



# Adi Shankara

## INSTITUTE OF ENGINEERING AND TECHNOLOGY, KALADY

Approved by AICTE & Affiliated to APJ Abdul Kalam Technological University  
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### B TECH ROBOTICS AND AUTOMATION

#### 2019 Scheme Syllabus- Course Outcomes

#### S1S2 B.Tech (2019) Syllabus

COURSE NAME	COURSE CODE	COURSE OUTCOME CODE	COURSE OUTCOME STATEMENTS
<b>BASICS OF CIVIL &amp; MECHANICAL ENGINEERING</b>	<b>EST 120</b>	<b>CO 1</b>	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.
		<b>CO 2</b>	Explain different types of buildings, building components, building materials and building construction
		<b>CO 3</b>	Describe the importance, objectives and principles of surveying.
		<b>CO 4</b>	Summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps
		<b>CO 5</b>	Discuss the Materials, energy systems, water management and environment for green buildings.
		<b>CO 6</b>	Analyse thermodynamic cycles and calculate its efficiency
		<b>CO 7</b>	Illustrate the working and features of IC Engines
		<b>CO 8</b>	Explain the basic principles of Refrigeration and Air Conditioning
		<b>CO 9</b>	Describe the working of hydraulic machines
		<b>CO 10</b>	Explain the working of power transmission elements
		<b>CO 11</b>	Describe the basic manufacturing, metal joining and machining processes
<b>BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING</b>	<b>EST 130</b>	<b>CO 1</b>	Apply fundamental concepts and circuit laws to solve simple DC electric circuits
		<b>CO 2</b>	Develop and solve models of magnetic circuits
		<b>CO 3</b>	Apply the fundamental laws of electrical engineering to solve simple ac circuits in steady state
		<b>CO 4</b>	Describe working of a voltage amplifier
		<b>CO 5</b>	Outline the principle of an electronic instrumentation system
		<b>CO 6</b>	Explain the principle of radio and cellular communication
<b>CIVIL &amp; MECHANICAL WORKSHOP</b>	<b>ESL 120</b>	<b>CO 1</b>	Name different devices and tools used for civil engineering measurements
		<b>CO 2</b>	Explain the use of various tools and devices for various field measurements

		CO 3	Demonstrate the steps involved in basic civil engineering activities like plot measurement, setting out operation, evaluating the natural profile of land, plumbing and undertaking simple construction work.
		CO 4	Choose materials and methods required for basic civil engineering activities like field measurements, masonry work and plumbing.
		CO 5	Compare different techniques and devices used in civil engineering measurements
		CO 6	Identify Basic Mechanical workshop operations in accordance with the material and objects
		CO 7	Apply appropriate Tools and Instruments with respect to the mechanical workshop trades
		CO 8	Apply appropriate safety measures with respect to the mechanical workshop trades
<b>PROGRAMIN G IN C</b>	<b>EST 102</b>	CO 1	Analyze a computational problem and develop an algorithm/flowchart to find its solution
		CO 2	Develop readable* C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
		CO 3	Write readable C programs with arrays, structure or union for storing the data to be processed
		CO 4	Divide a given computational problem into a number of modules and develop a readable multi-function C program by using recursion if required, to find the solution to the computational problem
		CO 5	Write readable C programs which use pointers for array processing and parameter passing
		CO 6	Develop readable C programs with files for reading input and storing output
<b>ELECTRICA L &amp; ELECTRONI CS WORKSHOP</b>	<b>ESL 130</b>	CO 1	Demonstrate safety measures against electric shocks.
		CO 2	Identify the tools used for electrical wiring, electrical accessories, wires, cables, batteries and standard symbols
		CO 3	Develop the connection diagram, identify the suitable accessories and materials necessary for wiring simple lighting circuits for domestic buildings
		CO 4	Identify and test various electronic components
		CO 5	Draw circuit schematics with EDA tools
		CO 6	Assemble and test electronic circuits on boards
		CO 7	Work in a team with good interpersonal skills
<b>ENGINEERIN G GRAPHICS</b>	<b>EST 110</b>	CO 1	Draw the projection of points and lines located in different quadrants
		CO 2	Prepare multiview orthographic projections of objects by visualizing them in different positions
		CO 3	Draw sectional views and develop surfaces of a given object
		CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.
		CO 5	Convert 3D views to orthographic views

