



SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
 (DEEMED TO BE UNIVERSITY)
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 Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119
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SCHOOL OF BUILDING & ENVIRONMENT

Department of Architecture

Board of Studies meeting for M.Arch.(Building Management) held on 02-07-2020

Venue: Virtual meet in ZOOM platform

Time: 9:20 AM – 12:00 PM

Members present:

External Members	Internal Members	Signature
AR. SARATH C KANTH Design Tech Architects Chennai	DR. DEVYANI GANGOPHAHY Dean & Head Department of Architecture School of Building & Environment	
Signature 	DR. SURESH KUPPUSAMY Senior Professor & Design Chair Department of Architecture	
	AR. SUKIRTHA SURESH Associate Professor	
	AR. RAMESH KUMARA Associate Professor	

Special invitees present:

S.No	Name and Designation	Signature
1.	AR. EBIN HARRISON Associate Professor	
2.	AR. SURYA RAJKUMAR Associate Professor	

Minutes of the Board of Studies 2020 meeting

- A Board of Studies meeting was held as Virtual mode in ZOOM platform on 2nd July 2020 with the following agenda:

1. Welcome address, Opening remarks on the proposal to introduce REGULATION 2020 and the methodology adopted.
2. Comparative analysis of existing R 2015 and proposed R 2020 curriculum structure, R 2020 curriculum structure and Salient Features of Regulation 2020.
3. Detailed discussions on the proposed syllabus (from semester 1 to semester 4) and proposed Regulation 2020.
4. Any other matter with the permission of Chair.

Agenda notes for (R15 / 2) / 1 - Welcome address, Opening remarks on the proposal to introduce REGULATION 2020 and the methodology adopted.

Dr. Devyani gangopadhyay welcomed the Board of Studies External member Ar. Sarath C Kanth and thanked him for accepting the invitation of SIST at a very short notice. She informed the member about the purpose of Board of Studies meeting with particular reference on the revision in M.Arch Building Management course. The syllabus is revised every 5 years to update the course with recent advancements on tools, techniques, and software's knowledge and to rectify the shortfalls in the current course structure. After the welcome note and introduction, the external committee member Ar.Sarath expressed his appreciation about the course that the M.Arch Building Management course is really doing good. Thanking note was given to the committee member by Dr.Devyani.

Dr. Devyani presented the Regulations 2015 - a retrospective, the good practices in the current curriculum about the importance of Dissertation and Pre-Thesis, documentation and analysis in Building management Studio, Professional training of 30 working days and providing common elective subjects to widen the professional choice. She further added the scope of improvement in the regulations 2015 to provide more importance in project scheduling, the need for more quantitative analysis modules and software's workshop for making the course more practical oriented and there is lack of knowledge in technology and sequencing of construction activities. Finally the methodology adopted in the formulation of the new regulations 2020 syllabus and curriculum is coordinated by Ar.Sukirtha Suresh with the discussions and comments from core committee under the guidance of our Design chair Dr.Suresh Kuppuswamy and myself.

Agenda notes for (R2020) / 2 - Comparative analysis of existing R 2015 and proposed R 2020 curriculum structure, R 2020 curriculum structure and Salient Features of Regulation 2020

Ar. Sukirtha Suresh presented the concepts involved in the proposed Regulations 2020 curriculum. She informed in tune with the SIST's requirement, the syllabus 2020 included the Programme educational Objectives (PEO), Programme outcomes and Programme specific outcomes (PSO) for all the courses and detailed for M.Arch Building Management. Course. She further discussed on the comparative analysis of R 2010, R 2015 and R 2020 and briefed on the inclusion of new theory and practical subjects, the subjects that are merged, the shifting of subject to other semesters.

After the detailed discussion on the comparative analysis of the current and proposed regulations, the external committee member Ar.Sarath remarked on the merging of all the building services to one semester is fine. The external member further added his query about the focus of the our Building Management course to be focused in one segment or to be focused on all the segments referred with the course focus of Building economics at NICMAR and Building services and Energy analysis at SPA, New Delhi. The external committee member also highlighted his thought on the proposed curriculum of regulations 2020 that it has covered everything and its good thing to have choice based subjects as electives.

