B. Tech. Fifth Semester Electrical Engg(CBCS)

MICROPROCESSOR AND MICROCONTROLLERS (BTCHEE501T)

Objectives:

The course objectives are:

1. To study fundamentals of microprocessor and microcontroller systems.

2. To study architecture of microprocessor & to understand the concept of memory organization, stack memory, Assembly language programming.

3. To study different interrupt techniques.

4. To study interfacing of microprocessor & microcontroller with different peripheral devices.

Outcome:

After completing this course students shall be able to:

1. Describe internal organization of 8085 and 8086 microprocessors and 8051microcontrollers.

2. Describe the concept of addressing modes and timing diagram of Microprocessor.

3. Interface 8085& 8051 with Keyboard/ Display, ADC/DAC, Stepper motor etc.

4. Demonstrate the concept of interrupts and its use.

5. Demonstrate the concept of Serial & parallel data communication

6. Describe Handshaking concept and interfacing with peripheral devices.

7. Interface various hardware with microprocessor and microcontroller.

Unit 1:

Approach to integrated system design using Microprocessors. Introduction to Intel's 8085A Architecture description, Flag register, Addressing modes, complete instruction set.

Unit 2 :

Instruction cycle and timing diagram, Stack operation with PUSH POP intsruction, 8085 Interrupts and ISR, CALL/RETURN instruction, Memory interfacing with 8085, linear and absolute decoding, Assembly Language programming of 8085.

Unit 3 :

8255 PPI architecture, Pin discripations, operating modes, BSR and I/O modes, IN and OUT instruction, Interfacing and 8255 with 8085, Interfacing of LEDs/Keys/display devices using 8255 PPI. 8253/54 programmable timer architecture, modes and interfcaing with 8085.Introduction to 8086 processor

Unit 4:

Difference between microprocessor & microcontroller, Architecture and Programming Model of 8051, PSW, Instruction Set, Addressing modes and Assembly Language Programming, Stack, Interrupt , Timers, Serial Communication, SFRs.

Unit 5:

Interfacing and Programming of - Memory, LED / LCD Display, Keyboard, Stepper & DC Motor, A/D and D/A convertors with 8051. Introduction to Arduino.

Text Books:

1. Programming and interfacing 8085A, Gaonkar, Wiley Eastern

2. Programming of 8085, D.V. Hall, McGraw Hill

3. Microprocessor principals and Applications Pal Tata Mc Graw Hill

4. The 8051 Microcontroller and Embedded system, M.A. Mazidi & J.G. MazidiPearson Eduction

Reference Books:

1. Intel Reference Manuals, Microprocessors & Microcontrollers: Intel

2. Microcontrollers – Peatman, Mc Graw Hill.

3. Microprocessors & Microcomputers based system design by Md. Rafiquzzaman.

4. The 8051 Microcontroller & Embeded Systems, Kenneth J. Ayala, Dhanvijay V. Gadre, CENGAGE Learning

5. Microprocessors principals and Applications Gomorra Tata Mc Graw Hill

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RTMNU , Nagpur University, Electrical Engineering 5th Semester B.Tech (CBCS) Subject name:- Control Systems Subject Code : BTCHEE502T Syllabus (Theory)	
Sr. No.	**Course Objective The Objective of this course is**
1	To study modeling and transfer function of linear time-invariant system
2	To understand the stability, time domain specifications and tools
3	To understand classical controller/compensator design for linear system
4	To study frequency domain analysis of linear system
5	An introduction to state space approach and to understand the theory state transition matrix

Course Outcome

After successful completion of this course the students will be able to:	
CO1	Model the linear systems and study the control system components specifications through classical approach.
CO2	Understand the time response and time response specifications and different controllers.
CO3	Analyze the absolute stability and analyze the relative stability through root locus method.
CO4	Frequency response tools like bode plot and nyquist plot
CO5	Understand the concepts of state variable approach

