4
Unit V Advanced microprocessor 8086:		
Features of 8086, Architectural comparison between 8085 & 8086, Memory organization (Banking Concept) & Memory segmentation. Microprocessor vs Microcontroller comparison.	7	CO5

Text Books

- 1 Microprocessor, Architecture, Programming and Applications with 8085, Ramesh S. Gaonkar, 5th edition, Penram International Publication, 2004.
- 2 The 8085 Microprocessor: Architecture, Programming and Interfacing, Authors: K. Udaya Kumar, B.S. Umashankar, Publisher: Pearson Education.
- 3 Microprocessors and Interfacing, Author: Douglas V. Hall, Publisher: McGraw-Hill Education
- 4 Advanced Microprocessors and Peripherals, Authors: A.K. Ray, K.M. Bhurchandi, Publisher: McGraw-Hill Education

References Books

1. 0000 to 8085 – Introduction to Microprocessor for Engineers and Scientists, P. R. Sridhar and P. K. Ghosh, 2nd edition, Prentice Hall India Ltd, 2005.
2. Introduction to Microprocessor, Aditya P. Mathur, 3rd edition, Tata McGraw-Hill, 2004.
3. Advanced microprocessors and Peripherals, A.K.Ray and K.M.Bhurchandi, 2nd, edition, Tata McGraw Hill, 2008
4. Microcontrollers Theory and Applications, Author: Ajay V. Deshmukh, Publisher: Tata McGraw-Hill

Suggested Activities / Micro Projects:

Activity No.	Suggested Activity / Micro Project
1	Signal Identification Drill, Bus Activity (Think-Pair-Share), Architecture Mapping Exercise, Memory Mapping Puzzle, Address Decoding Mini Design
2	Address Decoding Mini Design, Code Debugging Activity
3	Cycle Counting Challenge, Interrupt Priority Quiz, READY Signal Discussion
4	Mode Selection Activity, LED Interfacing Sketch, Timer Application (8253)
5	8085 vs 8086 Comparison Table, Embedded System Identification
6	Traffic light controller using 8085 + 8255, Run program in GNUSim8085, Verify output

Online Resources:

1. NPTEL Courses (SWAYAM)

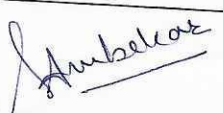
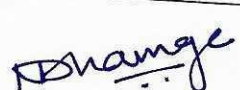
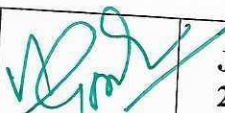
1. Microprocessors and Microcontrollers – IIT Kharagpur
2. Embedded Systems – IIT Madras
3. Digital Systems and Microprocessors – IIT Bombay
4. Use: Concept clarity, lecture videos, assignments, certification

2. YouTube Channels

- 1 Neso Academy - Excellent for 8085 architectures, instruction set, and timing diagrams
- 2 Gate Smashers - Covers microprocessor programming and previous year questions
- 3 Tutorials Point - Useful for quick conceptual explanations
- 4 All About Electronics - Good for hardware concepts and interfacing

3. Simulators & IDEs

- 1 GNUSim8085 - Open-source simulator for writing and debugging 8085 programs
- 2 Proteus Design Suite - Used for circuit simulation and interfacing (8255, 8253)

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1. Introduction to the course and its objectives.
 2. Overview of the course structure and content.
 3. Discussion of the course materials and assignments.
 4. Review of the course syllabus and schedule.

Topic	Assignment	Due Date
Introduction to the course	Assignment 1	Week 1
Overview of the course structure	Assignment 2	Week 2
Discussion of the course materials	Assignment 3	Week 3
Review of the course syllabus	Assignment 4	Week 4

1. Introduction to the course and its objectives.
 2. Overview of the course structure and content.
 3. Discussion of the course materials and assignments.
 4. Review of the course syllabus and schedule.

Signature	Date	Signature	Date
<i>[Signature]</i>	<i>[Date]</i>	<i>[Signature]</i>	<i>[Date]</i>

KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code: 5BOE03T - A	Name of Subject: Principles of Management		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	To enable students, understand the fundamental concepts of management, including the evolution and managerial roles and functions.
2	To enable students to learn the principles, processes, and types of planning and decision-making in managerial contexts.
3	To analyze different organizational structures and processes including staffing, delegation, and departmentalization.
4	To understand behavioral aspects of directing, including motivation, leadership, and communication.
5	To make them learn various control mechanisms, including budgeting and performance monitoring, to improve organizational productivity and effectiveness.

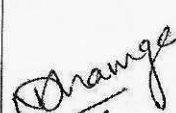
Course Outcomes	
After completion of syllabus, the student will be able to	
1	Define and explain the core concepts of management and distinguish between managers and administrators.
2	Demonstrate knowledge of planning, including setting objectives, formulating policies, and applying planning tools and techniques.
3	Analyse different organizational structures and processes including staffing, delegation, and departmentalization.
4	Understand behavioural aspects of directing, including motivation, leadership, and communication.
5	Utilize various control mechanisms, including budgeting and performance monitoring, to improve organizational productivity and effectiveness.

Course Competencies	
1	Apply foundational knowledge of management principles and develop the ability to plan, organize, lead, and control organizational activities effectively.
2	Implement communication skills, leadership skills, decision-making skills and performance monitoring skills to improve productivity and efficiency

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	-	-	-	-	2	2	-	-	3	3
CO2	2	2	-	-	3	-	-	-	--	3	3
CO3	-	3	-	-	-	-	-	3	-	3	3
CO4	-	-	-	-	-	-	3	3	3	-	3
CO5	-	2	-	-	-	-	-	-	-	3	3

Course Contents		Mapped with CO
Unit I : Introduction to Management:	8	CO1
Definition, Nature, Importance, Scope of Management – managerial roles and skills- Science or Art – Manager Vs Administrator – Evolution of Management – Scientific, human relations, system and contingency approaches (contributions of F.W Taylor, Henry Fayol, Elton Mayo, Glberth and McGregor) - Levels and Functions of Management.		
Unit II : Planning:	8	CO2
Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Planning Tools and Techniques – Decision making steps and process.		
Unit III : Organizing:	8	CO3
Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization —Span of Management - Job design- Recruitment, selection, Training and Compensation.		
Unit IV : Directing:	8	CO4
Foundations of individual and group behavior – motivation – motivational techniques – job enlargement – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication.		
Unit V : Controlling:	8	CO5
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.		

Text Books	
1	Principles and Practice of Management: L M Prasad, Sultan Chand & Sons educational. New Delhi
2	Principles of Management, Ramaswamy T., Himalaya Publication
3	Essentials of Management, Harold Koontz, O'Donnell and Heinz Weihrich, 2012, New Delhi, 9th edition, Tata McGraw Hill
4	Fundamentals of Management, Stephen P. Robbins, David A. Decenzo, 2016, Pearson Education, 9th Edition
5	Management Today- Principles and Practice / Edition-13th reprint
Reference Books	
1	Management - Text & Cases, Satya Raju, PHI, New Delhi
2	Management Fundamentals: Concepts, Applications, & Skill Development, 6th edition, Sage. 2014
3	Principles Of Management, Richard L. Daft, Cengage Learning, 2009

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KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code: 5BOE03T - B	Name of Subject: Professional Practices & Ethics		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	To understand the basic purpose of profession, professional ethics and various moral and social issues.
2	To analyze various moral issues and theories of moral development
3	To realize their roles of applying ethical principles at various professional levels
4	To identify their responsibilities for safety and risk benefit analysis.
5	To understand their constructive roles in dealing various global issues.

