P.K.UNIVERSITY, SHIVPURI (MP)
(FACULTY OF ENGINEERING & TECHNOLOGY)

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH.

ELECTRICAL ENGINEERING

ON

CHOICE BASED CREDIT SYSTEM (CBCS)

[Effective from the Session: 2022-23]

P.K.University,Vill-Thanra,Teh-Karera,Distt-Shivpuri (M.P.) 473665

EVALUATION SCHEME (2022-23)
B.TECH ELECTRICAL ENGINEERING
3rd Year (5th & 6th Semester)

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 3rd /Semester -5th

Subject Code	Subjects Name	Study Scheme Periods/Week			Credits	Marks in Evaluation Scheme						Total Marks of Internal & External
						Internal Assessment			External Assessment			
		L	T	P		Th	Pr	Total Internal	Th	Pr	Total External	Grand Total
UMANAEX501	Managerial Economics	4	0	0	4	30	-	30	70	-	70	100
UELECEX502	Electrical Machines-II	4	0	0	4	30	-	30	70	-	70	100
UINDUEX503	Industrial Sociology	3	0	0	3	30	-	30	70	-	70	100
UPOWEXE504	Power Transmission & Distribution	4	0	0	4	30	-	30	70	-	70	100
UCONTEX505	Control System	4	0	0	4	30	-	30	70	-	70	100
UINTEEX506	Internet of Things	4	0	0	4	30	-	30	70	-	70	100
UELECEX507	Electrical Machines-II Lab	0	0	2	1	-	25	25	-	25	25	50
UCONTEX508	Control System Lab	0	0	2	1	-	25	25	-	25	25	50
USOFTEX509	Software Based Power System Lab	0	0	2	1	-	25	25	-	25	25	50
Total		23	0	6	26	180	75	255	420	75	495	750
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												375

Study And Evaluation Scheme For B.Tech Electrical Engineering

Year- 3rd /Semester -6th

Subject Code	Subjects Name	Study Scheme Periods/Week			Credits	Marks in Evaluation Scheme						Total Marks of Internal & External
						Internal Assessment			External Assessment			
		L	T	P		Th	Pr	Total Internal	Th	Pr	Total External	Grand Total
UINDUEX601	Industrial Management	3	0	0	3	30	-	30	70	-	70	100
UPOWEEX602	Power System Analysis	4	1	0	5	30	-	30	70	-	70	100
USPECEX603	Special Electrical Machines	3	0	0	3	30	-	30	70	-	70	100
UPOWEEX604	Power Electronics	4	1	0	5	30	-	30	70	-	70	100
UMICREX605	Microprocessor	4	0	0	4	30	-	30	70	-	70	100
UPOWEEX606	Power Electronics Lab	0	0	2	1	-	25	25	-	25	25	50
UMICREX607	Microprocessor Lab	0	0	2	1	-	25	25	-	25	25	50
UELECEX608	Electrical Design & Fabrication Lab	0	0	2	1	-	25	25	-	25	25	50
Total		19	2	6	23	150	75	225	350	75	425	650
For pass the candidate is required to obtain 40% marks in each paper and 50% marks in aggregate.												325

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5thSemester

UMANAEX501: Managerial Economics	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. To recognize the knowledge on concepts and principles of Managerial Economics.
2. To describe and relate to the market the concepts of Demand and Supply.
3. To identify and recognize the Production Function concept and Cost Analysis.
4. To recognize the knowledge on Market structures and Game theory.
5. To describe National Income concept and types of Business Cycles.

Unit	Contents	Hours
1	**Introduction of Engineering Economics and Demand Analysis:** Meaning and nature of Economics, Relation between science, engineering, technology and economics; Meaning of Demand, Determinants of Demand, Shifts in demand, Law of Demand, Price Elasticity of Demand &Types, Income Elasticity, Cross price Elasticity, Determinants of Elasticity, uses and importance of elasticity.	**06**
2	**Concept of Supply:** Law of Supply, Factors affecting Supply, Elasticity of supply. **Demand Forecasting:** Introduction, Meaning and Forecasting, Methods or Techniques of Demand Forecasting, Criteria for Good Demand Forecasting, Demand Forecasting for a New Product;	**06**
3	**Cost Analysis-** Introduction, Types of Costs, Cost-Output Relationship: Cost Function, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in the Long Run; Short run and long run, Break- Even Analysis; Production functions: laws of variable proportions, law of returns; Economies of scale: Internal and external.	**06**

