SHRI RAWATPURA SARKAR UNIVERSITY, RAIPUR, CHHATTISGARH
FACULTY OF ENGINEERING

Two Years M.Tech. Programme

Scheme of Teaching and Examination

M.Tech. Third Semester Instrumentation & Techniques

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2022-2023)

S.No.	Course Code	Course Title	Hours / Week			Credits	Maximum Marks			Sem End Exam Duration (Hrs)
			L	T	P		Continuous Evaluation	Sem End Exam	Total	
1	MENIC301 T	Adaptive Control Systems	3	1	-	4	30	70	100	3
2	MENIC302 T	Elective-III	3	1	-	4	30	70	100	3
3	MENIC303 P	Technical paper writing and seminar	-	-	4	2	100	-	100	-
4	MENIC304 P	Pre Dissertation (Literature review/ Problem formulation/Synopsis)	-	-	28	14	60	140	200	-
						24			500	

Elective-III

(A) Analytical Instrumentation
(B) Real Time Systems
(C) Programmable Logic Controllers

<table>
<tr><td>Course Title</td><td colspan="5">Adaptive Control Systems</td></tr>
<tr><td>Course Code</td><td colspan="5">MENIC301T</td></tr>
<tr><td rowspan="2">Course Credits</td><td>L</td><td>T</td><td>P</td><td>TC</td><td></td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>4</td><td></td></tr>
<tr><td>Prerequisites</td><td colspan="5">Control Systems</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course will enable students to:
Assess the stability of autonomous and non-autonomous systems.
Design a model reference adaptive control system for a given system considering matched structured nonlinearities or uniformly bounded residual nonlinearities.
Address real-life problems during the design of a model-reference adaptive controller such as input constraints, disturbance rejection, partial measurements, and robustness.</td></tr>
<tr><td>Course Contents</td><td colspan="5">UNIT-I
Introduction:
Basic concepts and classification, Real-Time Parameter Estimation, Identification techniques; impulse response identification, parameter estimation, learning model approach.

UNIT-II
Adaptive control design:
Nodal reference adaptive control, input signal adaptive control. Practical application, adaptive autopilot, Auto-Tuning, Gain Scheduling, Self-tuning regulators

UNIT-III
Adaptive Regulators and Systems:
Deterministic Self-Tuning Regulators, Stochastic Adaptive Control, Stochastic and Predictive Self-Tuning Regulators, Model-Reference Adaptive Systems, Properties of Adaptive Systems
UNIT-IV</td></tr>
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	Robust and Self-Oscillating Systems: Practical Issues and Implementation, Commercial Products and Applications, Perspectives on Adaptive Control
	UNIT-V **Computer Aided Adaptive Control:** Adaptive controller adjustment – Indirect adaptive control, Direct Adaptive control, Adaptive control schemes – Model Reference Adaptive Controllers (MRAC), Self Tuning Adaptive Controllers (STAC), Adaptive control techniques.
Course Outcomes	**At the end of this subject student is able to:** • **Will have knowledge to describe a given dynamical system with a parametric model based on the unknown parameters** • **Will understand the application of the general scheme of an identifier plus a controller for an adaptive system** • **Can design controllers based on the identifier plus controller scheme, using the Model Reference and the Pole Placement methods.**
Text Books	1. **Adaptive Control**, ***Chatterjee & Permar***; Oxford University Press 2. **Adaptive Control**, ***Karl J. Aström, Björn Wittenmark***; Pearson Ed. 3. **Computer Aided Process Control, S.K Singh,** Prentice Hall of India
Reference Books:	1. **Adaptive Control, *Chang C. Hang, Weng K. Ho, Tong Heng Lee***; Instrument Society of America 2. **Adaptive Control Systems(Illustrated), *Rogelio Lozano, Gang Feng, Rogelio Lozano***; Newnes

Course Title	**Analytical Instrumentation**				
Course Code	**MENIC302TA**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Instrumentation Techniques**				
Course Objectives	**This course will enable students to:** • Acquire knowledge about the widely used analytical Instruments • Select Instrument for a particular analysis with come idea of its merits, demerits and limitations • Work as a service and maintenance engineering for these Instruments • Learn specific technique employed for monitoring different pollutants in air and water.				
Course Contents	**UNIT-I** **Absorption spectrometry:** (UV, Visible, IR), mass spectrometry, Möss Bauer spectroscopy, Principles, design aspects and application **UNIT-II** **NMR spectroscopy:** Principles, generation, equipment, Principles, design aspects and applications, limitations **UNIT-III** **ESR Spectroscopy:** Principles, design aspects, generation, equipment, applications, limitations **UNIT-IV** **NDP spectroscopy:** Principles, design aspects, generation, equipment, applications, limitations				