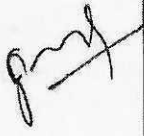
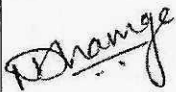
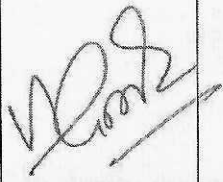
Course Outcomes	
After completion of syllabus, the student will be able to	
1	Understand basic purpose of profession, professional ethics and various moral and social issues.
2	Analyze various moral issues and theories of moral development.
3	Realize their roles of applying ethical principles at various professional levels.
4	Identify their responsibilities for safety and risk benefit analysis.
5	Understand their constructive roles in dealing various global issues.

Course Competencies	
1	Apply professional ethics, moral values, and social responsibilities while dealing with real-world scenarios in their respective professions.
2	Analyze ethical issues critically and perform risk-benefit analysis to make informed and responsible decisions in professional settings.
3	Demonstrate responsible behaviour and actively contribute to addressing global and societal challenges through ethical and socially conscious practices.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	-	-	-	2	3	1	1	-	3
CO2	-	2	-	-	-	-	3	-	1	-	2
CO3	-	-	-	-	-	-	3	1	2	-	1
CO4	-	-	2	-	2	-	2	-	-	-	3
CO5	-	-	-	-	-	3	3	1	1	-	3

Course Contents		Mapped with CO
Unit I : Human Values and Ethics:	8	CO1
Human Values, Morals, values and Ethics, Integrity, Work ethics, Service learning, Civic virtue, Respect for others, living peacefully, Caring, Sharing, Honesty, Courage		
Unit II : Engineering Ethics:	8	CO2
Engineering Ethics, Senses of 'Engineering Ethics', Variety of moral issues, Moral dilemmas, Moral Autonomy, Kohlberg's theory, Gilligan's theory		
Unit III : Engineering as Social Experimentation:	8	CO3
Engineering as Social Experimentation, Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, A Balanced Outlook on Law (Industrial Disputes Act, 1947; 07 3 Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923		
Unit IV : Safeties, Responsibilities and Rights:	8	CO4
Safety, Responsibilities and rights, Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Collective Bargaining, Professional Rights, Employee Rights		
Unit V : Global Issues and Professional Responsibilities:	8	CO5
Global issues, Multinational Corporations, Computer Ethics, Weapons Development, Engineers as Managers, Consulting Engineers, Engineers as Expert Witnesses and Advisors		

Text Book/ Reference Books	
1	Professional Ethics, R. Subramaniam, Oxford Publications, New Delhi.
2	Human Values and Professional Ethics by Jayshree Suresh and B. S. Raghavan, S. Chand Publications
3	Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.

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KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code:	Name of Subject:		
	5BOE03T - C	Insurance and Banking Management		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	To introduce the structure and functioning of the banking industry, with a focus on commercial and corporate banking in India.
2	To understand key commercial banking operations and regulatory frameworks like KYC, AML, FEMA, and payment systems (NEFT, RTGS, SWIFT).
3	To explore banking risk management practices, including ALM, NPA management, credit risk, and other financial risks.
4	To provide insights into insurance fundamentals, types of insurance policies, and risk measurement techniques
5	To examine the operational aspects of insurance companies including underwriting and claims management.

Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the structure and types of banking institutions in India and the concept of core and universal banking.
2	Describe key operations in commercial banking and apply regulatory norms such as KYC, AML, RTGS, NEFT, and FEMA.
3	Evaluate asset-liability management processes and prudential norms related to NPAs and credit risk management.
4	Illustrate the concepts and types of life and general insurance, and understand premium calculation and risk measurement.
5	Analyze the operational aspects of insurance companies including underwriting principles and claims settlement processes.

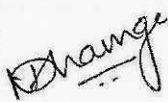
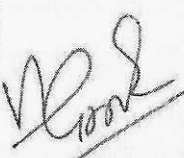
Course Competencies	
1	Understand the structure and regulations of banking and insurance in India.
2	Apply risk management practices and compliance frameworks like KYC, AML, FEMA, NEFT, and RTGS.
3	Analyze insurance policies and claims processes to evaluate financial and operational risks.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	2	-	-	-	2	3
CO2	-	-	-	-	2	2	2	-	-	3	3
CO3	-	-	-	-	2	2	-	-	-	3	3
CO4	-	-	-	-	3	2	2	-	-	3	2
CO5	-	-	-	-	3	2	2	-	-	3	2

Course Contents		Mapped with CO
Unit I : Introduction to Banking: Banking Industry: Structure of Banking Industry - Public and Private Sectors Banks in India - Corporate Banking and Universal Banking - Core Banking Innovation in Banking: E-Banking - Delivery Channels - ATM - EFTPOS - Phone Banking - Internet Banking - SMS Banking - Mobile Banking - Credit/Debit Cards - Smart Cards - UPI - Bancassurance.	8	CO1
Unit II : Commercial Banking Operations: Banking Operations: Payment and Settlement System - New Age Clearing - New Age Payment - RTGS - NEFT - SWIFT - NTGS - KYC Norms and Anti - Money Laundering - FEMA. Asset Liability Management (ALM): Concept - Organization and Techniques - Provision for NPA's - NPA's in Commercial Banks - Causes and Suggestions - Prudential Norms.	8	CO2
Unit III : Management of Banking Organization: Credit Risk Management: Introduction - Capital Adequacy Norms - Standardized and Advanced Approaches for Credit Risk - Credit Rating/Credit Scoring - Rating System Design. Loan Management: Contents of Loan Policy - Evaluating Credit Applicant Market Risk - Liquidity Risk - Interest Rate Risk - FOREX Risk.	8	CO3
Unit IV Introduction to Insurance: Introduction, Concept - Nature - Scope and Significance - Investment Patterns - Types of Policies. Life insurance: Premium Calculations - Annuities - Measurement of Risk and Morality Table. General Insurance: Fire Insurance - Conditions of Fire Insurance - Subrogation and Reinsurance - Accident and	8	CO4

Motor Insurance - Types of Motor Insurance - Factors to be considered for Premium Fixing - Concept of Health Insurance - Group Insurance - Home Insurance - Catastrophe Insurance		
Unit V : Management of Insurance Companies:	8	CO5
Underwriting: Functions - Principles - Underwriting in Life Insurance - Underwriting in Non-Life Insurance. Claims Management: Claim Settlement in General Insurance - Accident Benefit - Disability Benefit - Permanent Disability Benefit - Claim Settlement in Life Insurance - Maturity Claims and Death Claims.		