4	**Market Structure:** Market Structure Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.	**06**
5	Nature and characteristics of Indian economy, concepts of LPG, elementary concepts of National Income, Inflation and Business Cycles ,Concept of N.I. and Measurement., Meaning of Inflation, Types and causes , Phases of business cycle .Investment decisions for boosting economy(National income and per capital income)	**06**

Suggested Readings / Books

1. D.M. Mithani, ―Managerial Economics Theory & Applications‖ 2017, 8th Ed, Himalaya Publishing House.
2. Premvir Kapoor, Sociology and Economics for Engineers, Khanna Publishing House (Edition 2018)

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5thSemester

UELECEX502:Electrical Machines-II	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Demonstrate the constructional details and principle of operation of three phase Induction and Synchronous Machines.
2. Analyze the performance of the three phase Induction and Synchronous Machines K3 using the phasor diagrams and equivalent circuits.
3. Select appropriate three phase AC machine for any application and appraise its significance.
4. Start and observe the various characteristics of three phase Induction & Synchronous Machines
5. Explain the principle of operation and performance of Single-Phase Induction Motor & Universal Motor.

Unit	Contents	Hours
1	**Synchronous Machine-I** Constructional features, Armature winding, EMF Equation, Winding coefficients, Equivalent circuit and phasor diagram, Armature reaction, O.C.& S.C. tests, Voltage regulation using Synchronous Impedance method, MMF method, Potier's Triangle method, Parallel operation of synchronous generators, Operation on infinite bus, Synchronizing power and torque co-efficient.	**10**
2	**Synchronous Machine-II** Two reaction theory, Power flow equations of cylindrical and salient pole machines, operating characteristics. Synchronous Motor-Starting methods, Effect of varying field current at different loads, V- curves, Hunting & damping, Synchronous condenser.	**10**

3	**Three phase Induction Machine–I** Constructional features, Rotating magnetic field, Principle of operation, Phasor diagram, Equivalent circuit, Torque and power equations, Torque-slip characteristics, No-load & blocked rotor tests, Efficiency, Induction generator & its applications	**08**
4	**Three phase Induction Machine-II** Starting, Deep bar and double cage rotors, Cogging &Crawling, Speed control (with and without emf injection in rotor circuit)	**06**
5	**Single phase Induction Motor** Double revolving field theory, Equivalent circuit, No-load and blocked rotor tests, Starting methods, Repulsion motor, Universal motor, Brushless DC Motors.	**06**

Suggested Readings / Books

1. D.P. Kothari &I.J. Nagrath, "Electric Machines", Tata Mc GrawHill

2. Smarajit Ghosh, "Electric Machines", Pearson

3. Fitzerald, A.E., Kingsley and S.D. Umans, "Electric Machinery", McGraw Hill.

4.P.S.Bimbhra,"ElectricalMachinery",KhannaPublisher

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5thSemester

UELECEX507:Electrical Machines-II Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Perform various tests and demonstrate the various characteristics of three phase induction motor.
2. Demonstrate the working of three phase synchronous machine under different operating conditions.
3. Evaluate the performance of single-phase induction motor under different operating conditions.
4. Develop simulation models for Electrical Machines.

Note: Minimum ten experiments are to be performed from the following list, out of which there should be at least two software based experiments.

1. To perform no load and blocked rotor tests on a three phase squirrel cage induction motor And determine equivalent circuit.
2. To perform load test on a three phase induction motor and draw Torque -speed characteristics
3. To perform no load and blocked rotor tests on a single phase induction motor and determine equivalent circuit.
4. To study speed control of three phase induction motor by varying supply voltage and by keeping V/f ratio constant.
5. To perform open circuit and short circuit tests on a three phase alternator and determine.

   Voltage regulation at full load and at unity, 0.8 lagging and leading power factors by

(i) EMF method (ii) MMF method.

6. To determine V-curves and inverted V-curves of a three phase Synchronous motor.
7. To determine Xd and Xq of a three phase salient pole synchronous machine using the slip test and to draw the power-angle curve.
8. To study synchronization of an alternator with the infinite bus by using:

   (i) Dark lamp method (ii) two bright and one dark lamp method.
9. To determine speed-torque characteristics of three phase slip ring induction motor and study the effect of including Resistance or capacitance in the rotor circuit.
10. To determine speed-torque characteristics of single phase induction motor and study the Effect of voltage variation.
11. To determine speed-torque characteristics of a three phase induction motor by

    (i) Keeping v/f ratio constant (ii) increasing frequency at the rated voltage.
12. To draw O.C. and S.C. characteristics of a three phase alternator from the experimental Data and determine voltage regulation at full load, and Unity, 0.8 lagging and leading Power factors.
13. To determine steady state performance of a three phase induction motor using equivalent circuit.