Furthermore the external committee member Ar.Sarath enquired to Dr.Devyani about the criteria for joining the M.Arch Building Management course and he wished to have a mix of candidates from civil engineering to learn more on managing of whole project in a more analytical approach. Dr.Devyani welcomed the suggestion. Ar.Sarath finalized on the changes are perfectly good and mix of all is good work. The focus can be to certain subjects required like Project Scheduling, Building services, Building economics and life cycle of building can be as elective. It is a good system to introduce electives in semester 3 and 4 to give strength to electives.

Agenda notes for (R2020) / 3 – Detailed discussions on the proposed syllabus (from semester 1 to semester 4) and proposed Regulation 2020.

Ar. Ramesh Kumar presented the detailed syllabus of all the subjects in semester 1. He highlighted the introductive of unit 5 included as constructive assignment to give exposure on the case studies or hands on exposure. He further explained the detailed syllabus of all the subjects in semester 1 and the importance of new course Construction technology for providing knowledge in technology and sequencing of construction

activities, Research methodologies in built environment for introducing research activities in the early semester of the course, financial management for broader understanding on the project evaluation of feasibility and life cycle costing for linking up two different stake holders promoter and buyer, the practical subject for introducing project management software 1 to equip with the knowledge on the software's widely available.

After the detailed discussion on the semester 1 subjects, the BOS external committee member Ar.Sarath opened up with his suggestions to bring in industrial exposure to collaborate with industries for sponsored research projects and for all the constructive assignments and projects, the student can work on one small project to integrate between the subjects. Further the member added to include Energy management software's also in project management workshops.

Ar. Ramesh Kumar presented the detailed syllabus of all the subjects in semester 2. The BOS external committee member Ar.Sarath opened up with his suggestions to do project scheduling with limited resources in their Management studio because often project scheduling does not show on the resource constraints. The member added his comment on the subject Quantitative techniques for which the subject faculty from mathematics or civil engineering need to integrate and work out the statistics to be applicable for Building science. Further the member added a point to expose the students to more software's so that each group of students can explore and share their knowledge with rest of the class.

Ar. Sukirtha continued with the detailed discussion of the subjects in semester 3 and 4, the introduction of two new subjects the operations management, cost accounting and cost benefit analysis. The BOS external committee member Ar.Sarath opened up with his suggestions to mention the size of the company in which the students need to do their professional training. Further the member added a point in finalizing the dissertation topic before they proceed to professional training which helps the student to identify the right choice of the company.

Ar.Sukirtha enquired to the external member for the passing criteria can we mention one publication is mandatory for the candidate in the regulations. The external member Ar.Sarath commented instead of having a rule, the dissertation work is as good as a paper and he suggested to compile all the dissertation work into a journal.

Thereafter the discussion continued with the detail discussions on elective subjects by Ar.Ramesh kumar and Ar.Sukirtha. The BOS external committee member Ar.Sarath

opened up with his suggestion to have expert's lectures from industry and government for all the elective subjects. Rework on the subject responsible community action to facilitate large community of people. He further added some of the elective subjects like Building energy analysis and management can be toned down as a principle to go about as a policy and application just as pin-pointed and also suggested to include facility management as an elective because it is important for post occupancy of buildings. Our external committee member Ar.Sarath finally confirmed with the curriculum and appreciated that the elective subjects have become business verticals for the aspirants.

Vote of Thanks

Ar. Ramesh kumar thanked the expert member Ar. Sarath C Kanth for accepting the invitation of SIST in attending the BOS at a short notice. He thanked him for his valuable suggestions on the agenda items presented. He also thanked the Management, Chancellor Mam and President Sir for the support on conducting the BOS in the licensed digital platform, our Dean and Head, Dr. Devyani Gangopadhyay, Senior professor and Design chair Dr.Suresh Kuppasamy, Ar. Ebin Horrison, Ar. Sukirtha Suresh for coordinating the syllabus revision as Core committee and Ar.Surya Rajkumar for their contribution towards the conduct of this BOS meeting.