Text/ Reference Books	
1	N.R. Mohan Prakash, Banking, Risk and Insurance Management, Vikas Publishing
2	M.N. Mishra & S.B. Mishra, Insurance: Principles and Practice, S. Chand & Co
3	Sunil Kumar, Essentials of Banking and Insurance, JSR Publishing House
4	Bank Management and Financial Services (Indian Edition), Peter Rose & Sylvia Hudgins, 8th Edition, McGraw Hill Education
5	Principles And Practice of Bank Management, 2nd Revised Edition, Dr. P. Subba Rao & Dr. Promod Kumar Khanna, Himalaya Publishing House

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KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code: 5BOE03T - D	Name of Subject: Total Quality Management		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	Understand the principles, history, and key contributors of Total Quality Management (TQM)
2	Learn and apply essential quality tools like Kaizen, Six Sigma, and cost analysis.
3	Manage customer satisfaction, employee involvement, and supplier relationships.
4	Use quality improvement techniques such as control charts and the DMAIC process.
5	Apply advanced TQM tools like Benchmarking, QFD, TPM, and FMEA to enhance quality and reliability

Course Outcomes	
After completion of syllabus, the student will be able to	
1	Develop an understanding about Quality management in corporate world.
2	Employ various techniques being used in Total Quality Management.
3	Engage into control of processes in manufacturing and operations
4	Audit control systems and Quality management
5	Apply TQM tools like Benchmarking, QFD, Taguchi Loss Function, TPM, and FMEA to improve quality and reliability in industrial and service processes.

Course Competencies	
1	Apply Total Quality Management (TQM) principles in real-world corporate settings.
2	Operate quality tools and techniques to improve processes and ensure product reliability.
3	Evaluate and audit quality systems to support continuous improvement.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	-	2	-	2	1	-	-	-	1	1
CO2	-	2	2	-	3	1	-	-	-	2	2
CO3	-	2	3	-	2	1	1	2	-	2	2
CO4	-	2	2	2	2	1	1	-	-	2	2
CO5	-	2	3	-	3	1	1	-	2	2	2

Course Contents		Mapped with CO
Unit I: Introduction to Total Quality Management Introduction to Total Quality Management, A brief history, the concept of quality, evolution of total quality, principles of total quality, Gurus of total quality management, their philosophies and contributions, characteristics of quality leader, customer satisfaction, customer perception of quality, feedback, customer complaints.	8	CO1
Unit II: Tools of Quality Management Process, Problem solving method, Kaizen, Six Sigma, performance measures, Cost of Quality, Tools for Quality Assurance,	8	CO2
Unit III: Customers and Suppliers Management TQM Principles - Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement -Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy	8	CO3
Unit IV: Quality Improvement Techniques Quality Improvement Techniques - Control Charts for Variables - Definitions, Variation: Common vs. Special Causes, Process capability, Concept of six sigma - Introduction, advantages of six sigma, six sigma DMAIC process	8	CO4
Unit V: Total Productive Maintenance TQM Tools - Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA	8	CO5

Text Books	
1	Dale H.Besterfield, et al., Total Quality Management Pearson Education Asia, 1999. (Indian Areprint 2002)
2	Total Quality Management by Dale H. Besterfield, 2019, Pearson
Reference Books	
1	James R.Evans & William M.Lindsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5)
2	Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991
3	Oakland.J.S. "Total Quality Management" Butterworth – Heinemann Ltd., Oxford. 1989

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KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V					Subject Code: 5BOE03T - E		Name of Subject: Campus Sustainability	
Total Distribution per week								
Total Credit: 3		Lecture (L): 3			Tutorial (T): 0		Practical (P): 0	
Examination Scheme								
Continuous Assessment		Mid Semester Examination		End Semester Examination		Total Marks		Examination Duration:
20 Marks		30 Marks		50 Marks		100 Marks		3 Hrs

Course Objectives	
1	Develop an understanding of the principles and practices of sustainability in the context of educational institutions.
2	Build awareness of ecological, economic, and social sustainability challenges on campuses.
3	Enable students to assess and reduce the environmental footprint of academic activities.
4	Introduce tools and strategies for energy, water, and waste efficiency within campuses.
5	Promote student engagement and leadership in sustainability initiatives.

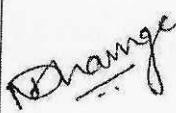
Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the concept of sustainability and its relevance to campus ecosystems.
2	Evaluate current campus practices in energy, water, and waste management.
3	Analyze the application of green infrastructure and sustainable mobility in institutions.
4	Propose practical and technical strategies for improving campus sustainability.
5	Demonstrate environmental responsibility through individual and group actions.

Course Competencies	
1	Understand the concept of sustainability and its application to campus ecosystems.
2	Evaluate and improve energy, water, and waste practices within institutions.
3	Apply green infrastructure strategies and promote sustainable mobility on campuses.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	3	3	-	2	-	2
CO2	-	-	-	-	-	2	3	-	-	2	2
CO3	-	-	-	2	-	2	2	-	2	2	2
CO4	-	-	-	2	-	2	2	-	2	3	2
CO5	-	-	-	-	-	2	3	3	3	2	-

Course Contents		Mapped with CO
Unit I: Foundations of Sustainability	8	CO1
Introduction to sustainability: environmental, economic, social dimensions, The role of academic institutions in promoting sustainability, UN Sustainable Development Goals (SDGs) and Education for Sustainable Development (ESD), Examples of sustainable campuses worldwide		
Unit II: Energy Management in Campus Infrastructure	8	CO2
Campus energy audits: methods and case studies, Renewable energy integration: solar, wind, biomass, Energy conservation in labs, hostels, and classrooms, Smart grids, sensors, and building automation systems		
Unit III: Water Conservation and Solid Waste Management	8	CO3
Water audits and sustainable usage, Rainwater harvesting systems and greywater reuse, Solid waste segregation, composting, and recycling models, E-waste handling and hazardous waste precautions		
Unit IV: Green Buildings and Sustainable Transportation	8	CO4
Concepts of green building: LEED, GRIHA, EDGE certifications, Use of sustainable construction materials, Campus biodiversity and green landscaping Bicycle-friendly campuses, EV charging, carpool systems		
Unit V: Community Engagement and Behavior Change	8	CO5
Building a green culture through clubs and campaigns, Institutional policies and green charters, Sustainability reporting and auditing tools, Design and presentation of a campus sustainability project		

Text book/Reference Books	
1	Geng, Yong, and Brent, Daniel. Sustainable Campus: Theory and Practice. Springer, 2021.
2	Agyeman, Julian et al. Local Environment: The International Journal of Justice and Sustainability (Selected papers)
3	United Nations. UN Sustainable Development Goals Reports – https://sdgs.un.org/
4	National Institute of Urban Affairs. Campus Sustainability Guidelines for Indian Institutions
5	AICTE & TERI Green Campus Manual (India-specific guidelines)

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KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code: 5BOE03T - F	Name of Subject: Indian Stock Market		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	Provide an in-depth understanding of the Indian capital and stock market structure.
2	Equip students with knowledge of equity, derivatives, mutual funds, and trading platforms.
3	Build analytical skills through fundamental and technical evaluation of securities.
4	Develop understanding of portfolio construction and investment strategies
5	Familiarize students with the regulatory framework, investor protection, and ethical investing

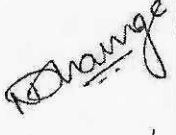
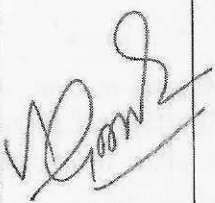
Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the structure and functions of Indian stock markets and financial instruments.
2	Demonstrate knowledge of trading mechanisms and regulatory compliance.
3	Apply technical and fundamental analysis to evaluate investment opportunities.
4	Analyze and compare financial products like mutual funds, ETFs, and derivatives
5	Construct and manage a diversified portfolio applying key risk-return concepts.