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5thSemester

UINDUEX503: Industrial Sociology	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Ability to grasp the intellectual and social origins of the emergence of Sociological Theories.
2. Ability to cultivate sociological perspectives and apply those in understanding the social issues.
3. Understand the sociology for specific purpose.
4. Be able to understand the human needs and adjust accordingly the set goals.

Unit	Contents	Hours
1	Industrial Sociology: Nature, Scope and Importance of Industrial Sociology. Social Relations in Industry, Social Organization in Industry- Bureaucracy, Scientific Management and Human Relations.	**06**
2	Rise and Development of Industry: Early Industrialism – Types of Productive Systems – The Manorial or Feudal system. The Guild system, the domestic or putting-out system, and the Factory system. Characteristics of the factory system. Causes and Consequences of industrialization. Obstacles to and Limitations of Industrialization.	**06**
3	Industrialization in India. Industrial Policy Resolutions – 1956.Science. Technology and Innovation Policy of India 2013.	**06**

4	Contemporary Issues: Grievances and Grievance handling Procedure. Industrial Disputes: causes, Strikes and Lockouts. Preventive Machinery of Industrial Disputes: Schemes of Workers Participation in Management- Works Committee, Collective Bargaining, Bi-partite & Tri-partite Agreement, Code of Discipline, Standing Orders. Labour courts & Industrial Tribunals.	**06**
5	Visualizing the future: Models of industrialization- Collectivist, anarchist, free market, environmentalist, etc. Cultural issues, consumer society and sociological concerns.	**06**

References:

1. PREMVIR KAPOOOR, Sociology & Economics for Engineers, Khanna Publishing House (Edition 2018).
2. GISBERT PASCAL, Fundamentals of Industrial sociology, Tata McGraw Hill, New Delhi1972.
3. SCHNEIDER ENGNO V., Industrial Sociology 2nd Ed., McGraw Hill Publishing Co., New Delhi, 1979.
4. MAMORIA C.B. And MAMORIA S., Dynamics of Industrial Relations in India.
5. SINHA G.P. and P.R.N. SINHA, Industrial Relations and Labour Legislations, New Delhi, Oxford and IBH Publishing Co., 1977.

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5th Semester

UPOWEEX504: Power Transmission & Distribution	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the general structure of power system, different supply system, rules and phenomena related to transmission line.
2. Be capable of calculating parameters of overhead transmission line.
3. Be capable of evaluating the performance of different types overhead transmission lines.
4. Be capable of analysis of mechanical and electrical design aspects of transmission system.
5. Impart the knowledge of insulated cables and neutral grounding.
6. Impart the knowledge of EHV AC and HVDC transmission.

Unit	Contents	Hours
1	**Power System Components:** Single line diagram of Power system, Brief description of power system Elements: Synchronous machine, transformer, transmission line, bus bar, circuit breaker and isolator. **Supply System:** Different kinds of supply system and their comparison, choice of Transmission Voltage. **Transmission Lines:** Configurations, types of conductors, resistance of line, skin effect, Kelvin's law, Proximity effect.	**08**
2	**Over Head Transmission Lines:** Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines Representation and performance of short, medium and long transmission lines, Ferranti effect, and Surge impedance loading.	**10**
3	**Corona and Interference:** Phenomenon of corona, corona formation, calculation of potential gradient, corona loss, factors affecting corona, methods of reducing corona and interference Electrostatic	**06**

	and electromagnetic interference with communication lines. **Overhead line Insulators:** Type of insulators and their applications, potential distribution over a string of insulators, methods of equalizing the potential, string efficiency.	
4	**Mechanical Design of transmission line:** Catenary curve, calculation of sag & tension, effects of wind and ice loading, sag template, vibration dampers. **Insulated cables:** Type of cables and their construction, dielectric stress, grading of cables, insulation resistance, capacitance of single phase and three phase cables, dielectric loss, heating of cables.	**08**
5	**Neutral grounding:** Necessity of neutral grounding, various methods of neutral grounding, earthing transformer, grounding practices. **Distribution Systems:** Distribution system layout, Introduction of Distribution System, Primary & Secondary distribution, Design consideration, distribution system losses, Classification of Distributed system- Radial Ring interconnected systems, Stepped distribution	**08**