Minutes approved by:



Dr. Devyani Gangopadhyay
Dean & Head, Department of Architecture,
School of Building & Environment
Internal Member



Dr. Suresh Kuppasamy
Senior Professor & Design Chair,
School of Building & Environment
Internal Member



Ar. Sarath C Kanth
Design Tech Architects, Chennai
External Expert Member

Note:

The contents highlighted in yellow colour are newly added in the revised syllabus

SAR 5101	CONSTRUCTION PROJECT MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the basic requisites of different management practices, systems, management skills during design and execution phases.
- To explain the students with various project planning and coordination techniques during the pre-construction and construction phase of a project.
- To familiarize the knowledge on software application in project planning of large scale project at various stages.

UNIT 1 PROJECT MANAGEMENT FRAMEWORK**14 Hrs.**

Introduction - Project management, Project management versus Traditional management, Different forms of Project Management – Project Phases – Project Life Cycle – Project Management Process through Initiation, Planning, Execution, control and closure within the triple constraints of scope, time and cost with all inputs, tools & techniques and outputs.

UNIT 2 PROJECT PLANNING**12 Hrs.**

Project Plan Development - Scope Planning with inputs –Master Plan – Programming – Scheduling – Project Organization–Scope planning and Work Definition, Tools and techniques-Expert Judgement and meetings, Outputs of scope planning-Collect requirements, defining scope - WBS, Classification of levels, Scope Control- scope verification and change control.

UNIT 3 COMMUNICATION MANAGEMENT**10 Hrs.**

Inputs: Project Management plan -The Project Management Configuration Plan-Stakeholder register, Documentation and Communication “Road Map” –Enterprise environmental factors, Organizational process assets. Tools & techniques -Communication requirements analysis, Communication Technology –Communication models and methods: General Guidelines for Effective Communication -Conducting High-Quality Meetings - Communication Skills and the Project Manager -Key Project Documentation – Information distribution. Outputs: Communication Management plan to manage stakeholder engagement -Project Manager’s Checklist & Project documents update.

UNIT 4 PROJECT PORTFOLIO MANAGEMENT**12 Hrs.**

Defining and Implementing Project Portfolio Management – Objectives, practices and organizational roles – evolution of PPM - Bridging the Gap between Operations management and Project Management for multiple projects - Project Portfolio Optimization- PPM tools -Standardization, measurement and process improvement, Project Selection and Risk.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1:** Understand the basics of traditional management systems, management skills and project planning including initiation and execution.
- CO2:** Critically evaluate various management methods in planning, execution considering scope verification and control
- CO3:** Outline various work breakdown structure and other activities with reference to project scope, time and cost.
- CO4:** Analyze and assimilate communication and coordination skills to handle complex projects during different phases.
- CO5:** Comprehend various objectives, practices and roles of an organization executing multiple projects.
- CO6:** Understand and bridge the gap in resource allocation for complex project.

TEXT / REFERENCE BOOKS

1. Chitkara, K.K, Construction Project Management, Planning, Scheduling and Controlling, 3rd Edition, Tata McGraw Hill Publishing Co., New Delhi, 2014
2. Calin M. Popescu, Chotchai Charoenngam, Project planning, Scheduling and Control in Construction: An Encyclopaedia of Terms and Applications, John Wiley, New York, 1995
3. Juri Sutt, Manual of Construction Project Management, John Wiley and Sons, 2011
4. Willis E.M., Scheduling Construction projects, John Wiley and Sons, 1986
5. George J. Ritz, Sidney M. Levy, Total Construction Project Management, Second Edition, McGraw-Hill Professional, 2013
6. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, Incorporated, 2013
7. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling and Controlling, 10th Edition, Wiley India Pvt. Ltd., 2013
8. Jonathan F. Hutchings, Project Scheduling Handbook (Civil and Environmental Engineering), CRC Press, 2003
9. Asma Khan and Sean Burn, Project Portfolio Management in Construction Industry, Booktango, 2013

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA5101	CONSTRUCTION PROJECT MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- The objective of the course is to introduce and disseminate the knowledge about project management and their application during the pre- construction and construction phase of a large construction project life cycle.
- To provide the basic understanding about the various project management methodologies used in various phases like initiation, feasibility, design phase, bid and award phases, construction and closeout phases of a project.