Course Competencies	
1	Understand the structure and functions of the Indian stock market and its financial instruments.
2	Apply analytical tools and trading knowledge to evaluate investments and build portfolios.
3	Demonstrate understanding of regulatory compliance and ethical investing practices.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	2	-	-	2	-	-	-	1	2
CO2	2	1	2	-	-	3	-	-	2	2	3
CO3	1	2	3	-	-	2	-	-	-	3	3
CO4	1	1	2	-	-	2	-	-	-	2	3
CO5	2	1	3	-	-	2	-	-	-	3	3

Course Contents		Mapped with CO
Unit I: Overview of Financial Markets & Stock Exchanges	8	CO1
Introduction to financial markets: Money vs. Capital market, Primary & Secondary markets, Stock exchanges in India: NSE, BSE, MCX, Role of SEBI and regulatory framework, Market participants: FIIs, DIIs, retail, HNIs Demat & Trading accounts, clearing & settlement (T+1 cycle)		
Unit II: Equity Market Instruments & Trading Mechanism	8	CO2
Types of securities: Equity, preference shares, debentures, IPO Process and Book Building, Market indices: Nifty, Sensex (construction & relevance), Order types: market, limit, stop-loss, Trading mechanisms: intraday vs. delivery, Circuit breakers, price bands, margin systems		
Unit III: Technical & Fundamental Analysis	8	CO3
Charts: Line, bar, candlestick, Patterns: head & shoulders, double top/bottom, triangles, Indicators: Moving Average, RSI, MACD, Bollinger Bands Fundamental analysis: P&L statement, Balance Sheet, Cash Flow Key ratios: EPS, P/E, ROE, Debt-equity ratio, DCF Model basics		
Unit IV: Derivatives and Mutual Funds	8	CO4
Introduction to Derivatives: Futures and Options, Hedging, speculation, arbitrage, Option chain, Greeks (basic understanding), Mutual funds: Types, NAV, SIP, SWP, AUM, ETFs and Index Funds, Fund selection and performance metrics		
Unit V: Portfolio Management & Regulatory Environment	8	CO5
Risk-return analysis and investor profiling, Asset allocation & diversification strategies, Basics of portfolio construction, Regulatory bodies: SEBI, AMFI, NISM, Insider trading, corporate governance, taxation (STCG, LTCG), Investor protection and grievance redressal		

Text Books	
1	Indian Financial System" By M. Y. Khan
2	McGraw Hill Education (Covers capital markets, SEBI, trading mechanisms, mutual funds)
Reference Books	
1	"Security Analysis and Portfolio Management" – S. Kevin, PHI Learning
2	"Fundamentals of Financial Markets" – V. A. Avadhani, Himalaya Publishing
3	"Fundamental Analysis for Investors" – Raghunathan V., McGraw Hill
4	NSE Academy Certified Capital Market Professional (E-NCCMP) modules
5	NISM Series: Equity Derivatives & Mutual Funds Distributor Study Material

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KDK College of Engineering, Nagpur

B. Tech.

CE/ ME/ EE/ CSE/ IT/ AI&DS/ ETC Engineering

Semester V	Subject Code:	Name of Subject:		
	5BOE03T - G	Climate Change		
Total Distribution per week				
Total Credit: 3	Lecture (L): 3	Tutorial (T): 0	Practical (P): 0	
Examination Scheme				
Continuous Assessment	Mid Semester Examination	End Semester Examination	Total Marks	Examination Duration:
20 Marks	30 Marks	50 Marks	100 Marks	3 Hrs

Course Objectives	
1	Understand the scientific principles underlying climate change.
2	Explore the causes and evidence of global warming and climate change.
3	Analyze the impacts of climate change on ecosystems, societies, and economies
4	Examine national and international climate policies, treaties, and frameworks.
5	Identify engineering and technological strategies for climate mitigation and adaptation.

Course Outcomes	
After completion of syllabus, the student will be able to	
1	Explain the basic science of climate systems and greenhouse effect.
2	Interpret evidence and data supporting global climate change.
3	Assess environmental, social, and economic impacts of climate change.
4	Describe national and international responses and frameworks like UNFCCC, Kyoto Protocol, Paris Agreement.
5	Propose technological and policy-based solutions to mitigate and adapt to climate change.

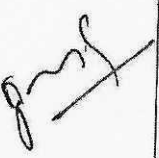
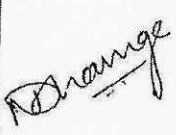
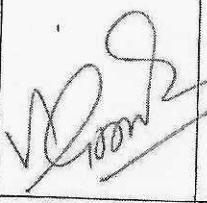
Course Competencies	
1	Inculcate the scientific basis of climate systems and global warming.
2	Analyze climate change impacts and interpret related environmental data.
3	Evaluate global climate policies and propose strategies for mitigation and adaptation.

CO_PO Mapping											
	Programme Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	2	-	-	-	-	-	-	-	-	2
CO2	-	3	-	2	2	-	-	-	-	-	3
CO3	-	2	-	-	3	2	-	-	2	2	-
CO4	-	-	-	-	3	3	-	-	-	2	2
CO5	-	2	3	2	2	3	3	1	1	2	-

Course Contents		Mapped with CO
Unit I: Climate Science Fundamentals	8	CO1
Earth's energy balance and the greenhouse effect, Natural vs anthropogenic causes of climate change, Role of carbon cycle and feedback mechanisms, Climate models and prediction tools		
Unit II: Evidence of Climate Change	8	CO2
Observed temperature and precipitation trends, Melting glaciers, sea-level rise, ocean acidification, IPCC reports and global climate data sources, Regional climate change patterns in India		
Unit III: Impacts of Climate Change	8	CO3
Environmental: biodiversity, forests, oceans, Social: health, migration, and agriculture, Economic: infrastructure, energy, and livelihoods, Case studies: floods, droughts, cyclones		
Unit IV: Climate Change Governance	8	CO4
Global treaties: UNFCCC, Kyoto Protocol, Paris Agreement, National policies: NAPCC, SAPCCs (India's response), Role of international bodies: IPCC, UNEP, COP summits, Climate finance and carbon trading		
Unit V: Mitigation and Adaptation Strategies	8	CO5
Renewable energy technologies and carbon capture, Sustainable urban and industrial design, Disaster-resilient infrastructure, Behavioral and lifestyle changes, Role of engineers in climate innovation		

Text Books	
1	1. Climate Change: From Science to Sustainability" by A. Barrie Pittock – Earthscan
2	"Global Warming: Understanding the Forecast" by David Archer – Wiley
3	"Introduction to Climate Change" by D. G. Martin – Oxford University Press

Reference Books	
1	IPCC Sixth Assessment Report (AR6) – https://www.ipcc.ch
2	India's National Action Plan on Climate Change (NAPCC) – https://moef.gov.in
3	"The Climate Solution" by Mridula Ramesh – Hachette India
4	UN SDG Goal 13 Reports – https://sdgs.un.org/goals/goal13

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. VI Semester Electrical Engineering

Electrical Engineering				
Semester VI	Subject Code: 6BEE01T	Name of Subject: Power Electronics		
Total Hours Distribution per week				
Total Credit: 4	Lecture (L): 4Hrs	Tutorial (T) : -	Practical (P): -	
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives:

Students will develop the ability to:-

1. Describe the characteristics and operating principles of power semiconductor devices.
2. Examine the performance of controlled rectifiers and dual converters.
3. Analyze the operation of DC-DC converters, AC voltage controllers, and cycloconverters.
4. Assess the performance of inverters and PWM control techniques.
5. Evaluate the role of power electronic converters in industrial drives and power system applications.