Unit No	**Description**	**Hours**
Unit-I	**Introduction to Control System:** Need of control system, Open loop control and closed loop control, Significance of actuators and sensors, Control system Components (DC/AC servomotors, potentiometer, synchro), Mathematical representation of simple mechanical, electrical and electromechanical systems, Transfer function, Block diagram representation and reduction. Signal flow graph.	**10 Hours**
Unit-II	**Time Response Analysis:-** 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, dominant poles, Time response specifications of second order system, Different types of Controllers(PD,PI,PID, Introduction of LAG, LEAD compensation.	**09 Hours**
Unit-III	**Stability analysis & Root locus**: Stability of control systems, condition of stability, characteristics 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.	**10 Hours**

Unit-IV	**Frequency Domain Analysis** Concept of frequency response of a dynamical system. Construction of Bode plot, the stability margin on Bode plot and assessing close-loop stability. Construction of polar plot for a system. Nyquist stability criterion and stability margin. Effect of gain variation and addition of poles and zeroes on the frequency response plots.	**8 Hour**
Unit-V	**State Variable Analysis:-** Concept of state, state variable and state model, Systems state model with physical variable, phase variable and canonical variables with state diagram, Transfer function from state model, Stability of state space model.	**9 Hours**

Books Recommonded

Text Books:

1 ModerncontrolsystemEngineerring by K.Ogatta , Publisher - PrenticeHall,India

2 ControlSystemAnalysis by Nagrath/Gopal , Publisher- NewageInternational

3 AutomaticControlSystems by B.C.Kuo, Publisher - PrenticeHall,India

4 ControlSystemEngineering by S.K.Bhattacharya, Publisher - Pearson

ReferenceBooks :

1 LinearSystemDesign by D'azzoandHoupis, Publisher- McGrawHill

2 ControlSystems,Principles&Design by M. Gopal Publisher - TMH(TataMcGrawHill)

3 ControlSystemsEngineering by SamarajitGhosh Publisher - Pearson

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RTMNU, Nagpur University - Electrical Engineering

5th Sem B.Tech. Semester- Power Electronics- BTCHEE503T

Syllabus (Theory)

Sr. No.	Course Objective
1.	To introduce students to understand construction, operation and various characteristics of SCR.
2.	To familiarize students to the different types of power semiconductor devices and their switching Operation, characteristics and performance parameters.
3.	To understand basic operation of AC to DC conversion system.
4.	To understand operation and application of DC to AC power conversion system with harmonic reduction methods.
5.	Operation, switching techniques and basics topologies of DC-DC switching
	Course Outcome
After successful completion of this course students will be able to demonstrate the ability to have	
CO-1	Knowledge of different types of semiconductor switches and their characteristics.
CO-2	Knowledge of different types of power conversion system with their operation.
CO-3	Knowledge of various rectifier circuits at loading conditions.
CO-4	Knowledge of various operating modes of inverter and control circuits.
CO-5	Knowledge of different DC –DC conversion circuit & four quadrant operation.

Syllabus (Power Electronics)	
Content	**No. of Hours**
Unit-I **SCR:** SCR, its characteristics (v-i, Turn On & Turn Off characteristics), ratings, Triggering requirements (GATE Characteristics), Triggering circuits (R, RC & UJT relaxation oscillator), Series & Parallel connections (only introduction). **Protection of SCR:** Over voltage, over current, dv/dt, di/dt protection, Snubber circuit.	**8**
Unit-II **Static controllable switches:** Structure, characteristics & performance of MOSFET, GTO, IGBT, TRIAC, DIAC. Gate driver circuits for MOSFET, IGBT. **Commutation techniques of SCR:** Natural commutation (only working), Forced Commutation A, B, C, D, E & F.	**10**
Unit-III **Rectifier:** Line commutated 1φ & 3φ Half (Semi) & fully controlled bridge converters, quadrant of operation, circuit configuration, performance parameters, input-output waveforms for R, RL loads, effect of freewheeling diode. **Dual converters:** circulating current type & non-circulating current type.	**10**
Unit-IV **Inverter:** Single Phase Series Inverter, 1Phase bridge inverter & 3φ bridge inverters (120° & 180° Modes), output voltage control, Harmonic reduction by PWM Tech. (SPWM, MPWM, SinPWM), Working of CSI, Comparison of VSI& CSI. **Cycloconverter (1φ):** working & limitations	**9**