UNIT 1	PROJECT MANAGEMENT FRAMEWORK	12 Hrs
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Introduction - Project management, Project management versus Traditional management, Different forms of Project Management – Project Phases – Project Life Cycle – Project Management Process through Initiation, Planning, Execution, control and closure within the triple constraints of scope, time and cost with all inputs, tools & techniques and outputs. Construction project organisations, organisation structure and process; scope and services of PMCO, Roles and Responsibilities of Project Manager, client, promoter, consultant, contractor and the organisational procedures.

UNIT 2	COMMUNICATION & MANAGEMENT INFORMATION SYSTEM (MIS)	9 Hrs
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Project Management plan - The Project Management Configuration Plan - Communication requirements analysis, Communication Technology –Communication models and methods: General Guidelines for Effective Communication - Conducting High-Quality Meetings - Communication Skills and the Project Manager - Key Project Documentation – Information distribution. Management Information Systems; Scope, significance, design criteria of MIS; Formats of MIS for construction stages; Information technology in MIS.

UNIT 3	PROJECT COST AND PORTFOLIO PLANNING	9 Hrs
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Building Economics; Cost components of a construction project; Direct & Indirect costs; Distribution of hard cost in the project, Factors that influencing the construction cost, cost estimation tools, Interpretation of cost information; use of cost indexes etc., Defining and Implementing Project Portfolio Management – Objectives, practices and organizational roles – evolution of PPM - Bridging the Gap between Operations management and Project Management for multiple projects -Project Portfolio Optimization- PPM tools -Standardization, measurement and process improvement, Project Selection and Risk.

UNIT 4	QUALITY MANAGEMENT	9 Hrs
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Quality concepts; Evolution of modern concept of Quality management process approach; TQM. Introduction, Concept and philosophy of TQM -Statistical Quality control-Quality control operations – concepts – norms, techniques and procedures – quality and time – concept of quality in building design, construction and concepts of project management Gurus. Quality assurance & control, information needs at different levels of project organization – organizational functions – types of information. Quality management system, Quality System standards elements, Contractual implications of quality systems– quality management systems – concepts and meaning.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Case study and presentation of large construction projects. Understand and develop site organisation structure, develop site logistics plan for the project planning activities. Develop and present the WBS of the project for various trade packages and prepare a schedule basis CPM technique using scheduling software like MS Project and Primavera Project Planner and find the critical path of the project.

Max. 45 Hours**COURSE OUTCOMES:**

CO1	Understand the basics of traditional management systems, management skills and project planning including initiation and execution.
CO2	Critically evaluate various management methods in planning, execution considering scope verification and control
CO3	Outline various work breakdown structure and other activities with reference to project scope, time and cost.
CO4	Analyse and assimilate communication and coordination skills to handle complex projects during different phases.
CO5	Comprehend various objectives, practices and roles of an organization executing multiple projects.
CO6	Understand and bridge the gap in resource allocation for complex projects.

TEXTS / REFERENCE BOOKS

1. Chitkara, K.K, Construction Project Management, Planning, Scheduling and Controlling, 3rd Edition, Tata McGraw Hill Publishing Co., New Delhi, 2014
2. Calin M. Popescu, ChotchaiCharoenggam, Project planning, Scheduling and Control in Construction: An Encyclopaedia of Terms and Applications, John Wiley, New York, 1995
3. JuriSutt , Manual of Construction Project Management, John Wiley and Sons, 2011
4. Willis E.M., Scheduling Construction projects, John Wiley and Sons, 1986

5. George J. Ritz, Sidney M. Levy, Total Construction Project Management, Second Edition, McGraw-Hill Professional, 2013
6. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, Incorporated, 2013
7. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling and Controlling, 10th Edition, Wiley India Pvt. Ltd., 2013
8. Jonathan F. Hutchings, Project Scheduling Handbook (Civil and Environmental Engineering), CRC Press, 2003
9. Asma Khan and Sean Burn, Project Portfolio Management in Construction Industry, Booktango, 2013
10. Peter Fewings and Christian Henjewe, Construction Project Management, An Integrated Approach, 3rd edition, Swales & Willis Ltd, Exeter, Devon, UK, 2019.
11. Saleh Mubarak, Construction Project Scheduling and Control, Willey & Sons, 2015.