Course Outcomes

After successful completion of the course, students will be able to:-

CO1	Differentiate various power semiconductor devices based on their construction, characteristics, and applications.
CO2	Investigate the performance of controlled rectifiers and dual converters considering harmonics and power factor improvement.
CO3	Examine the operation and performance of choppers, AC voltage controllers, and cycloconverters.
CO4	Assess the performance of inverters and PWM techniques used in DC-AC conversion..
CO5	Evaluate the application of power electronic converters in industrial drives and power transmission systems.

Course Competencies:

On successful completion of the course, students will attain the following competencies:

1. Evaluate power semiconductor devices and power electronic converters for efficient electrical energy conversion and control.
2. Apply power electronic techniques and converter systems in electrical drives and power system applications such as UPS, SVC, and HVDC transmission.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	2	2	1	-	-	2	2	1
CO2	3	3	2	3	2	2	2	1	-	-	2	2	1
CO3	3	3	2	3	2	2	2	1	-	-	2	2	1
CO4	3	2	2	2	2	2	2	1	-	-	2	2	1
CO5	3	3	2	3	2	2	2	1	-	-	2	2	1

SYLLABUS

Details of Topic	Hours	Mapped with CO
Unit 1: Power Semiconductor Devices:	10	CO1
Characteristics and ratings of SCR, TRIAC, DIAC, GTO, Power Transistor, MOSFET, and IGBT, di/dt and dv/dt rating of SCR, pulse triggering method, Natural and Forced Commutation circuits		
Unit 2: AC to DC Converters:	10	CO2
Single-phase and three-phase fully controlled and Half-controlled converters with R/RL loads, Effect of freewheeling diode, Rectifier with Line commutated inverter operation, harmonic analysis, power factor improvements, Dual Converter		
Unit 3: DC to DC Converters (Choppers), AC Voltage Controllers and Cycloconverters:	9	CO3
Principle of operation, classification (A, B, C, D, E), step-up/step-down techniques, Current Limit Control, technique, PWM techniques. Single-phase and three-phase AC voltage controllers, and cycloconverters for AC-AC conversion.		
Unit 4: DC to AC Converters (Inverters):	9	CO4
Single phase Series Inverter, Single-phase bridge inverter, three-phase bridge inverters 180 and 120 degree mode, current source inverters, voltage control technique in inverter, PWM control technique SPWM, MPWM, Sin PWM		
Unit 5: Power Electronics Applications:	10	CO5
D.C. Motor Speed Control using ac to dc converter, Chopper fed DC Drives, Induction motor speed control using Stator voltage, Rotor resistance control, Slip Power Energy recovery schemes, UPS, Static reactive power control SVC, HVDC		

Text Books

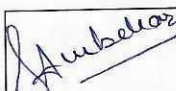
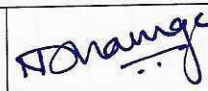
1. Power Electronics by Vedam Subrahmanyam New Age International.
2. Power Electronics by M.D. Singh and Khanchandani. Tata McGraw Hill
3. Power Electronics by P.C.Sen
4. Thyristors and their Applications by G.K.Dubey , Joshi , Doradla and Sinha New Age Publication

References Books

1. Power Electronics by Ned Mohan, Tora Undeland , William P Robbins John Wiley and Sons.
2. Power Electronics circuits Devices and Applications by M.H.Rashid PHI

NPTEL Link:

1	https://nptel.ac.in/courses/108101126 FUNDAMENTAL OF POWER ELECTRONICS, PROF. L UMANAND Department of Electronic Systems Engineering IISc Bangalore
2	https://nptel.ac.in/courses/108105066 Power Electronics, IIT Kharagpur Prof. D.Prasad, Prof. N.K. De, Dr. D.Kastha, Prof. Sabyasachi Sengupta

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. VI Semester Electrical Engineering

Semester Electrical Engineering			
Semester VI	Subject Code: 6BEE01P	Name of Subject: Power Electronics Laboratory	
Total Hours Distribution per week			
Total Credit: 1	Lecture (L):	Tutorial (T) :-	Practical (P): 2 Hr
Examination Scheme			
Continuous Assessment		End Sem Examination	Total Marks
25 Marks		25 Marks	50Marks

Practical Course Objectives

Students will develop the ability to:-

1. Design, simulation, and testing of power semiconductor devices and power electronic converters such as rectifiers, choppers, inverters, and AC voltage controllers.
2. Develop the ability to apply power electronic techniques and MATLAB/Simulink tools for motor drive control and modern industrial.

Practical Course Outcomes

After completing the practical course, students will be able to:-

CO1	Demonstrate the characteristics and operation of power semiconductor devices and their triggering circuits.
CO2	Analyze and verify the performance of AC-DC, DC-DC, and DC-AC power converters under different operating conditions.
CO3	Implement and evaluate control techniques for rectifiers, choppers, inverters, AC voltage controllers, and cycloconverters.

Course Competencies:

On successful completion of the course, students will attain the following competencies:

1. Demonstrate the operation and characteristics of power semiconductor devices and their triggering techniques.
2. Analyze the performance of various power electronic converters through experimentation under different operating conditions.
3. Model, simulate, and evaluate power electronic systems and control techniques using MATLAB/Simulink tools.

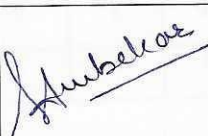
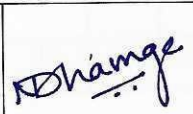
CO-PO Articulating Matrix:

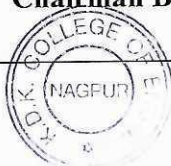
CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	2	-	-	-	-	-	1	3	1
CO2	3	3	2	3	2	-	-	-	-	-	1	3	2
CO3	3	3	3	2	3	-	-	-	1	1	1	3	3

LIST OF PRACTICALS:

Pr. No.	List of Practical's
1	To study and plot the V-I characteristics of SCR and determine its latching and holding currents.
2	To study the switching characteristics of Power MOSFET and IGBT.
3	To study and verify SCR triggering circuits using R, RC and UJT firing methods.
4	To study and verify the operation of single-phase fully controlled rectifier with R and RL loads.
5	To study the effect of firing angle and freewheeling diode on the performance of controlled rectifiers.
6	To study and verify the operation of a three-phase fully controlled rectifier.
7	To study and verify the operation of a step-down (Buck) chopper and analyze the effect of duty cycle variation.
8	To study and verify the operation of a step-up (Boost) chopper using PWM control technique.
9	To study and verify the performance of a single-phase AC voltage controller with R and RL loads.
10	To study and verify the operation of a single-phase cycloconverter for AC-to-AC frequency conversion.
11	To study and verify the operation of a single-phase bridge inverter and analyze its output waveform.
12	To simulate a three-phase bridge inverter operating in 120° and 180° conduction modes using MATLAB
13	To model and analyze the performance of a UPS system under various loading conditions using MATLAB.
14	To model and analyze PWM control techniques for DC-DC choppers using MATLAB/Simulink.
15	To generate and analyze SPWM waveforms for inverter control using MATLAB/Simulink.