Unit-V **Chopper:** Buck (Step Down), Boost (Step Up), Choppers, Two Quadrant & Four Quadrant operation of Chopper, Output Voltage Control Techniques: Currentlimit control, Time ratio control. **Applications of power electronic** in Renewable energy system, Smart grid & Electric vehicles. (Only Block Diagram description)	**8**

Books Recommended:

Text Books:

1) Power Electronics circuits Devices and Applications by M. H. Rashid, Prentice Hall India
2) Power Electronics, by M.D.Singh & Khanchandani , Tata McGraw Hill
3) Power Electronics by P.C.Sen.
4) Thyristors and their Applications by G.K.Dubey and Doralda, Joshi and Sinha , New Age

Reference Books:

1) Power Electronics", Ned Mohan, Tora M. Udeland, William P. Riobbins, John Wiley & sons

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5thSEM, B.Tech.- Advanced Electrical Power System (BTCHEE504T)

Syllabus(Theory)

Teaching Scheme	Theory-03	-	Practical-00	Total-3
Examination Scheme	Internal Assessment-30	End Semester Assessment-70		Total-100

Sr No	Course Objective The objective of this course is-
3.51	Understanding of power system concepts like analysis of symmetrical and unsymmetrical faults using symmetrical components as a tool
2	Knowledge of power system stability
3	Appreciation of economics, control & management of power system

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Apply symmetrical components concepts in fault analysis
CO2	Evaluate fault currents for different types of faults
CO3	Appreciate concepts of power system stability.
CO4	Understand methods to control the voltage, frequency and power flow
CO5	Understand economic operation of power system.

Syllabus (Advanced Power System)

Content	No. of Hours
Unit I: Symmetrical Component transformation: Three phase power in unbalanced circuit in terms of symmetrical component. Sequence impedances of Generator. Transformer Transmission line & Passive loads. Phase shift in star/ delta three phase transformer (Yd1, Yd11 connection.).	06
Unit II: Symmetrical & Unsymmetrical fault analysis: Symmetrical fault analysis without & with pre fault load current. L-G, L-L-G, L-L, open conductors faults analysis using symmetrical components. Selection of Circuit Breakers ratings, current limiting reactors.	08
Unit III : Stability of Power System- Steady state, Dynamic and Transient stability definition. Dynamics of synchronous machine, swing equation, swing equation for machines swinging coherently and Non-Coherently. Power angle equation. Steady state stability studies. **Transient stability studies:** - Swing curve. Equal Area criterion for transient stability. Application of equal area criterion for different disturbances. Solution of swing equation by point by point method. Methods of improving transient stability..	10
Unit V Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators	09
Unit IV Economic operation of power system: Introduction, Distribution of load between units Within the plant Optimum generation scheduling considering transmission losses. Representation of transmission loss using loss formula coefficient. Derivation of loss formula co-efficient, simulation of co-ordination equation on digital computer.	07

Books Recommended: -

Text Book

1. W.D. Stevenson Jr., Elements of power system analysis, McGraw-Hill publications, 3rd Edition
2. O. I. Elgerd, —Electric Energy Systems Theory‖, McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, —Power System Analysis‖, Pearson Education Inc., 1999.
4. D. P. Kothari and I. J. Nagrath, —Modern Power System Analysis‖, McGraw Hill Education, 2003.
5. C. L. Wadhwa- Electrical Power System, New Academic Science Limited,2012

Reference Book

1. Hadi Saadat, Power System Analysis , TMH , 2002
2. J. Grainger and W. D. Stevenson, —Power System Analysis‖, McGraw Hill Education, 1994.
3. Prabha Kundur, Power System Analysis and Control , TMH, 2008
4. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, —Electric Power Systems‖, Wiley, 2012.

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RTMNagpurUniversity-ElectricalEngineering
5thSEM,B.Tech.- Power Station Practice(BTCHEE5O5T)
Syllabus(Theory)

Sr No	Course Objective The objective of this course is-
1	Solve the load problems along with the load study of practical parameters.
2	Understand the practical aspects of working of all conventional power stations.
3	Understand the workings of major equipment's, different excitation systems, captive and cogeneration.