SAR 5102	BUILDING SERVICES I	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the basic concepts of planning, design aspects and relevant codes of building services for complex building typologies.
- To familiarize the students with integration and coordination techniques of various building services during different phases of a project

UNIT 1 WATER SUPPLY AND SANITARY ENGINEERING**14 Hrs.**

Plumbing Codes -Health Requirements for Plumbing - Water Quantity and Pressures - Water-Pipe Sizing Wastewater piping-Wastewater-System Elements - Waste-Pipe Materials - Layout of Waste Piping - Interceptors - Piping for Indirect Wastes - Waste-Pipe Sizing - Venting - Plumbing-System Inspection and Tests. Gas piping - Gas Supply – Gas pipe Sizes - Estimating Gas Consumption – Gas pipe Materials.

UNIT 2 FIRE SAFETY**16 Hrs.**

Fire detection & Fire alarm systems – fire protections systems – study of codes and standards - Telecommunications Structured Cabling Systems - Blown Optical Fibre Technology (BOFT) -sprinkler systems - Automatic Sprinklers - System Design – Standpipes- Water Supplies for sprinkler and Standpipe Systems - Central Station Supervisory Systems-Integration of services — fire alarm system – fire-fighting system and monitoring – safety and security systems – FAS, PAS – access control system- fire fighter telephone system – CCTV surveillance system – IBMS system.

UNIT 3 VERTICAL TRANSPORTATION**8 Hrs.**

Escalators - Elevator Installations - Definitions of Elevator Terms - Elevator Hoist ways - Elevator Cars -Electric Elevators - Hydraulic Elevators - Planning for Passenger Elevators – Elevator systems in high-rise buildings - Planning and design of elevator lobby areas- Dumbwaiters - Conveyers and Pneumatic Tubes - Mail Chutes, recent development in elevator technology.

UNIT 4 NOISE CONTROL**10 Hrs.**

Vibrations from mechanical equipment-Pumps & motors - basic practice of vibration isolation & guidelines, wall, floor & ceiling construction AC ducts - Characteristics of duct system noise, noise sources in ducts & preventive measures, fan room treatment, hangers, water piping system noise control, Building Codes & Standards.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

CO1: Understand design, planning, execution, installation of building services in various building typologies

CO2: Acquire appraisal of new technologies in the building services and monitoring the same during pre-construction and operational phase of complex buildings.

CO3: Analyze and interpret various national and international codes for services and understand the concept of application of the same.

CO4: Integrate building services and demonstrate various energy saving practices.

CO5: Examine the various techniques for noise control and related construction methods.

CO6: Evaluate quantitative metrics for various building services.

TEXT / REFERENCE BOOKS

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5th edition, 1994
2. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7th edition, 2013
3. M.David Egan, Architectural Acoustics, J. Ross Pub., 2007
4. Gurcharan Singh, Jagdish Singh, Water Supply & Sanitary Engineering, Standard Publishers Distributors, 2007
5. Shri V.K. Jain, Fire Safety in Buildings, New age publishers, 2010
6. BIS, National Building Code 2005, New Delhi, 2005.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SAR 5106	BUILDING SERVICES II	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the basic concepts of heating, ventilation and cooling strategies in large residential and institutional complexes.
- To familiarize the students with electrical services, building automation, networking and development for infrastructure services during different phases of a project.

UNIT 1HVAC 14 Hrs.

Major Factors in HVAC Design – Ventilation - Duct Design - Heat Losses - Heat Gains - methods of heating buildings –General procedure for sizing a heating plant- methods of cooling and air conditioning - Sizing an Air-Conditioning Plant – Refrigeration - Cycles - Air-Distribution Temperature for Cooling - Condensers – Compressor-Motor Units.