		<b>CO 6</b>	Obtain multiview projections and solid models of objects using CAD tools
<b>ENGINEERING MECHANICS</b>	<b>EST 100</b>	<b>CO 1</b>	Recall principles and theorems related to rigid body mechanics
		<b>CO 2</b>	Identify and describe the components of system of forces acting on the rigid body
		<b>CO 3</b>	Apply the conditions of equilibrium to various practical problems involving different force system.
		<b>CO 4</b>	Choose appropriate theorems, principles or formulae to solve problems of mechanics.
		<b>CO 5</b>	Solve problems involving rigid bodies, applying the properties of distributed areas and masses
<b>ENGINEERING CHEMISTRY</b>	<b>CYT 100</b>	<b>CO 1</b>	Apply the basic concepts of electrochemistry and corrosion to explore its possible applications in various engineering fields.
		<b>CO 2</b>	Understand applications.
		<b>CO 3</b>	Apply the knowledge of analytical method for characterizing a chemical mixture or a compound. Understand the basic concept of SEM for surface characterisation of nanomaterials.
		<b>CO 4</b>	Learn about the basics of stereochemistry and its application. Apply the knowledge of conducting polymers and advanced polymers in engineering.
		<b>CO 5</b>	Study various types of water treatment methods to develop skills for treating wastewater.
<b>ENGINEERING CHEMISTRY LAB</b>	<b>CYL 120</b>	<b>CO 1</b>	Understand and practice different techniques of quantitative chemical analysis to generate experimental skills and apply these skills to various analyses
		<b>CO 2</b>	Develop skills relevant to synthesize organic polymers and acquire the practical skill to use TLC for the identification of drugs
		<b>CO 3</b>	Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing and interpreting the IR spectra and NMR spectra of some organic compounds
		<b>CO 4</b>	Acquire the ability to understand, explain and use instrumental techniques for chemical analysis
		<b>CO 5</b>	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments
		<b>CO 6</b>	Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economical and environmental problems and why it is an integral part of curriculum



## 2019 Scheme Syllabus- Course Outcomes

### S3S4 B.Tech (2019) Syllabus

COURSE NAME	COURSE CODE	COURSE OUTCOME CODE	COURSE OUTCOME STATEMENTS
<b>PARTIAL DIFFERENTIAL EQUATION AND COMPLEX ANALYSIS</b>	<b>MAT 201</b>	<b>CO1</b>	Understand the concept and the solution of partial differential equation.
		<b>CO2</b>	Analyze and solve one dimensional wave equation and heat equation
		<b>CO3</b>	Understand complex functions, its continuity differentiability with the use of Cauchy-Riemann equations.
		<b>CO4</b>	Evaluate complex integrals using Cauchy's integral theorem and Cauchy's integral formula, understand the series expansion of analytic function
		<b>CO5</b>	Understand the series expansion of complex function about a singularity and Apply residue theorem to compute several kinds of real integrals.
<b>PROCESSING AND PROPERTIES OF MATERIALS</b>	<b>RAT201</b>	<b>CO1</b>	Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC.HCP.
		<b>CO2</b>	Explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy. Construction and Understanding, identification of phase diagrams and reactions
		<b>CO3</b>	Understand and suggest the heat treatment process & types. Significance of properties Vs microstructure. demonstrate the test used to find hardenability of steels
		<b>CO4</b>	Analyze the various surface hardening methods and understand their applications
		<b>CO5</b>	Explain features, classification, applications of non ferrous materials like Aluminium, Copper, Magnesium, composite, Polymers etc