Text Books:

1. W.D. Stevenson, ―Element of Power System Analysis‖, McGraw Hill

2. C.L. Wadhwa, ―Electrical Power System‖, New age international Ltd. Third Edition

3. AsfaqHussain, ―Power System‖, CBS Publishers and Distributors

4. B. R. Gupta, ―Power System Analysis and Design‖, Third Edition, S. Chand & Co.

5. M. V. Deshpande, ―Electrical Power System Design‖, Tata McGraw Hill

6. S. Sivanagaraju & S. Satyanarayana, ―Electric Power Transmission and Distribution‖, Pearson Education

7. Kothari &Nagrath, ―Power System Engineering‖,Tata McGraw-Hill Education

8. T.A. Short, ―Electric Power Distribution Handbook‖, CRC Reference Books:

9. Soni, Gupta &Bhatnagar, ―A Course in Electrical Power ―, Dhanpat Rai & Sons

10. S.L. Uppal, ―Electric Power‖, Khanna Publishers

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5th Semester

UCONTEX505: Control System	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Impart the knowledge of open loop and close loop control system, servomechanism.
2. Do modeling of mechanical, electrical and electro-mechanical systems by differential equations.
3. Learn about representation of the system by transfer function, block diagram reduction technique and signal flow graph.
4. Analyze the system response and stability in both time-domain and frequency domain.
5. Make students capable of designing of P, PI and PID controllers.
6. Impart the knowledge of Root Locus Technique and State variable Techniques.
7. Learn the features of different types of compensators and to design compensators using time-domain and frequency domain specifications.

Unit	Contents	Hours
1	**Control System Concepts:** Concept of Control system, Physical Systems and their Mathematical Modeling, Constructional and working of AC & DC servomotor, synchros, stepper motor and tachometer. Transfer function models, Block diagram algebra, Signal flow graph, Mason's gain formula, Open loop and closed loop systems and their sensitivity analysis.	**08**
2	**Time Response Analysis:** Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants. Design specifications of second order systems, Proportional, Derivative, Integral and PID compensations, design considerations for higher order systems and performance indices.	**08**

3	**Stability and Algebraic Criteria:** Concept of stability and its necessary conditions, Routh-Hurwitz criteria and its limitations. **Root Locus Technique:** Root contour, Construction of root loci, Effect of transportation lag and Root locus of non-minimal phase system and Effect of pole-zero cancellation.	**08**
4	**Frequency Response Analysis:** Frequency Response analysis from transfer function model, Construction of polar and inverse polar plots. **Stability in Frequency Domain:** Nyquist stability criterion, Determination of gain and phase margin from Bode & Nyquist Plots, Nichol Charts, Correlation between time and Frequency Responses.	**08**
5	**Introduction to Design:** The design problems and preliminary considerations of lead lag and lead-lag compensation networks, design of closed loop systems using compensation techniques in time and frequency domains. **State Space Technique:** The concept of state & space, State-space model of physical system, conversion of state-space to transfer function model and vice-versa, Similarity transformation of the control system, Concept of controllability and observability and their testing.	**08**

Text Books:

1. Nagrath & Gopal, ―Control System Engineering‖, new age International.
2. K. Ogata, ―Modern Control Engineering‖, Pearson India.
3. B.C. Kuo & Farid Golnaraghi, ―Automatic Control System‖ McGraw Hill, 2018.
4. D. Roy Choudhary, ―Modern Control Engineering‖, Prentice Hall of India.
5. Ambikapathy, ―Control Systems‖,Khanna Publishers.

Department of Electrical & Electronics Engineering
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P.K. University, Shivpuri (MP)
3rd Year/5th Semester

UCONTEX508: Control System Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: The minimum of 10 experiments are to be performed from the following, out of which at least three should be software based.

1. To determine response of first order and second order systems for step input for various values of Constant 'K' using linear simulator unit and compare theoretical and practical results.
2. To study P, PI and PID temperature controller for an oven and Compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode Plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output vs input characteristics
7. To determine speed-torque characteristics of an ac servomotor.
8. To study performance of servo voltage stabilizer at various loads Using load bank.
8. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.
9. To study characteristics of positional error detector by angular displacement of two Servo potential- Meters.