	UNIT-V **X-Rays and Other Techniques:** X-rays absorption, fluorescence and diffractometric techniques, electron microscope and microprobe, EXAFS, ESCA, and Auger techniques. Chromatography and colorimetry. Instrumentation of thermo physical and transport properties of matter, DTA, DSC.
Course Outcomes	**At the end of this subject student is able to:** • Understand the working principle of Ion Selective Electrodes, PH electrodes and conductivity meters. • Study of different types of Gas Analyzers. • Basis of Chromatography • Knowledge of Spectrophotometers • Study of NMR Spectrometers and radiations techniques.
Text Books	1. **Instrumental Methods of Analysis (VI edition).** ***Willard H.W., Merritt L.L., Dean J.A., Settle F.A.,*** 2. **Handbook of Analytical Instruments**, ***R.S. Khandpur***; Tata Mcgraw Hill
Reference Books:	1. **Instrumentation, Measurement and Analysis,** ***B.C. Nakra, K.K. Chaudhry***; Tata Mcgraw Hill 2. **Instrument Engineers Handbook –** ***B.G. Liptak***.

Course Title	**Real Time Systems**				
Course Code	**MENIC302TB**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites	**Operating Systems Concepts**				
Course Objectives	**This course will enable students to:** • To study the basic of tasks and scheduling To understand programming languages and databases • To analyze real time communication • To analyze evaluation techniques and reliability models for Hardware Redundancy • To understand clock synchronization				
Course Contents	**UNIT-I** **Real Time Systems - Basics and Applications:** Typical Real-Time Applications, Hard Versus Soft RealTime Systems, A Reference Model of Real-Time Systems **UNIT-II** **Real-time Scheduling:** Commonly Used Approaches to Real-Time Scheduling, Clock Driven Scheduling, Priority-Driven Scheduling of Periodic Tasks **UNIT-III** **Scheduling and Resources:** Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems, Resources and Resource Access Control **UNIT-IV** **Multiprocessor Scheduling:**				

	Resources Access Control, and Synchronization, Scheduling Flexible Computations and Tasks with Temporal Distance Constraints
	UNIT-V **Communication and OS:** Real-Time Communication, Operating Systems
Course Outcomes	**At the end of this subject student is able to:** • An ability to understand advanced concepts in theory of computer science; • An ability to understand advanced concepts in applications of computer science; • An ability to apply knowledge of advanced computer science to formulate the analyze problems in computing and solve them; • An ability to learn emerging concepts in theory and applications of computer science;
Text Books	1. **Real Time Systems**, ***Saeed B. Niku***; Prentice Hall 2. **Real Time Systems**, ***C.M. Krishna, K.G. Shin***; Mcgraw Hill
Reference Books:	**1. Real-Time Systems, *Jane W. S. Liu*** 2. **Real-Time Systems : Scheduling, Analysis, and Verification, *Albert M. K. Cheng***

Course Title	**Programmable Logic Controllers**				
Course Code	**MENIC302TC**				
Course Credits	**L**	**T**	**P**	**TC**	
	3	**1**	**-**	**4**	
Prerequisites					
Course Objectives	**This course will enable students to:** • Students will be able to describe typical components of a Programmable Logic Controller. • Students will be able to explain the basic concepts of a Programmable Logic Controller. • Students will be able to state basic PLC terminology and their meanings. • Students will be able to explain and apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.				
Course Content	**UNIT-I** **PLC Basics:** An Overall look at programmable Logic Controllers, General PLC Programming Procedure, Devices to which PLC Input and Output Modules are connected. **UNIT-II** **Basic PLC Programming:** Programming On/Off Inputs to Produce On-Off Outputs, Relation of Digital Gate Logic to Contact/Coil Logic, Creating Ladder Diagrams from Process Control Descriptions. Basic PLC Functions, Register Basics, PLC Time Functions, PLC Counter Functions. Intermediate Functions, PLC Arithmetic Functions, PLC Number Comparison Functions, Numbering Systems and PLC Number Conversion Functions.				