		<b>CO6</b>	Understand the electrical,thermal,magnetic and optical properties of materials
<b>ELECTRONIC DEVICES AND CIRCUITS</b>	<b>RAT 203</b>	<b>CO1</b>	Design of wave shaping circuits
		<b>CO2</b>	Design and analyze biasing schemes for transistor circuits
		<b>CO3</b>	Model and evaluate amplifier circuits
		<b>CO4</b>	Choose an amplifier with appropriate specifications for electronic circuit applications
		<b>CO5</b>	Design and analyze oscillator circuits
		<b>CO6</b>	Build and evaluate different waveform generation circuits using Op-amps and timer ICs
<b>DIGITAL ELECTRONICS</b>	<b>RAT 205</b>	<b>CO1</b>	Represent numbers in different digital formats and to perform logical operations
		<b>CO2</b>	Choose a digital IC based on its characteristics
		<b>CO3</b>	Analyze and synthesize combinational logic circuits and to derive minimal logic functions
		<b>CO4</b>	Analyze and design sequential logic circuits
		<b>CO5</b>	Familiarize A/D and D/A conversion techniques
		<b>CO6</b>	Familiarize The basic concepts of memory, programmable logic devices
		<b>CO7</b>	Design basic combinational and sequential logic circuits using Verilog
<b>MACHINE DRAWING AND SOLID MODELLING LAB</b>	<b>RAL 201</b>	<b>CO1</b>	Understand the basic principles of machine drawing as per standards and to get familiar with the different schemes of dimensioning, providing symbols with simple machine parts drawings.
		<b>CO2</b>	Understand and get familiar to specifying limits, fits, dimensional and geometric tolerances and surface roughness in machine drawings
		<b>CO3</b>	Get familiar to assembly drawing practices and prepare assembly drawings of robotic components.
		<b>CO4</b>	Get hands on using CAD software for preparing 2D drawings and 3D models of parts and to export them to various formats for different applications.
		<b>CO5</b>	Get hands on preparing the assemblies of various machine parts using cad models and using them for various analysis purposes
<b>ELECTRONIC CIRCUITS AND</b>	<b>RAL 203</b>	<b>CO1</b>	Design and develop various wave shaping circuits, amplifiers and oscillators using discrete components

<b>DIGITAL ELECTRONICS LAB</b>		<b>CO2</b>	Design and test various circuits using opamps
		<b>CO3</b>	Design and test various combinational and sequential logic circuits
		<b>CO4</b>	Design PCBs
		<b>CO5</b>	Program basic combinational circuits using Verilog
<b>SUSTAINABLE ENGINEERING</b>	<b>MCN201</b>	<b>CO 1</b>	Understand the relevance and the concept of sustainability and the global initiatives in this direction
		<b>CO 2</b>	Explain the different types of environmental pollution problems and their sustainable solutions
		<b>CO 3</b>	Discuss the environmental regulations and standards
		<b>CO 4</b>	Outline the concepts related to conventional and non-conventional energy
		<b>CO 5</b>	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles
<b>DESIGN AND ENGINEERING</b>	<b>EST 200</b>	<b>CO 1</b>	Explain the different concepts and principles involved in design engineering.
		<b>CO 2</b>	Apply design thinking while learning and practicing engineering.
		<b>CO 3</b>	Develop innovative, reliable, sustainable and economically viable designs incorporating knowledge in engineering.
<b>PROFESSIONAL ETHICS</b>	<b>HUT 200</b>	<b>CO 1</b>	Understand the core values that shape the ethical behavior of a professional.
		<b>CO 2</b>	Adopt a good character and follow an ethical life.
		<b>CO 3</b>	Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.
		<b>CO 4</b>	Solve moral and ethical problems through exploration and assessment by established experiments.
		<b>CO 5</b>	Apply the knowledge of human values and social values to contemporary ethical values and global issues.
<b>PROBABILITY, STATISTICS AND NUMERICAL METHODS</b>	<b>MAT 202</b>	<b>CO 1</b>	Understand the concept, properties and important models of discrete random variables and,using them, analyze suitable random phenomena.
		<b>CO 2</b>	Understand the concept, properties and important models of continuous random variables and,using them, analyze suitable random phenomena.
		<b>CO 3</b>	Perform statistical inferences concerning characteristics of a population based on attributes of samples drawn from the population