Software based experiments (Use MATLAB, LABVIEW etc. or equivalent open source freeware software like Scilab using Spoken Tutorial MOOCs)

10. To simulate PID controller for transportation lag.
11. To determine time domain response of a second order system for Step input and obtain Performance Parameters.
13. To convert transfer function of a system into state space form And vice-versa.
14. To plot root locus diagram of an open loop transfer function and Determine range of gain _k' fir Stability.
15. To plot a Bode diagram of an open loop transfer function.
16. To draw a Nyquist plot of an open loop transfers functions and Examine the stability of the Closed loop system.

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5th Semester

UINTEEX506: Internet of Things	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Able to understand the application areas of IOT.
2. Able to realize the revolution of Internet in Mobile Devices, Cloud &Sensor Networks.
3. Able to understand building blocks of Internet of Things and characteristics.
4. Explain the function blocks, three-layer model and five-layer model of IoT
5. Describe privacy, security and design related challenges of IoT
6. Describe IoT applications in the field of Electrical Engineering

Unit	Contents	Hours
1	**IoT Web Technology** The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	**08**
2	**IoT Applications for Value Creation Introduction** IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing	**08**

	Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, e Health.	
3	**Internet of Things Privacy, Security and Governance** Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps towards a Secure Platform, Smarty Approach. Data Aggregation for the IoT in Smart Cities, Security.	**06**
4	**Architectural Approach for IoT Empowerment** Introduction, Defining a Common Architectural Ground, IoT Standardization,M2M Service Layer Standardization, OGC Sensor Web for IoT, IEEE, IETF and ITU-T Standardization activities, Interoperability , Physical vs. Virtual, Solve the Basic First, Data Interoperability, Semantic Interoperability, Organizational Interoperability, Eternal Interoperability, Importance of Standardization, Plan for Validation and testing, Important Economic Dimension, Research Roadmap for IoT Testing Methodologies. Semantic as an Interoperability Enabler and related work.	**08**
5	**Identity Management Models in IoT** Introduction, Vulnerabilities of IoT, Security requirements, Challenges for a secure Internet of Things, identity management, Identity portrayal, Different identity Management model: Local identity, Network identity, Federated identity, Global web identity, Identity management in Internet of Things, User-centric identity management, Device-centric identity management, Hybrid identity management.	**08**

Text Books/ Reference Books:

1. Olivier Hersent,DavidBoswarthick, Omar Elloumi, ―The Internet of Things key applications and protocols‖,Wiley
2. Adrian McEwen,HakinCassimally, ‖Designing the Internet of Things‖ Wiley India

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/5th Semester

UCONTEX09: Software Based Power System Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following List-

1. Calculate the parameters of single phase transmission line.

2. Calculate the parameters of three phase single circuit transmission line.

3. Calculate the parameters of three phase double circuit transmission line.

4. Determine the ABCD constant for transmission line.

5. Simulate the Ferranti effect in transmission line.

6. Calculate the corona loss of transmission line.

7. Calculation of sag & tension of transmission line.

8. Calculation of string efficiency of insulator of transmission line.

9. Calculation for grading of underground cables.

10. Simulate the skin effect in the transmission line

11. Calculation of ground clearance of transmission line

12. Calculate the parameters for underground cable

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/6th Semester

UINDUEX601:Industrial Management	
Credit:3	**Max Marks:100 (IA:30,ETE:70)**
3L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

On successful completion of this course, the students will be able:

1. Understand the basic concept of Industrial management and its types and ownership.
2. Know the functions of management with the help of scientific theory and human resource management.
3. Know the objective and measurement in work study and use the different model of inventory control.
4. Design the control chart for variable and attributes in statistical quality control and implementing sampling plan.
5. Analyze the project management scheme in project network analysis

Unit	Contents	Hours
1	Introduction: Concept and scope of Industrial Management. Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.	06
2	Functions of Management, Taylor‘s Scientific Management Theory, Fayol‘s Principles of Management, Social responsibilities of Management, Introduction to Human resources management: Nature of HRM, functions and importance of HRM.	06

