

Bachelor of Technology (B. Tech.)

Instrumentation and Control

B. Tech. Year- III Semester – VI

Subject Name: Building Automation

Subject Code: BTIC14601

Type of course: Professional Elective Course

Prerequisite (if any): Sensor/ transducer, transmitters, converters, final control element, basic instrumentation symbols, control panel

List of Courses where this course will be prerequisite : Not applicable

Rationale:

Security of the building and safety of personal are becoming important aspects now a day and in near future, it will be in a great demand. Complex infrastructure requires a variety of building automation and control Systems. Building Management System (BMS) is computer-based control system installed in building that controls and monitors the total MEP (Mechanical – Electrical – Plumbing) and security Structure. BMS consist of both Hardware and software. This subject will help the students to understand the various aspects of different systems seen in well structured building.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

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Content:

Sr. No.	Content	Total Hrs	Module Weightage
1	Introduction Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.	4	10 %
2	Fire Alarm System Fundamentals: Fire modes, Components, and Principles of Operation. FAS Components: Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Field Components, Panel Components, Applications. FAS Architectures, Concept of IP enabled fire & alarm system, design aspects and components of PA system Fire Standards: FAS Design procedure in brief, NFPA 72A, BS 5839 Case study.	6	13 %
3	CCTV Surveillance Camera: Operation & types, Camera Selection Criteria, Components of CCTV system like cameras, types of lenses, typical types of cables, Controlling system. CCTV system types Case study	6	13 %
4	Security Systems - Access Control Fundamentals: Introduction to Security Systems, Concepts. Perimeter protection -Intruder Detection - Passive and Active detection Vehicle scanning and surveillance People scanning - Detection, Identification, Verification Biometric system, Smart card, Electric strike, Magnetic lock, Wiegand wiring, Case study	8	18 %

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5	<p>HVAC system Fundamentals: Introduction to HVAC, HVAC Fundamentals, Basic Processes (Heating ,Cooling etc) Basic Science: Air Properties, Psychometric Chart, Heat Transfer mechanisms, Examples. Human Comfort: Human comfort zones, Effect of Heat, Humidity, Heat loss. Processes: Heating Process & Applications (I.e. Boiler, Heater), Cooling Process & Applications (I.e. Chiller), Ventilation Process & Applications (I.e. Central Fan System, AHU, Exhaust Fans), Unitary Systems (VAV, FCU etc). Control Theory: Instrumentation Basics, Field components & use, DDC & applications. Control Panel: HVAC Control Panel, MCC Basics, Panel Components</p>	8	18 %
6	<p>Energy Management System: ASHRAE Symbols Energy Management: Energy Savings concept & methods Lighting Control System Lighting requirement, Day-lighting design Concept of Luminance and Illuminance and their measurement, Lighting Sensor, Control panel, Switches, Controllers Building Efficiency improvement, Renewable energy sources - Solar, Wind, Bio-waste Case study</p>	7	16 %
7	<p>Smart Building- definition and concept Green Building definition and concept - LEED, USGBC, GBCI, etc. Case Study</p>	3	6 %
8	<p>Communication protocol for Building Automation systems BACnet, Lontalk, OPC, MODBUS, ZigBee, Bluetooth, Wi-fi</p>	3	6 %

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10 %	40 %	20 %	10 %	10 %	10 %

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom’s Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Smart Buildings systems for Architects, Owners and Builders	Jim Sinopoli	Butterworth-Heinemann ISBN-9781856176538	2010	2 nd ed.
2	Understanding Building Automation Systems	Reinhold A. Carlson, Robert A. Di Giandomenico	R.S. Means Company ISBN-9780876292112	1991	1 st ed.
3	Intelligent Building Systems	Albert Ting-Pat So WaiLok Chan	Kluwer Academic publisher ISBN-9780792384915	2012	3 rd ed.



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4	HVAC Controls and Systems	Levenhagen, John I.Spethmann, Donald H	McGraw-Hill Pub. ISBN- 9780070375093	1993	1 st ed.
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Course Outcomes:After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	analyze current philosophy, technology, terminology, and practices used in building automation	25 %
CO-2	evaluate different fire standards, FAS Components, FAS loops, Architectures	20 %
CO-3	select hardware and software for HVAC system	20 %
CO-4	evaluate energy management system	10 %
CO-5	Evaluate access control system	25 %

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	1	1	1	1	2	3	2	1	2	2	3	3	2	2	3
CO-2	1		1	1	1	2	2	1	2	2	1	1	2	2	1
CO-3			2	2	1	1	1	1	1	1	1	1	2	1	2
CO-4	1	1	1	1	1	1	1	1	1	1	1	3	2	2	1
CO-5	1	1	1	1	1	2	2	1	2	2	1	1	2	2	1

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List of Open learning website:

<http://nptel.ac.in/video.php>
<https://buildingsolutions.honeywell.com/en-US/Pages/default.aspx>
<http://www.isa.org>
<http://www.controleng.com/>
<http://www.schneider-electric.com/b2b/en/solutions/system/s1/buildings-systems.jsp>
<http://www.automation.siemens.com/>
<http://coep.vlab.co.in/?sub=33&brch=97>
<https://instrumentationtools.com/>

List of Open Source Software: Not applicable

FOR LAB SESSIONS:

List of Experiments:

1. Illumination (lighting) control
2. Electric power control
3. Heating, Ventilation and Air-conditioning (HVAC)
4. Security and observation
5. Access control
6. Fire detector (Ionization, optical, heat, beam, smoke) & alarm system
7. Lifts, elevators etc.
8. Biometric system
9. Closed-circuit television (CCTV)
10. Control Panel
11. PA system
12. Alarm Monitor
13. Security Automation

Major Equipment Needed:

Computers, I/O modules, PLC, SCADA software, DCS set up, HVAC set up, fire detector sensors, RFID detector, Proximity sensors, Face and Voice detection system, Biometric system, etc.

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