

## B.Tech. - III Semester – VI

**Subject Name: Basics of Building Automation**

**Subject Code: BTIC15602**

**Type of course:** Open Elective Course

**Prerequisite (if any):** Basic Sensors and Transducers

**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	
2	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**

### **Content:**

Sr. No.	Content	Total Hrs	Module Weightage
1	<b>Introduction</b> 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.  <b>Green Building</b> definition and concept - LEED, USGBC, GBCI, etc. Case Study	4	13 %
2	<b>Fire Alarm System</b> 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	20 %
3	<b>CCTV Surveillance</b> 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	20 %

<b>4</b>	<b>Security Systems - Access Control</b> <b>Fundamentals:</b> Introduction to Security Systems, Concepts. <b>Perimeter protection</b> -Intruder Detection - Passive and Active detection <b>Vehicle scanning and surveillance</b> <b>People scanning</b> - Detection, Identification, Verification <b>Biometric system, Smart card, Electric strike, Magnetic lock, Wiegand wiring,</b> Case study	<b>6</b>	<b>20 %</b>
<b>5</b>	<b>HVAC system</b> <b>Fundamentals:</b> Introduction to HVAC, HVAC Fundamentals, Basic Processes (Heating ,Cooling etc) <b>Basic Science:</b> Air Properties, Psychometric Chart, Heat Transfer mechanisms, Examples. <b>Human Comfort:</b> Human comfort zones, Effect of Heat, Humidity, Heat loss. <b>Processes:</b> 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).	<b>4</b>	<b>13 %</b>
<b>6</b>	<b>Lighting Control System</b> 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	<b>4</b>	<b>14 %</b>

#### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10 %</b>	<b>40 %</b>	<b>20 %</b>	<b>10 %</b>	<b>10 %</b>	<b>10 %</b>

**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 <sup>nd</sup> ed.
2	Understanding Building Automation Systems	Reinhold A. Carlson, Robert A. Di Giandomenico	R.S. Means Company ISBN-9780876292112	1991	1 <sup>st</sup> ed.
3	Intelligent Building Systems	Albert Ting-Pat So WaiLok Chan	Kluwer Academic publisher ISBN-9780792384915	2012	3 <sup>rd</sup> ed.

4	HVAC Controls and Systems	Levenhagen, John I.Spethmann, Donald H	McGraw-Hill Pub. ISBN-9780070375093	1993	1 <sup>st</sup> 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	PO3	PO 4	PO5	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

**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. Alarm Monitor
12. 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.