		<b>CO 4</b>	Compute roots of equations, evaluate definite integrals and perform interpolation on given numerical data using standard numerical techniques
		<b>CO 5</b>	Apply standard numerical techniques for solving systems of equations, fitting curves on given numerical data and solving ordinary differential equations.
<b>KINEMATIC S AND DYNAMICS OF MECHANIS MS</b>	<b>RAT 202</b>	<b>CO1</b>	Understand the kinematic details of machines, kinematic pairs and degrees of freedom and determining the loop closure equations of various linkages and find known and unknown coordinates
		<b>CO2</b>	Determine the velocity and acceleration of a point in open loop planar mechanisms.
		<b>CO3</b>	Analyze the static force in simple mechanisms and determine the forces for a particular acceleration using inverse dynamics
		<b>CO4</b>	Determine equations of motion and acceleration equations for various planar mechanisms, and identify the known and unknown variables for forward dynamic analysis
		<b>CO5</b>	Illustrate the derivation of Euler's dynamic equations for pure rotation from Newton's laws and solve simple problems using this method.
		<b>CO6</b>	Understand the free, damped and forced vibration of single DoF systems
<b>MANUFACT URING PROCESSES</b>	<b>RAT 204</b>	<b>CO1</b>	Understand the basics of the primary manufacturing processes and apply the knowledge in designing parts for robotic applications CO 2 CO 3. CO 4 CO 5 CO 6
		<b>CO2</b>	Understand the various joining processes and choose the appropriate mechanical and adhesive joining process for the parts.
		<b>CO3</b>	Understand the conventional machining operations and to decide the optimal parameters for a specific machining requirement
		<b>CO4</b>	Understand the operations in a CNC machine and optimally choose the parameters and settings for a specific machining requirement.
		<b>CO5</b>	Decide the datum and tool offset parameters for the required machining operation and to manually program the CNC machine.
		<b>CO6</b>	Understand the various nonconventional and net-shape manufacturing techniques and optimally select the appropriate process to realise a part.
<b>MICROCON TROLLER AND EMBEDDED SYSTEMS</b>	<b>RAT 206</b>	<b>CO1</b>	Understand the internal architecture of 8051 Microcontroller
		<b>CO2</b>	Develop simple programs for 8051 using assembly language programming

		<b>CO3</b>	Interface 8051 microcontroller with peripheral devices using ALP/Embedded C
		<b>CO4</b>	Interpret the architecture and design concept of embedded systems
		<b>CO5</b>	Design embedded systems based on Arduino CO
		<b>CO6</b>	Explain the concepts of embedded operating system
<b>MANUFACTURING AND PROTOTYPING LAB</b>	<b>RAL 202</b>	<b>CO 1</b>	Get hands on various manual production machines and processes. CO2. Identify the various operations and the required machines and attachments for prototyping the robotic components. CO3.. CO4.. CO5
		<b>CO 2</b>	Identify the various operations and the required machines and attachments for prototyping the robotic components.
		<b>CO 3</b>	Preparing the CNC machines and programming them for machining robotic components
		<b>CO 4</b>	Use CAD/CAM for generating CNC code for production machines to realise parts
		<b>CO5</b>	Understand the properties of 3D printed parts and use the rapid prototyping effectively to make prototypes
<b>MICROCONTROLLER AND EMBEDDED SYSTEMS LAB</b>	<b>RAL 206</b>	<b>CO1</b>	Program and test a microcontroller system.
		<b>CO2</b>	Interface a microcontroller system to user controls and other electronic systems
		<b>CO3</b>	Design embedded systems for the required applications





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## 2019 Scheme Syllabus- Course Outcomes