s	**UNIT-III** **Data Handling Functions:** The PLC SKIP and MASTER CONTROL RELAY Functions, Jump Functions, PLC Data Move Systems, Other PLC Data Handling Functions. PLC Functions -Working with Bits, PLC Digital Bit Functions and Applications, PLC Sequencer Functions, Controlling a Robot with a PLC, PLC Matrix Functions. **UNIT-IV** **Advanced PLC Functions:** Analog PLC Operation, PID Control of Continuous Process, Networking PLCs. **UNIT-V** **PLC Deployment:** Alternative Programming Language, PLC Auxiliary Commands and Functions, PLC installation, Troubleshooting and Maintenance, Selecting a PLC, Operation Simulation and Monitoring,Commonly Used Circuit Symbols.
Course Outcomes	**At the end of this subject student is able to:** • Identify basic components of a PLC and describe their functions. • Create, edit, download, and run PLC programs. • Monitor variable values in real time in program execution. • Interpret simple ladder logic programs. • Effectively write basic and intermediate level PLC programs
Text Books	1. **Programmable Logic Controllers**, ***John W. Webb, Ronald A. Reis***; Prentice Hall - 5th Ed 2. **Computer Based Industrial Control, *Krishna Kant*;** Prentice Hall
Reference Books:	1. **Programmable Logic Controllers: Principles & Applications, *Webb & Reis***, Prentice Hall of India. 2. **Programmable Logic Control: Principles & Applications**, NIIT, Prentice Hall of India.

Course Title	**TECHNICAL PAPER WRITING AND SEMINAR**				
Course Code	**MENIC303P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**4**	**2**	
Prerequisites	Industrial report writing and paper writing				
Course Objectives	**This course will enable students to:** • Describe the research process. • Outline the elements of a thesis/dissertation. • Select a research topic of importance to the profession. • Effectively work with their academic advisor and graduate committee. • Develop and follow an appropriate timeline for completion of the thesis/dissertation. • Identify an appropriate theory base for their research. • Develop a conceptual model relevant to their research.				
Course Contents	1. Each student will select a topic in the area of power system engineering and related area in the state of art area & technical development. 2. The topic will be decided by the Student, Guide and Departmental research committee. 3. Each student will make seminar presentation with audio/video aids, for the duration of 45 minutes and seminar work shall be in form of report to be submitted by the students at the end of the semester. 4. This report copies must be duly signed by guide and Head of Department. Attendance of all students for all seminars is compulsory. 5. Define the statement of research problem 6. Literature survey, familiarity with research journals 7. Broad knowledge off the available techniques to solve the problems 8. Technical writing skills 9. Presentation skills				
Course Outcomes	**After the completion of course:** • Acceptable with minor or no revisions (no further approval required) • Acceptable with major revisions in content or format not acceptable				

Reference Books	1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. 2. Roberts, C. M. (2010). The dissertation journey. Thousand Oaks, CA: Corwin.

Course Title	**PREDISSERTATION (LITERATURE REVIEW/ PROBLEM FORMULATION/ SYNOPSIS)**				
Course Code	**MENIC304P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**28**	**14**	
Prerequisites	Paper writing				
Course Objectives	**This course will enable students to:** • Demonstrate the skills for good presentation and technical report writing skills. • Apply engineering and management principles while executing the project.				
Course Contents	1. Each student will select a topic in the area of power system engineering and related area in the state of art area & technical development. 2. Every student will carry out dissertation under the supervision of a Supervisor. 3. The topic shall be approved by a committee constituted by the Head of the concerned department. 4. Every student will be required to present two seminar talks, First at the beginning of the Dissertation (Phase-I)to present the scope of the work and to finalize the topic, and second towards the end of the semester, presenting the work carried out by him/her in the semester. 5. The committee constituted will screen both the presentations and work. 6. Define the statement of research problem 7. Literature survey, familiarity with research journals 8. Broad knowledge off the available techniques to solve the problems 9. Technical writing skills 10. Presentation skills				
Course Outcomes	**After the completion of course:** • Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. • Students will be able to use different experimental techniques. • Students will be able to use different software/computational/analytical tools. • Students will be able to design and develop an experimental set up/equipment/test				

	rig. • Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them. • Students will be able to either work in a research environment or in an industrial environment.
Reference Books	1. Student will learn to survey the relevant literature such as books, national/international referred journals and contact resource persons for the selected topic of research. 2. Roberts, C. M. (2010). The dissertation journey. Thousand Oaks, CA: Corwin.