3	Work Study: Introduction, definition, objectives, steps in work study, Method study: definition, objectives, steps of method study, Work Measurement: purpose, types of study — stop watch methods — steps — allowances — standard time calculations — work sampling, Production Planning and Control Inventory Control: Inventory, Cost, Models of inventory control: EOQ, ABC, VED	**06**
4	**Quality Control:** statistical quality control, Control charts for variables and attributes, Acceptance Sampling- Single sampling- Double sampling plans, Introduction to TQM.	**06**
5	**Project Management:** Project network analysis, CPM, PERT and Project crashing and resource leveling.	**06**

Reference Books:

1. Engineering Management (Industrial Engineering & Management)/ S.C. Sharma & T.R. Banga, Khanna Book Publishing Co. (P) Ltd., Delhi (ISBN: 978-93-86173-072)
2. Industrial Engineering and Management/ P. Khanna, Dhanpatrai Publications Ltd.
3. Production & Operation Management /PaneerSelvam /PHI.
4. Industrial Engineering Management/NVS Raju/Cengage Learning.
5. Industrial Engineering Management I RaviShankar/ Galgotia.

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/6th Semester

UPOWEEX602:Power System Analysis	
Credit:5	**Max Marks:100 (IA:30,ETE:70)**
4L+1T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Develop mathematical model of a given power system.
2. Analyze the steady state condition of Power System using Power Flow Analysis.
3. Analyze the behavior of the power system under faulted condition.
4. Illustrate the stability status of power system under transient condition.

Unit	Contents	Hours
1	**Representation of Power System Components:** Synchronous machines, Transformers, Transmission lines, One-line diagram, Impedance and reactance diagram, per unit system. Symmetrical Components: Symmetrical Components of unbalanced phasors, power in terms of symmetrical components, sequence impedances and sequence networks.	08
2	**Symmetrical Fault Analysis:** Transient if R-L series circuit, calculation of 3-phase short circuit current and reactance of Synchronous machine, internal voltage of loaded machines under transient conditions. **Unsymmetrical Faults:** Analysis of single line to ground fault, line-to-line fault and Double Line to ground fault on an unloaded generators and power system network with and without fault impedance. Formation of Z bus using singular transformation and algorithm, computer method for short circuit calculations.	08
3	**Load Flows:** Introduction, bus classifications, nodal admittance matrix (YBUS), development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, approximation to N-R method, line flow equation sand fast decoupled method.	08

4	**Power System Stability:** Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion and step-by-step method. Factors affecting steady state and transient stability and methods of improvement.	**08**
5	**Traveling Waves:** Wave Equation for uniform Transmission lines, velocity of propagation, surge impedance, reflection and transmission of traveling waves under different line loadings. Bewlay's lattice diagram, protection of equipment and line against traveling waves.	**08**

Text Books:

1. W.D. Stevenson, Jr. ―Elements of Power System Analysis‖,McGraw Hill.

2. C.L. Wadhwa, ―Electrical Power System‖, New Age International.

3. Chakraborthy, Soni, Gupta &Bhatnagar, ―Power System Engineering‖, DhanpatRai&Co.

4. T.K. Nagsarkar& M.S. Sukhija, ―Power System Analysis‖ Oxford University Press, 2007.

Department of Electrical & Electronics Engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
3rd Year/6th Semester

USPECEX603: Special Electrical Machines	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Study the basic concept of poly phase induction machines.
2. Understand the basic principle and working of induction generator.
3. Explain the basic concept of poly phase Stepper Motors.
4. Analyses the basic principle and working of Permanent Magnet Machines.
5. Differentiate between different type poly phase Single Phase Commutator Motors.

Unit	Contents	Hours
1	**Poly-phase AC Machines:** Construction and performance of double cage and deep bar three phase induction motors; e.m.f. injection in rotor circuit of slip ring induction motor, concept of constant torque and constant power controls, static slip power recovery control schemes (constant torque and constant power)	08
2	**Induction Generator:** SEIG, DFIG: Operating Principle, Equivalent Circuit, Characteristics, and Application Two Phase AC Servomotors: Construction, torque-speed characteristics, performance and applications.	06
3	**Stepper Motors:** Principle of operation, variable reluctance, permanent magnet and hybrid stepper motors, characteristics, drive circuits and applications. Switched Reluctance Motors: Construction; principle of operation; torque production, modes of operation, drive circuits.	08

4	**Permanent Magnet Machines:** Types of permanent magnets and their magnetization characteristics, demagnetizing effect, permanent magnet dc motors, sinusoidal PM A C motors, brushless dc motors and their important features and applications, PCB motors. Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors; introduction to permanent magnet generators and applications	**10**
5	**Single Phase Commutator Motors:** Construction, principle of operation, characteristics of universal and repulsion motors; Linear Induction Motors. Construction, principle of operation, linear force, and applications.	**06**

Text Books:

1. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.