### S5S6 B.Tech (2019) Syllabus

COURSE NAME	COURSE CODE	COURSE OUTCOME CODE	COURSE OUTCOME STATEMENTS
<b>INTRODUCTION TO ROBOTICS</b>	<b>RAT 301</b>	<b>CO1</b>	Familiarize with anatomy, specifications and types of Robots
		<b>CO2</b>	Obtain forward and inverse kinematic models of robotic manipulators
		<b>CO3</b>	Plan trajectories in joint space & Cartesian space and avoid obstacles while robots are in motion
		<b>CO4</b>	Develop dynamic model and design the controller for robotic manipulators
		<b>CO5</b>	Choose appropriate Robotic configuration and list the technical specifications for robots used in different applications
		<b>CO6</b>	Familiarize with different types of mobile robots, kinematic models, motion control and sensors for mobile robots
<b>SOLID MECHANICS</b>	<b>RAT 303</b>	<b>CO1</b>	Determine the stresses, strains and displacements of structures by tensorial and graphical (Mohr's circle) approaches

		<b>CO2</b>	Analyze the strength of materials using stress-strain relationships for structural and thermal loading
		<b>CO3</b>	Perform basic design of circular shafts and thin walled structures subjected to torsional loading and analyze beams subjected to bending moments under different idealized loading conditions
		<b>CO4</b>	Determine the deformation of structures subjected to various loading conditions using strain energy methods
		<b>CO5</b>	Analyze column buckling and appreciate the theories of failures and its relevance in engineering design
<b>INDUSTRIAL AUTOMATION</b>	<b>RAT 305</b>	<b>CO1</b>	Explain the basic concepts of automation methodologies and trends in manufacturing automation.
		<b>CO2</b>	Explain the working principle and applications of different types of sensors and actuators
		<b>CO3</b>	Discuss different automated inspection methods.
		<b>CO4</b>	Explain the design aspects of modern CNC machines.
		<b>CO5</b>	Explain the basic principles and operation of different types of material handling devices
		<b>CO6</b>	Develop different pneumatic and hydraulic circuits based on their applications
		<b>CO7</b>	Familiarize the basic concepts of PLC programming.
<b>CONTROL SYSTEMS</b>	<b>RAT 307</b>	<b>CO1</b>	Model the systems using transfer function approach as well as state space approach
		<b>CO2</b>	Employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions
		<b>CO3</b>	Compute the time domain and frequency domain specifications of a system
		<b>CO4</b>	Analyze dynamic systems for their stability and performance using root locus and Bode plot
		<b>CO5</b>	Identify the needs of different types of controllers and compensators to ascertain the required dynamic response from the system.
		<b>CO6</b>	Analyze systems using state space approach
		<b>CO7</b>	Explain a variety of methods for analyzing nonlinear systems
<b>MANAGEMENT FOR ENGINEERS</b>	<b>HUT310</b>	<b>CO1</b>	Explain the characteristics of management in the contemporary context (Cognitive Knowledge level: Understand).
		<b>CO2</b>	Describe the functions of management (Cognitive Knowledge level: Understand).

		<b>CO3</b>	Demonstrate ability in decision making process and productivity analysis (Cognitive Knowledge level: Understand).
		<b>CO4</b>	Illustrate project management technique and develop a project schedule (Cognitive Knowledge level: Apply).
		<b>CO5</b>	Summarize the functional areas of management (Cognitive Knowledge level: Understand).
<b>AUTOMATION LAB</b>	<b>RAL 331</b>	<b>CO1</b>	Design and develop various hydraulic and electro-hydraulic systems
		<b>CO2</b>	Design and develop various pneumatic and electro-pneumatic systems
		<b>CO3</b>	Familiarization of ladder programming and testing of PLC circuits
		<b>CO4</b>	Familiarization of hydraulic, pneumatic, electrohydraulic, electro pneumatic circuits in simulation package
<b>ROBOT OPERATING SYSTEMS LAB</b>	<b>RAL 333</b>	<b>CO1</b>	Understand the applications of ROS in real world complex scenarios
		<b>CO2</b>	Work with turtlesim, Gazebo, MoveIt and Rviz
		<b>CO3</b>	Familiarize about the concepts behind navigation
		<b>CO4</b>	Interface with hardware and analyze the issues in hardware interfacing
<b>DISASTER MANAGEMENT</b>	<b>MCN 301</b>	<b>CO1</b>	Define and use various terminologies in use in disaster management parlance and organise each of these terms in relation to the disaster management cycle (Cognitive knowledge level: Understand).
		<b>CO2</b>	Distinguish between different hazard types and vulnerability types and do vulnerability assessment (Cognitive knowledge level: Understand).
		<b>CO3</b>	Identify the components and describe the process of risk assessment, and apply appropriate methodologies to assess risk (Cognitive knowledge level: Understand).
		<b>CO4</b>	Explain the core elements and phases of Disaster Risk Management and develop possible measures to reduce disaster risks across sector and community (Cognitive knowledge level: Apply)
		<b>CO5</b>	Identify factors that determine the nature of disaster response and discuss the various disaster response actions (Cognitive knowledge level: Understand).