(List is indicative. Minimum 8 practical's based on above syllabus covering all topics are expected.)

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. VI Semester Electrical Engineering

Semester VI	Subject Code: 6BEE02T	Name of Subject: Power System-II		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs.		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives

Students will develop the ability to:-

1. Analyze the operation and performance of various components of the modern power system
2. Modelling and control of various aspects of power system

Course Outcomes

After successful completion of the course, students will be able to:-

CO1	Apply per-unit representation and symmetrical component transformation to analyze balanced and unbalanced power system networks.
CO2	Analyze symmetrical and unsymmetrical faults in power systems
CO3	Analyze concepts of power system stability.
CO4	Evaluate the economic operation of power plants
CO5	Analyze load frequency control and excitation systems for maintaining stability

Course Competencies:

Students completing this course will develop the competency to:

1. Demonstrate the ability to analyze and solve power system operational and fault-related problems using engineering principles.
2. Assess system security through stability studies and selection of suitable protection methods.
3. Optimize power system operation through economic dispatch and automatic control strategies.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	2	2	1	-	-	2	2	1
CO2	3	3	2	3	2	2	2	1	-	-	2	2	1
CO3	3	3	2	3	2	2	2	1	-	-	2	2	1
CO4	3	2	2	2	2	2	2	1	-	-	2	2	1
CO5	3	3	2	3	2	2	2	1	-	-	2	2	1

SYLLABUS

Details of Topic	Hours	Mapped with CO
UNIT- I: Per Units & Symmetrical Component transformation		
Per-Unit representation of Power system– Selection of base quantities, percent and per unit values, advantage of per unit system, single line impedance diagram. Three phase power in unbalanced circuit in terms of symmetrical component. Sequence impedances of Generator. Transformer Transmission line & Passive loads.	7	CO1
Unit II: Symmetrical & Unsymmetrical fault analysis		
Symmetrical fault analysis without & with pre fault load current. L-G, L-L-G, L-L, open conductor faults analysis using symmetrical components. Selection of Circuit Breakers ratings, current limiting reactors.	10	CO2
Unit III: Power System Stability		
Dynamics of synchronous machine, Steady state and transient stability, Swing equation and its numerical solution, equal area criterion for transient stability, Application of equal area criterion for different disturbances, improvement of transient stability.	9	CO3
Unit IV: Economic operation of power plant		
Introduction, cost curves, heat rate, incremental rate, economic load sharing among generating units. Distribution of load between units Within the plant, Optimum generation scheduling considering with & without transmission losses.	7	CO4
Unit V: Power System Dynamics		
Turbines and speed governors, dependence of load on frequency & voltage effect of governor droop on load sharing among generators, Modelling and analysis of single area load-frequency control, supplementary control, and concept of control area. Role of excitation system, main & pilot exciters, description of different types of excitation systems.	7	CO5

Text Books

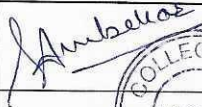
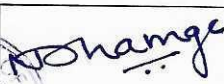
1. I.J. Nagrath, D. P. Kothari, Power System Engineering, Tata McGraw-Hill publications, 2008
2. Ashfaq Husain, Electrical Power System, CBS Publication, 5th Edition
3. C. L. Wadhwa, Electrical Power Systems, New Age International Publisher, 6th Edition
4. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand Publication, 2008

References Books

1. W.D. Stevenson, Elements of power system analysis, McGraw-Hill publications, 3rd Edition
2. O. I. Elgerd, Electric Energy Systems Theory: An Introduction, McGraw-Hill publications, 2nd Edition
3. Hadi Saadat, Power System Analysis, TMH, 2002
4. James A Momoh, Smart Grid : Fundamentals of Design and Analysis, Wiley 2012
5. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, "Smart Grid: Technology and Applications", Wiley 2012

NPTEL Link:

1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ee17 Power System Engineering By Prof. Debapriya Das IIT Kharagpur
2	https://nptel.ac.in/courses/117105140 Power System Analysis Prof. Debapriya Das, IIT Kharagpur

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. VI Semester Electrical Engineering

B. Tech. VI Semester Electrical Engineering				
Semester VI	Subject Code: 6BEE03T	Name of Subject: Energy Economics		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs.	Tutorial (T) : -		Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives

Students will develop the ability to:-

1. Provide knowledge of energy economics, energy resources, consumption patterns, and economic decision-making methods used in the energy sector.
2. Develop the ability to apply energy modelling, forecasting, market analysis, and techno-economic assessment techniques for sustainable energy planning and policy evaluation.

Course Outcomes

After successful completion of the course, students will be able to:-

CO1	Analyze the principles of energy economics, engineering economics, and economic analysis methods for energy projects.
CO2	Analyze energy demand-supply characteristics, energy resources, and consumption patterns
CO3	Apply energy modelling and forecasting techniques for energy planning and climate change studies.
CO4	Evaluate energy pricing mechanisms, energy markets, taxation policies, and regulatory aspects.
CO5	Examine sustainable energy policies and climate change mitigation measures.

Course Competencies:

Students completing this course will develop the competency to:

1. Estimate energy resources, energy markets, economic evaluation techniques,
2. Analyze sustainable energy policies for techno-economic decision making in conventional and renewable energy systems.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	1	2	-	-	2	2	3
CO2	3	3		1	-	-	2	-	-	-	2	2	3
CO3	3	3	2	2	2	-	2	2	-	-	2	2	3
CO4	2	3	1	-	-	1	2	1	-	-	3	2	3
CO5	2	3	2	1	-	2	3	2	-	-	2	2	3

SYLLABUS

Details of Topic	Hours	Mapped with CO
UNIT- I: Energy Economics		
Origin and Definitions of Energy Economics, Link between Economics and Energy, Energy Resources and Energy Commodities; Properties of Energy Resources and Energy Commodities, concept of Energy conservation and Energy efficiency. Basics of engineering economics, Role of engineering economics in the decision making process, Economic decisions versus design decisions, discount rate and economic equivalence, present-worth analysis, annual equivalent- worth analysis, rate-of-return analysis, depreciation, and taxation, developing project cash flows, social cost benefit analysis, Origins of renewable energy project risks, sensitivity analysis, break-even analysis, expected value decisions.	8	CO1
Unit II: Demand and Supply of energy		
Demand for Energy as a Derived Demand, National Energy, consumption, Economic Growth and World Energy Consumption, Demand substitution and energy use Classification of Energy supplies: renewable and non-renewable, Fossil fuels (coal, oil, natural gas), Renewable energy (Hydro, Marine, wind, solar, Geothermal, bio), Nuclear power, Trend and patterns of energy production.	9	CO2
Unit III: Energy Modelling		
Review of various energy sector models, energy demand analysis and forecasting, energy supply assessment and evaluation, energy demand – supply balancing, energy modelling in the context of climate change	9	CO3
Unit IV: Energy Prices and Markets		
Global and National scenario Trend and Patterns of Energy Consumption and the Energy Crisis (since 1970 the Oil shocks and other events), Basic pricing principles, short run versus long run marginal cost pricing, peak load, seasonal, sectoral pricing of electricity, pricing of natural gas and petroleum products, green power markets Energy Pricing and Taxation: Production Cost versus Return on Investment, Models of Pricing, Market Failures, Peak and Off-peak Pricing, Subsidies, The role of regulatory bodies like MERC, Energy Finance: Banks, International organizations, Green Finance initiatives	8	CO4
Unit V: Sustainable Development and Energy Policy		
Concept of Sustainable Development and SDGs, Energy Security: India's initiatives, Energy and Climate Change, Energy Efficiency and carbon emissions: Global and National trends, Energy Policy The Economics of Climate Change, Climate Change Background, Overview of GHG Emissions, Economic Approach to Control the Greenhouse Effect, Options to Cope with Global Warming, Generic Options, National Policy Options, Emissions Trading System (ETS)	8	CO5

Text Books

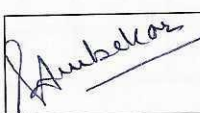
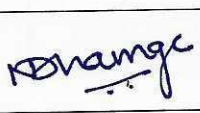
1. Bhattacharyya, S C. (2011), Concepts, Issues, Markets and Governance, Springer
2. Kandpal T.C. & Garg, H.P. (2003), Financial Evaluation of Renewable Energy Technologies, Macmillan India Park
3. C. S., Kim, G., & Choi, S. (2007). Engineering Economics. Pearson Prentice Hall, New Jersey.