Course Outcomes

Aftersuccessfulcompletionofthiscoursethestudentwillbeableto:

CO1	Understand various sources of electrical energy and different factors related to generating stations and connected load.
CO2	Study general layout, major equipment's and auxiliaries in thermal power station.
CO3	Understand the basic principle of hydro power station.
CO4	Learn basics of nuclear power generation.
CO5	Understand the different excitation systems, captive and cogeneration

Syllabus (Power Station Practice)

Content	No. of Hours
Unit I **Sources of Electrical Energy: -** Coal, oil and natural gas water power, nuclear fission and fusion, their scope and potentialities for energy conversion. **Different Factors Connected with A Generating Station: -** Connected Load, Maximum Demand, Demand Factor, Load Factor, Diversity Factor, Plant Capacity and Utilization Factor, Load Curve, Load Duration Curve, Load Survey, Base Load and Peak Load Station, Advantages of Interconnection.	08
Unit II Thermal Station: - Choice of Site, Location, Size and number of Units, General Layout, Major Equipment, Essential and Non-Essential Auxiliaries, Electric Supply to Auxiliaries, Cost of Generation, Factors Affecting Costs of Generation, Depreciation of Plant	08
Unit III Hydro Station: - Hydrology, Stream Flow, Flow Duration Curve, Power Duration Curve, Mass Curve, Reservoir Capacity, Type of Hydro Plants and their field of Use, Pumped Storages Plants and their Utility, Surge Tanks, Governing Characteristics of Turbine and Hydro Generators.	08
Unit IV Nuclear Station: - Principle of Nuclear energy, materials, types of nuclear reactors, breeder reactors, location, material for moderator and control rods, cost economics.	08
Unit V **Voltage Control of A.C. Generator: -** Exciter instability, methods of stabilizing exciter voltage, Automatic voltage regulator action. **Cogeneration, Captive Power Generation & Sustainable Development** Definition and scope, cogeneration technologies, industries suitable for cogeneration, captive generation advantages, and constraints, captive generation options, type of captive power plants, financing of captive power plants, Energy problems, prospects of changes in energy supply, agenda for sustainable development.	08

Books Recommended: -

Text Book

1. **B. R. Gupta**, "Generation of Electrical Energy",7th Edition- 2017 S.CHAND AND COMPANY LTD.
2. **M.V. Deshpande,**"Elements of Electrical Power Station Design"2010, PHI Learning Pvt. Ltd., New Delhi.

Reference Book

1. **Paul Breeze** "Power Generation Technology" 2005, Elsevier Science.
2. **Thomas Henry Carr** "Electric Power Stations", Chapman & Hall.

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RTM Nagpur University-Electrical Engineering
5th Sem, B.Tech.- (Electrical Machines-II) - (BTCHEE5O5T)

Sr. No.	The Course Objective The objective of this course
1.	Understand the basics of speed control & different types breaking in AC & DC Machines.
2.	Understand the Voltage regulation method of alternator & parallel operation, two reaction theory.
3.	Power flow and applications of synchronous motors
4.	Transient behavior of synchronous machine.

Course Outcomes	
After successful completion of this course the student will be able to	
CO1	To explain speed control & electric braking in AC & DC machines
CO2	To analyses & compare Voltage regulation method & parallel operation of alternator
CO3	To explain two reaction theory of salient pole synchronous machine & slip test.
CO4	To analyses power flow in synchronous machine, comparison, applications and working of reluctance motor & PM ac motors.
CO5	To describe Transient behavior of synchronous machine under the sudden short circuit, determination of reactance's.

Syllabus (Electrical Machines-II)

Contents	No of Hours
Unit-I Crawling & cogging phenomenon, induction generator, Speed control of Induction Machines, speed control by supply frequency or V/F control, stator voltage control, number of poles controlling method, cascaded connection, rotor rheostat control. Electric braking method of induction motor & dc motors, dynamic or rheostatic, plugging and regenerative braking methods.	8Hrs
Unit-II Voltage regulation of alternator & parallel operation, phasor diagram on load, voltage regulation by Zero power factor (ZPF) method, construction of potier triangle, condition for synchronization, methods of synchronization	8Hrs
Unit-III Two reaction theory of salient pole rotor machine, Power angle characteristics, phasor diagram of salient pole rotor machine, slip test, expression of synchronizing power, effect of change in input or mechanical torque.	8Hrs
Unit-IV Power flow in synchronous motor, condition for maximum power developed, Hunting & prevention, Synchronous condenser, applications, comparison of synchronous motor & I.M, Reluctance motors & permanent magnet AC Motors.	8Hrs