		<b>CO6</b>	Explain the various legislations and best practices for disaster management and risk reduction at national and international level (Cognitive knowledge level: Understand).
<b>INDUSTRIAL ECONOMICS &amp; FOREIGN TRADE</b>	<b>HUT 300</b>	<b>CO1</b>	Explain the problem of scarcity of resources and consumer behaviour, and to evaluate the impact of government policies on the general economic welfare. (Cognitive knowledge level: Understand)
		<b>CO2</b>	Take appropriate decisions regarding volume of output and to evaluate the social cost of production. (Cognitive knowledge level: Apply)
		<b>CO3</b>	Determine the functional requirement of a firm under various competitive conditions. (Cognitive knowledge level: Analyse)
		<b>CO4</b>	Examine the overall performance of the economy, and the regulation of economic fluctuations and its impact on various sections in the society. (Cognitive knowledge level: Analyse)
		<b>CO5</b>	Determine the impact of changes in global economic policies on the business opportunities of a firm. (Cognitive knowledge level: Analyse)
<b>MANAGEMENT FOR ENGINEERS</b>	<b>HUT 310</b>	<b>CO1</b>	Explain the characteristics of management in the contemporary context (Cognitive Knowledge level: Understand).
		<b>CO2</b>	Describe the functions of management (Cognitive Knowledge level: Understand).
		<b>CO3</b>	Demonstrate ability in decision making process and productivity analysis (Cognitive Knowledge level: Understand).
		<b>CO4</b>	Illustrate project management technique and develop a project schedule (Cognitive Knowledge level: Apply).
		<b>CO5</b>	Summarize the functional areas of management (Cognitive Knowledge level: Understand).
		<b>CO6</b>	Comprehend the concept of entrepreneurship and create business plans (Cognitive Knowledge level: Understand).
<b>DESIGN OF MACHINE ELEMENTS</b>	<b>RAT 302</b>	<b>CO1</b>	To review concepts of statics and strength of materials.
		<b>CO2</b>	To introduce fundamental approaches to failure prevention of components.
		<b>CO3</b>	To provide knowledge in the design of common machine elements such as fasteners, shafts, springs and couplings.
		<b>CO4</b>	To provide knowledge in the design of welded joints and fillet joints in tension, torsion and bending.
		<b>CO5</b>	To provide basic design methods for gear drives, belt drives and bearings