2. P.C. Sen "Principles of Electrical Machines and Power Electronics" Johnwilley&Sons, 2001

3. Cyril G. Veinott "Fractional and Sub-fractional horse power electric motors" McGraw Hill International, 1987

4. M.G. Say "Alternating current Machines" Pitman & Sons.

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UPOWEEX604: Power Electronics	
Credit:5	**Max Marks:100 (IA:30,ETE:70)**
5L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Understand the characteristics as well as the operation of BJT, MOSFET, IGBT, SCR, TRIAC and GTO and identify their use in the power switching applications.
2. Ability to comprehend the non-isolated DC-DC converters and apply their use in different Power electronics applications.
3. Analyze the phase-controlled rectifiers and evaluate their performance parameters.
4. Ability to apprehend the working of single-phase ac voltage controllers, cyclo-converters and their various applications.
5. Ability to analyze a inverter for single and three phase system.

Unit	Contents	Hours
1	**Power semiconductor devices:** Introduction: Concept of Power Electronics, scope and applications, desired Characteristics of controllable switches **Power semiconductor switches and their characteristics:** Power Diode, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, and GTO.	08
2	**Thyristor:** Rating & protection, Methods of SCR commutation, Gate Drive Circuit, Series and Parallel operation. **DC-DC Converters:** Introduction, Control Strategies, Buck converter, Boost Converter, Buck-Boost converter, Analysis of buck converter, Switched Mode power Supply (SMPS).	06

3	**Phase Controlled Converters:** Single phase half wave controlled rectifier with various loads, Effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters with various loads. Performance Parameters of single phase uncontrolled and controlled converters. Three phase half wave converters, three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters	**10**
4	**AC Voltage Controllers:** Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads, sequence control, Introduction to Matrix converter. **Cyclo Converters:** Basic principle of operation, single phase to single phase, three phase to single phase output voltage equation.	**10**
5	**Inverters:** Single phase and Three phase bridge inverters, VSI, CSI, Voltage control of single phase inverters, PWM Techniques, Introduction to Multi level inverter.	**06**

Text Books:

1. M.H. Rashid,―Power Electronics: Circuits, Devices & Applications‖, Pearson India,4th Edition, 2018.

2. Ned Mohan, T.M.Undeland and W.P.Robbins, ―Power Electronics: Converters, Applications and Design‖, Wiley India Ltd,2008

3. P.C. Sen, ―Power Electronics‖, McGraw Hill Education (India) Pvt. Ltd.

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UPOWEEX606: Power Electronics Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: The minimum of 10 experiments is to be performed out of which at least three should be software based.

1. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
2. To study V-I characteristics of SCR and measure latching and holding Currents.
3. To compare the R, RC &UJT trigger circuit for SCR.
4. To study the commutation circuit for SCR.
5. To study single phase fully controlled bridge rectifiers with resistive and Inductive loads.
6. To study single phase fully controlled bridge rectifiers with DC motor load.
7. To study three-phase fully controlled bridge rectifier with resistive and Inductive loads.
8. To study single-phase ac voltage regulator with resistive and inductive loads.
9. To study single phase cyclo-converter
10. To study the four quadrant operation of chopper circuit
11. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments (PSPICE/MATLAB or equivalent open source freeware Software like Scilab using Spoken Tutorial MOOCs)

12. To obtain the simulation of single phase half wave controlled rectifier with R and RL load and plot load voltage and load current waveforms.
13. To obtain simulation of single phase fully controlled bridge rectifier and Plot load voltage and load current waveform for inductive load.
14. To obtain simulation of single phase full wave ac voltage controller and draw load Voltage and load current waveforms for inductive load.
15. To obtain simulation of step down dc chopper with L-C output filter for Inductive load and Determine steady-state values of output voltage ripples in output voltage and load Current.