References Books

1. Belli, P., Anderson, J., Barnum, H., Dixon, J., & Tan, J. P. (1998). Handbook on economic analysis of investment operations. The World Bank, Washington,
2. DC. Dahl, C. (2015). International Energy Markets: Understanding Pricing, Policies, & Profits.
3. PennWell Books. Desai, V. (1997). Guidelines for the economic analysis of projects. Asian Development Bank.

e-resource:

1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_hs136 NPTEL course on Energy Economics and Policy By Prof. Shyamasree Dasgupta IIT Mandi
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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. VI Semester Electrical Engineering

B. Tech. VI Semester Electrical Engineering				
Semester VI	Subject Code: 6BEE04T	Name of Subject: Distributed Generation		
Total Hours Distribution per week				
Total Credit: 3	Lecture (L): 3 Hrs.		Tutorial (T) : -	Practical (P): -
Examination Scheme				
Mid Sem Examination	Continuous Assessment	End Sem Examination	Total Marks	Examination Duration:
30 Marks	20 Marks	50 Marks	100 Marks	3 Hours

Course Objectives

Students will develop the ability to:-

1. Describe the fundamentals and classifications of distributed generation systems.
2. Examine renewable energy sources and their utilization in distributed generation applications.
3. Analyse power electronic converters, control strategies, and energy storage systems used in DG.
4. Assess the impact of distributed generation on power quality, protection, and system reliability.
5. Evaluate technical, economic, regulatory, and emerging trends associated with DG..

Course Outcomes

After successful completion of the course, students will be able to:

CO1	Analyze the principles, classifications, and benefits of distributed generation technologies.
CO2	Analyze solar PV, wind, biomass, and other renewable energy sources for distributed generation applications.
CO3	Apply power electronic converters and energy storage systems for efficient operation and control of DG systems.
CO4	Assess the impact of DG integration on power quality, protection, reliability, and grid performance.
CO5	Evaluate technical, economic, regulatory, and policy aspects of distributed generation systems.

Course Competencies:

Students completing this course will develop the competency to:

1. Analyze the principles and operation of distributed generation systems and renewable energy technologies.
2. Evaluate the performance of power electronic interfaces and energy storage systems employed in distributed generation.
3. Design and assess distributed generation systems considering grid integration, reliability, and sustainability requirements.

CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	1	-	-	-	1	2	3
CO2	3	3	2	1	2	-	2	-	-	-	1	3	3
CO3	3	3	3	2	3	-	1	-	-	-	2	3	3
CO4	3	3	2	2	2	1	2	-	-	-	1	3	3
CO5	2	3	2	1	-	1	2	1	-	-	2	2	3

SYLLABUS

Details of Topic	Hours	Mapped with CO
UNIT- I: Introduction to Distributed Generation	6	CO1
Concept and need for distributed energy generation, Centralized vs. decentralized generation Classification of DG technologies: renewable and non-renewable, Benefits: reliability, resilience, efficiency, environmental technical challenges in integration		
Unit II: Renewable Energy Technologies for Distributed Generation	9	CO2
Solar PV Systems: Operating principles, I-V and P-V curves, MPPT techniques, PV configurations: standalone, grid-connected, hybrid Design aspects and performance modeling Wind Energy Systems: Wind turbine types, power curves, site selection Wind generators: Squirrel cage, DFIG, PMSG Grid integration aspects. Other DG Sources: Biomass, small hydro, fuel cells, diesel generators, Working principles and applications.		
Unit III: Power Electronics and Energy Storage for Distributed Generation	9	CO3
Overview of power converters: DC-DC, DC-AC, AC-DC, Voltage source and current source inverters Control of inverters: frequency, voltage, and reactive power Energy storage technologies: batteries, supercapacitors Hybrid energy systems and energy management strategies.		
Unit IV: Grid Integration, Power Quality, and Protection	8	CO4
Operating modes: grid-connected, islanded, Synchronization techniques Standards and codes: IEEE 1547, IEC 61727, CEA regulations, Power quality issues: harmonics, flicker, voltage sags, Protection: anti-islanding, fault detection, coordination.		
Unit V: Technical and Economic Evaluation of Distributed Generation	8	CO5
Impact of DG on voltage profile, losses, and system reliability, Reactive power capabilities and VAR support, Economic analysis: CAPEX, OPEX, LCOE, payback period, Tariff mechanisms: net metering, TOD, feed-in tariffs.		

Text Books

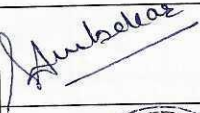
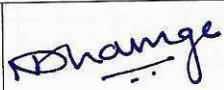
1. G. M. Masters, Renewable and Efficient Electric Power Systems, 3rd Edition, Wiley, 2021.
2. M. H. J. Bollen and F. Hassan, Integration of Distributed Generation in the Power System, Wiley-IEEE Press, 2011.

References Books

1. John Twedell and Tony Weir, Renewable Energy Resources, 4th Edition, Routledge, 2021.
2. Mukund R. Patel and Omar Faruque, Wind and Solar Power Systems: Design, Analysis, and Operation, 3rd Edition, CRC Press, 2021.
3. IEEE Std 1547-2018, Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces.

e-resource:

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|---|--|
| 1 | NPTEL Course Distributed Generation and Renewable Energy Integration, Prof. Ashish Pathak, NIT Delhi |
|---|--|

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. VI Semester Electrical Engineering

Semester Electrical Engineering			
Semester VI	Subject Code: 6BEE04P	Name of Subject: Distributed Generation Lab.	
Total Hours Distribution per week			
Total Credit: 1	Lecture (L):	Tutorial (T) : -	Practical (P): 2 Hr
Examination Scheme			
Continuous Assessment		End Sem Examination	Total Marks
25 Marks		25 Marks	50Marks

Practical Course Objectives	
Students will develop the ability to:-	
1. Provide practical knowledge of distributed generation technologies, renewable energy systems, and their operating principles. 2. Analyze, model, and evaluate the performance of distributed generation systems, power electronic converters, and energy storage systems. 3. Assess the technical, economic, and regulatory aspects associated with distributed generation and smart grid applications.	