<b>ELECTRIC DRIVES AND CONTROL</b>	<b>RAT 304</b>	<b>CO1</b>	Explain the working of different types of motors commonly used in robotics and the need for Electric drives
		<b>CO2</b>	Recognize the different power semiconductor device and their working principles
		<b>CO3</b>	Describe the working of SCR and the various techniques used for triggering SCR
		<b>CO4</b>	Demonstrate design of various speed control techniques of DC motors
		<b>CO5</b>	Explain the working of single phase and Three phase inverters
		<b>CO6</b>	Explain the working of Position control and speed control of different types of motors
<b>SIGNALS AND SYSTEMS</b>	<b>RAT 306</b>	<b>CO1</b>	Familiarize with types of signals and systems
		<b>CO2</b>	Obtain the frequency domain representation of continuous signals
		<b>CO3</b>	Obtain frequency domain representation of discrete time signals
		<b>CO4</b>	Develop filtering methods based on DFT
		<b>CO5</b>	Computation of DFT
<b>COMPREHENSIVE COURSE WORK</b>	<b>CST 308</b>	<b>CO1</b>	Comprehend the concepts of discrete mathematical structures (Cognitive Knowledge Level: Understand)
		<b>CO2</b>	Comprehend the concepts and applications of data structures (Cognitive Knowledge Level: Understand)
		<b>CO3</b>	Comprehend the concepts, functions and algorithms in Operating System (Cognitive Knowledge Level: Understand))
		<b>CO4</b>	Comprehend the organization and architecture of computer systems (Cognitive Knowledge Level: Understand)
		<b>CO5</b>	Comprehend the fundamental principles of database design and manipulation (Cognitive Knowledge Level: Understand)
		<b>CO6</b>	Comprehend the concepts in formal languages and automata theory Cognitive Knowledge Level: Understand)
<b>ROBOTICS LAB</b>	<b>RAL332</b>	<b>CO1</b>	Test forward, inverse kinematic modelling and path planning of robotic manipulators

		<b>CO2</b>	Test basic control algorithms in mobile robots to move to a point, to follow a line, to follow a path and for obstacle avoidance
		<b>CO3</b>	Familiarize about localisation of mobile robots
		<b>CO4</b>	Calibrate sensors used in robots
		<b>CO5</b>	Design and develop sensor-based systems in robots
<b>MINI PROJECT</b>	<b>RAD 334</b>	<b>CO1</b>	Identify technically and economically feasible problems (Cognitive Knowledge Level: Apply)
		<b>CO2</b>	Identify and survey the relevant literature for getting exposed to related solutions and get familiarized with software development processes (Cognitive Knowledge Level: Apply)
		<b>CO3</b>	Perform requirement analysis, identify design methodologies and develop adaptable & reusable solutions of minimal complexity by using modern tools & advanced programming techniques (Cognitive Knowledge Level: Apply)
		<b>CO4</b>	Prepare technical report and deliver presentation (Cognitive Knowledge Level: Apply)
		<b>CO5</b>	Apply engineering and management principles to achieve the goal of the project (Cognitive Knowledge Level: Apply)
<b>SENSORS AND TRANSDUCERS</b>	<b>RAT 312</b>	<b>CO1</b>	Analyze and select the most appropriate sensors and transducers for a robotic application
		<b>CO2</b>	Explain fundamental principle of working of sensors and transducers for robots
		<b>CO3</b>	Interpret typical manufacturer's data sheet of sensors and transducers and use them for selection in typical applications



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## 2019 Scheme Syllabus- Course Outcomes

### S7S8 B.Tech (2019) Syllabus

<b>COURSE NAME</b>	<b>COURS E CODE</b>	<b>COURSE OUTCOM E CODE</b>	<b>COURSE OUTCOME STATEMENTS</b>
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<b>ALGORITHMS AND DATA STRUCTURES</b>	<b>RAT401</b>	<b>CO1</b>	Analyse various data structures and their applicability
		<b>CO2</b>	Use appropriate data structures like arrays, linked lists, stacks and queues to solve real world problems efficiently.
		<b>CO3</b>	Comprehend and implement various techniques for searching, sorting and Hashing
		<b>CO4</b>	Represent and manipulate data using nonlinear data structures like trees and graphs to design algorithms for various applications.
		<b>CO5</b>	Identify the appropriate data structure to design efficient algorithm for the given application
<b>ELECTRICAL DRIVES AND CONTROL LAB</b>	<b>RAL411</b>	<b>CO1</b>	Test the basic characteristics of power semiconductor devices.
		<b>CO2</b>	Test the various techniques used for triggering SCRs and solid state devices.
		<b>CO3</b>	Test and design choppers and inverters.
		<b>CO4</b>	Test the speed control of DC motors.
		<b>CO5</b>	Design and develop different speed control schemes for DC motor drives.
		<b>CO6</b>	
<b>SEMINAR</b>	<b>RAQ413</b>	<b>CO1</b>	Identify academic documents from the literature which are related to her/his areas of interest (Cognitive knowledge level: Apply).
		<b>CO2</b>	Read and apprehend an academic document from the literature which is related to her/ his areas of interest (Cognitive knowledge level: Analyze).
		<b>CO3</b>	Prepare a presentation about an academic document (Cognitive knowledge level: Create).
		<b>CO4</b>	Give a presentation about an academic document (Cognitive knowledge level: Apply).
		<b>CO5</b>	Prepare a technical report (Cognitive knowledge level: Create)
<b>PROJECT PHASE I</b>	<b>RAD415</b>	<b>CO1</b>	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).
		<b>CO2</b>	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).