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UMICREX605: Microprocessor	
Credit:4	**Max Marks:100 (IA:30,ETE:70)**
4L+0T+0P	**End Term Exams: 3 hrs.**

Course Outcome: - On successful completion of this course, the students will be able:

1. Study of microprocessor system
2. Development of flow chart for understanding the data flow.
3. Learning assembly language to program microprocessor-based system.
4. Interfacing different peripheral devices with microprocessor.
5. Building logic for microprocessor-based system

Unit	Contents	Hours
1	**Introduction to Microprocessor:** Introduction to Microprocessor and its applications, Microprocessor Evolution Tree, Microprocessor Architecture (Harward & Princeton), General Architecture of the Microprocessor and its operations, Component of Microprocessor system: Processor, Buses, Memory, Inputs-outputs (I/Os) and other Interfacing devices.	**08**
2	**8-bit Microprocessor:** **Intel 8085 microprocessor:**Pin Diagram, Internal architecture: ALU, Registers, Timing and control unit, interrupt: **Instruction Set of 8085:** Instruction format, op-codes, mnemonics, no. of bytes computation of the instruction, Machine cycles and Tstates and Execution time computation of an instruction. Classification of instruction with their examples. Writing of assembly Language programs.	**06**
3	**16-bit Microprocessor:** **Architecture of Intel 8086:** Pin Diagram, Bus Interface Unit, Execution unit, Register organization, Memory addressing, Memory Segmentation, Pipelining, Min &	**10**

	Max operating Modes **8086Instruction set**: Format, Addressing Modes, and Instruction Set Groups: Data transfer, Arithmetic, Logic, String, Branch control transfer and Processor control. Interrupts: Hardware and software interrupts.	
4	**Fundamental of Programming:** Program structure for microprocessors, Flowcharts of series, parallel, and controls structures. **Assembler Level Programming:** Memory space allocation for monitor and user program. Assembly language program using Debug or MASM assembler.	**10**
5	**Peripheral Interfacing:** Programmed I/O, Memory Mapped I/O, and Interrupt Driven I/O, DMA I/O interface, Serial and Parallel communications. **Peripheral Devices:** DMA controller (Intel 8237), Programmable peripheral interface (Intel 8255), Programmable timer/counter (Intl 8253/8254), Programmable Interrupt Controller (Intel 8259).	**06**

Text Books:

1. Gaonkar, Ramesh S, ―Microprocessor Architecture, programming and applications with the 8085‖ Pen ram International Publishing 5th Ed.

2. Avtar Singh& Walter A. Triebel ―8088 & 8086 Microprocessor‖ Pearson Education.

3. Ray, A.K. &Burchandi, K.M., ―Advanced Microprocessors and Peripherals:Architecture, Programaming and Interfacing‖ Tata Mc. Graw Hill.

4. AK Gautam, ―Advanced Microprocessors‖, Khanna Publishers.

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UMICREX607: Microprocessor Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

A. Study Experiments (any two):

1. To study 8085 based microprocessor system
2. To study 8086 and 8086A based microprocessor system
3. To study Pentium Processor B. Programming based Experiments (any four):
4. To develop and run a program for finding out the largest/smallest number from a given set of numbers.
5. To develop and run a program for arranging in ascending/descending order of a set of Numbers
6. To perform multiplication/division of given numbers
7. To perform conversion of temperature from 0F to 0C and vice-versa
8. To perform computation of square root of a given number
9. To perform floating point mathematical operations (addition, subtraction, multiplication and Division)

B. Interfacing based Experiments (any four):

10. To obtain interfacing of RAM chip to 8085/8086 based system
11. To obtain interfacing of keyboard controller
12. To obtain interfacing of DMA controller
13. To obtain interfacing of PPI
14. To obtain interfacing of UART/USART
15. To perform microprocessor based stepper motor operation through 8085 kit
16. To perform microprocessor based traffic light control
17. To perform microprocessor based temperature control of hot water.

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UELECEX608:Electrical Design & Fabrication Lab	
Credit:1	**Max Marks:50 (IA:25,EA:25)**
0L+0T+2P	**End Term Exams: 2 hrs.**

Note: Minimum ten experiments are to be performed from the following list:

1. PCB Design & Fabrication.
2. Transformer design & Fabrication.
3. Small Power Supply design & Fabrication.
4. Filter design & Fabrication.
5. Controller design & Fabrication.
6. Inductor design and Fabrication.
7. Measurement of electrical parameters of AC & DC machine.
8. Design & Fabrication of High Power factor controlled rectifier.
9. Design & Fabrication of Microcontroller based digital energy meters / sensors.
10. Design & Fabrication of Power amplifier.
11. Design Fabrication of AC phase converter and its firing circuit.
12. IGBT based single phase inverter design and Fabrication.
13. Design & Fabrication of chopper.