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Unit-V Transient behavior of synchronous machine, short circuit ratio, sequence components, sudden three phase short circuit, constant flux linkage theorem, Transient, sub-transient reactance's & time constants, equivalent circuit diagram, determination of negative and zero sequence reactance.	8Hrs

Books Recommended

1. I.J.Nagrath and D.P.Kothari, " Electrical Machines", Tata Mcgraw hill, 3rd edition 2010

2. Dr. P.S. Bhimbra, "Electrical machinery" Khanna publication.

3. P.K.Mukherji, s chakravarti, "Electrical machines", Dhanpat rai, publication

4. Asfaque Hussain "Electric Machines", Dhanpat rai, publication, 2nd edition,2008

5. A.E.Fitzerald, c.kingsley, s.d.umens, " Electrical Machinery", Mcgraw hill first edition, 1985.

Reference Book

1. M. G. Say," Alternating current machines", fifth edition, E.L.B.S. Publication

2. A.F. Puchstein, T.C. Lloyd, A.G. Conrad, "Alternating current machines", John Wiley and Sons, New York 1954.

3. P.C. Sen, "Principles of Electric Machines and Power Electronics ", John Wiley and Sons, Publication, second edition 1997.

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RTMNagpurUniversity-ElectricalEngineering

5thSEM,B.Tech.- Electrical Power Utilization(BTCHEE5O5T)

Syllabus(Theory)

Sr No	Course Objective The objective of this course is-
1	Understand the concept of various Heating, Welding methodologies, Illumination methods and traction supply system.
2	Appreciative of the concepts of Electrolysis processes, DG system

Course Outcomes	
Aftersuccessfulcompletionofthiscoursethestudentwillbeableto:	
CO1	Understand use of electric energy for industrial heating.
CO2	Study the use of electrical energy in electric welding
CO3	Learn basics of Illumination and design of lighting schemes for Various applications
CO4	Understand pumps and DG systems and evaluate their performance.
CO5	Understand Electric Traction system with its power supply structure.

Syllabus (Electrical Power Utilization)

Content	No. of Hours
Unit I :-Electric Heating: Types and methods of electrical heating, advantages of electrically produced heat, types &application of electric heating equipments, transfer of heat. • Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating. • Induction heating: Core type & core less induction furnace & application • Dielectric heating: Principle and application. • Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.	08
Unit II Electric Welding: - Importance, Advantages & Disadvantages of welding, classification of welding processes. Resistance welding, Butt welding, Spot welding, Seam welding, Electric arc welding, ultrasonic welding, laser beam welding.	08
Unit III Illumination:- Nature of light, terms used in illumination, solid angle, laws of illumination, Colour Rendering Index(CRI), Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, floodlighting, street lighting, energy saving in lighting systems.	08
Unit IV Pumps& DG Set: - **Pumps:-** Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, energy conservation opportunities in pumping system. **Diesel Generating Systems:** Introduction, selection and installation factors, operational factors, energy performanceassessment in DG sets, energy saving measures for DG sets.	08
Unit VElectric Traction Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment), Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve	08

Books Recommended: -

Text Book

1. **J.B. Gupta ,** "Utilization of Electric Power & Electric Traction" 10th Edition 2012, Reprint 2021, S. K. Kataria & Sons, New Delhi.
2. **H Partap , "**Art and Science of Utilization of Electrical Energy" Dhanpat Rai & Sons, Delhi
3. **Dr N. V.Suryanarayana,** "Utilization of Electrical Power", Wiley Eastern Ltd, New Age International
4. **George M. Chute**, **Robert D. Chute ,** "Electronics in Industry" McGraw Hill

Reference Book

1. **E. Openshaw Taylor** , "Utilization of Electric Energy", Orient Longman
2. Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency

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