Practical Course Outcomes	
After completing the practical course, students will be able to:-	
CO1	Analyze the performance characteristics of distributed generation technologies, renewable energy systems, and energy storage systems.
CO2	Apply simulation and experimental techniques to evaluate power electronic converters, grid integration, power quality, and protection aspects of distributed generation systems.
CO3	Assess the technical, economic, and regulatory aspects of distributed generation systems and modern smart grid applications.

Course Competencies:

Students completing this course will develop the competency to:

1. Apply renewable energy technologies and distributed generation systems for decentralized power generation applications.
2. Analyze the performance, control, and grid integration of distributed generation systems using modern simulation and analytical tools.
3. Evaluate the techno-economic and regulatory aspects of distributed generation and smart grid technologies.

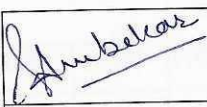
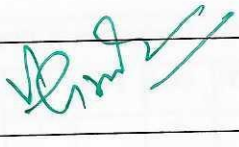
CO-PO Articulating Matrix:

CO	Program Outcomes & Program Specific Outcomes												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	-	1	-	-	-	1	2	3
CO2	3	3	2	1	2	-	2	-	2	1	1	3	3
CO3	3	3	3	2	3	-	1	-	1	2	2	3	3

LIST OF PRACTICALS:

Pr. No.	List of Practical's
1	To Study of various Distributed Generation technologies and their classifications.
2	Simulation of Solar PV characteristics (I-V and P-V curves).
3	To implement & analysis of Maximum Power Point Tracking (MPPT) techniques for PV systems.
4	Modeling and performance analysis of grid-connected and standalone Solar PV systems.
5	To Study and simulation of Wind Energy Conversion System characteristics and power curves.
6	To perform analysis of different wind generators (SCIG, DFIG and PMSG).
7	To Study of DC-DC converters used in distributed generation systems.
8	Simulation of Voltage Source Inverter (VSI) for DG applications.
9	To Control of inverter for voltage, frequency, and reactive power regulation.
10	To Study and comparison of energy storage systems (Battery and Supercapacitor).
11	Simulation of hybrid renewable energy systems with energy management strategies.
12	To study the Synchronization of distributed generation systems with the utility grid.
13	Analysis of power quality issues such as harmonics, voltage sag, and flicker in DG systems.
14	To Study of anti-islanding protection and fault detection techniques in DG systems.
15	Technical and economic evaluation of DG systems using LCOE and payback period calculations.

(List is indicative. Minimum 8 practical's based on above syllabus covering all topics are expected.)

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KDK College of Engineering, Nagpur
Faculty of Science and Technology
B. Tech. VI Semester Electrical Engineering

Semester VI					Subject Code: 6BEEMD04T					Name of Subject: Microcontroller & Interfacing				
Total Hours Distribution per week														
Total Credit: 3			Lecture (L): 3 Hrs.					Tutorial (T):			Practical (P): -			
Examination Scheme														
Mid Sem Examination			Continuous Assessment			End Sem Examination			Total Marks			Examination Duration:		
30 Marks			20 Marks			50 Marks			100 Marks			3 Hours		

Course Objectives

Students will develop the ability to:-

1. Understand the architecture, organization, memory structure, and operational features of the 8051 Microcontrollers.
2. Develop assembly language and embedded C programs using various addressing modes and instruction sets of the 8051.
3. Analyze and configure timers, counters, interrupts, and serial communication modules of the 8051 Microcontrollers.
4. Design and implement interfacing of peripheral devices such as displays, keyboards, ADCs, DACs, sensors, and actuators.
5. Develop Microcontroller-based embedded solutions for real-time monitoring and control applications.

Course Outcomes

After successful completion of the course, students will be able to:

CO1	Explain the architecture, memory organization, and functional features of the 8051 Microcontroller.
CO2	Develop assembly language and embedded C programs using the instruction set and addressing modes of the 8051 Microcontrollers
CO3	Analyze and implement timer, counter, interrupt, and serial communication functions in 8051-based embedded systems.
CO4	Design interfacing circuits for displays, sensors, ADCs, DACs, and actuators using the 8051 Microcontroller.
CO5	Design and evaluate microcontroller-based solutions for real-time monitoring and control applications.

Course Competencies:

Students completing this course will develop the competency to:

1. Understand microprocessor and Microcontroller architectures.
2. Apply knowledge to design interfacing with peripherals.
3. Develop assembly programs and debug systems.
4. Analyze Microcontroller-based embedded systems.

CO-PO Articulating Matrix:

CO-PO Articulating Matrix:														
CO	Program Outcomes & Program Specific Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	2	1	2	-	-	-	3	-	-	1	-	
CO2	3	3	3	2	3	-	-	-	1	1	1	1	-	
CO3	3	3	3	3	3	-	-	-	1	1	1	2	-	
CO4	3	3	3	3	3	1	-	-	2	1	2	3	-	
CO5	3	3	3	3	3	1	1	-	2	2	2	3	-	

Syllabus

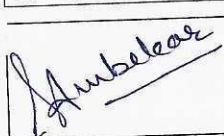
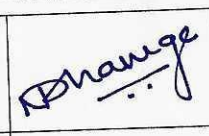
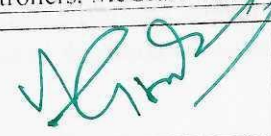
Details of Topic	Hours	Mapped with CO
Unit-I Introduction to Microcontrollers and 8051 Architecture -		
Introduction to Embedded Systems, Microprocessor versus Microcontroller, Applications of Microcontrollers, Overview of MCS-51 Family, Architecture of 8051 Microcontroller, CPU Organization, Memory Organization (RAM, ROM, SFRs), Register Banks and Program Status Word (PSW), Functional Description, Clock Generation and Reset Circuit	8	CO1
Unit-II 8051 Instruction Set and Programming		
Programming Model of 8051, Addressing Modes, Data Transfer Instructions, Arithmetic Instructions, Logical Instructions, Branch and Program Control Instructions, Bit Manipulation Instructions, Assembly Language Programming Concepts, Embedded C Programming for 8051.	8	CO2
Unit-III		
Timers and Counters - Timer Registers, Timer Modes (0, 1, 2, and 3), Delay Generation, Event Counting Applications Interrupts - Interrupt Structure of 8051, Interrupt Vector Table, Interrupt Priority and Enable Registers, Interrupt Programming Serial Communication - UART Architecture, Serial Communication Modes, Baud Rate Generation, RS-232 Interface, Serial Communication Programming.	8	CO3
Unit-IV Interfacing Techniques with 8051		
Display and Input Device Interfacing - LED Interfacing, Seven Segment Display Interfacing, Matrix Keyboard Interfacing, LCD (16x2) Interfacing, ADC Interfacing, DAC Interfacing, . .	8	CO4
Unit-IV Advanced Interfacing and Applications		
External Memory Interfacing, Stepper Motor Interfacing, Relay and Actuator Interfacing, Traffic Light Controller, Temperature Monitoring System, Design Considerations for Embedded Systems.	8	CO5

Text Books

1. Mazidi, M. A., Mazidi, J. G., and McKinlay, R. D., The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson Education.
2. Ayala, K. J., The 8051 Microcontroller, Cengage Learning.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education.

References Books

1. Myke Predko, Programming and Customizing the 8051 Microcontroller, McGraw-Hill.
2. D. V. Hall, Microprocessors and Interfacing, McGraw-Hill.
3. John Peatman, Design with Microcontrollers, McGraw-Hill.

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