		<b>CO3</b>	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).
		<b>CO4</b>	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).
		<b>CO5</b>	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
		<b>CO6</b>	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply)
<b>MOBILE ROBOTS</b>	<b>RAT413</b>	<b>CO1</b>	Explain the fundamental computational issues involved in mobile robotics and issues related to locomotion
		<b>CO2</b>	Translate the working principle of different visual and non-visual sensors to select the appropriate ones for a particular application
		<b>CO3</b>	Explain the techniques used for representing and reasoning about space
		<b>CO4</b>	Classify the different software architecture in the development of robotic applications
		<b>CO5</b>	State the techniques used for pose maintenance and localization techniques used in robotics
<b>AI AND MACHINE LEARNING</b>	<b>RAT402</b>	<b>CO1</b>	Appreciate the role of AI in solving problems in different domains and their evolution of AI
		<b>CO2</b>	Explain the different learning techniques used in Machine learning
		<b>CO3</b>	Recognize the need for multilayer neural network for solving complex tasks
		<b>CO4</b>	Understand the fundamental concepts of Image processing and its application in computer vision
		<b>CO5</b>	Explain the different ways of perception of the environment by a robot and its use in path planning
<b>MACHINE VISION</b>	<b>RAT414</b>	<b>CO1</b>	Understand the vision capturing systems and its industry standards.
		<b>CO2</b>	Acquire images and standardize the images by applying standard techniques like smoothing and filtering.
		<b>CO3</b>	Apply various transform tools like frequency domain and affine transform.

		<b>CO4</b>	Apply various segmentation algorithms.
		<b>CO5</b>	Apply state-of-the-art pattern analysis techniques like clustering, classifying and dimensionality reduction.
<b>DESIGN FOR MANUFACTURING AND ASSEMBLY</b>	<b>RAT416</b>	<b>CO1</b>	Remember the basic principles of designing for economical production and understand the principles of selection of materials for product development.
		<b>CO2</b>	Understand the general design recommendations for machined parts
		<b>CO3</b>	Enumerate the general design considerations for casting, casting tolerances and Remember the factors in design of weldments
		<b>CO4</b>	Analyze the effects of thermal stresses in welded joints and Understand the various advantages and limitations of joining techniques
		<b>CO5</b>	Remember the design factors for forging and Understand the design guidelines for extruded sections.
		<b>CO6</b>	Remember Keeler-Goodman formability diagram and its concept and Apply design guidelines to assembly
<b>SUPERVISORY CONTROL</b>	<b>RAT476</b>	<b>CO1</b>	Understand basic process control loops CO2 CO3 CO4 CO5
		<b>CO2</b>	Design and develop ladder based PLC programs
		<b>CO3</b>	Illustrate simple computerized process control systems such as DAQ and DDC
		<b>CO4</b>	Illustrate SCADA systems and its building blocks for industrial automation
		<b>CO5</b>	Understand Distributed Control System and its applications.
<b>PROJECT PHASE II</b>	<b>RAD416</b>	<b>CO1</b>	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply).
		<b>CO2</b>	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).
		<b>CO3</b>	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: Apply).
		<b>CO4</b>	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).

		<b>CO5</b>	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
		<b>CO6</b>	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).