Cooling Equipment – Central Plant Packaged Units - Zoning - Packaged Air-Conditioning Units – Absorption Units for Cooling - Ducts for Air Conditioning - Built-Up Air-Conditioning Units - Variable-Air- Volume (VAV) Systems - Air-Water Systems - Control Systems for Air Conditioning - Heating and Air Conditioning – Industrial -Air Conditioning - Chemical Cooling - Year-Round Air Conditioning - Energy efficiency techniques in air conditioning - Air conditioning in IT environments, hospitals etc., - Air conditioning for green buildings.

UNIT 2ELECTRICAL SERVICES**12 Hrs.**

Electrical power – DC / Ac system, electrical load and emergency power – electrical conductors and raceways – electrical distribution in buildings – Substations – substation equipment's – power distribution system – standby and alternate power supply system. Light and sight – quality of light – lighting methods – daylight – system design of lighting. Measuring Light and Illumination –selection of recommended Illuminance - Zonal Cavity Method of Calculating Illumination - Lamp characteristics and Selection Guide –Impact of light on color - Integration of services – Electrical power monitoring– IBMS system.

UNIT 3BUILDING AUTOMATION AND NETWORKING**12 Hrs.**

Introduction to building automation systems – components of BAS – HVAC – Lighting – electrical systems- water supply and sanitary systems– fire safety – security -communication and office automation system – concept of Intelligent buildings - Integration of services – water pump monitoring & control - Control of Computerized HVAC Systems -Direct Digital Control - chillers, pumps, BTU monitoring & control ,Data networking– IBMS system and its components – centralized control equipment's – substation and field controllers – field sensors.

UNIT 4INFRASTRUCTURE SERVICES**10 Hrs.**

Civil infrastructure services for residential and institutional complexes with planning, design, construction and maintenance of external development works such as water supply, sewerage, solid wastes, roads and storm water drainage, including raw water harvesting methods

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1:** Understand various concepts of ventilation systems which includes, design, planning, execution, installation of the same in various building typologies.
- CO2:** Critically evaluate and study importance of lighting and appraisal of new technologies in design of lighting systems in complex buildings.
- CO3:** Analyze and interpret various national and international codes for services and understand the concept of application of the same.
- CO4:** Integrate building services and demonstration of various energy saving practices.
- CO5:** Examine the various components and techniques for building automation and related design and installation techniques.
- CO6:** Analyze and assimilate diverse civil infrastructure services in different types of projects.

TEXT / REFERENCE BOOKS

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5th edition, 1994
2. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7th edition, 2013
3. Shan Wang, Handbook of Air Conditioning and Refrigeration, 2nd Edition, McGraw Hill, 2000
4. Krieder, J. F., Handbook of Heating Ventilation and Air Conditioning, Taylor & Francis, 2005
5. Barrie Rigby, Design of Electrical Services for Buildings, 4th Edition, Routledge, 2013
6. W. E. Steward, T. A. Stubbs, Modern Wiring Practice Design and Installation; 14 edition, Newnes, 2009
7. BIS, National Building Code 2005, New Delhi, 2005

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**Exam Duration: 3 Hrs.****PART A : 2 questions from each unit, each carrying 4 marks.****: 08 x 05 = 40 Marks****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****: 04 x 15 = 60 Marks**

SARA5103	BUILDING SERVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the basic concepts of planning, design, execution and maintainability of mechanical, electrical, plumbing and fire safety services so as to effectively co-ordinate preconstruction and construction phase of projects.
- To familiarize the students with integration and coordination of various internal building services and external infrastructure services such as electrical, storm water drainage, sewerage, communication system and other civil infrastructure facilities.

UNIT 1	WATER SUPPLY AND SANITARY ENGINEERING	9 Hrs
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Water Quantity and Pressures - Water-Pipe Sizing Wastewater piping-Wastewater-System Elements - Layout of Waste Piping - Interceptors - Piping for Indirect Wastes - Waste-Pipe Sizing - Venting - Plumbing-System Inspection and Tests. Gas piping - Gas Supply – Gas pipe Sizes - Estimating Gas Consumption – Gas pipe Materials. building automation systems – components of BAS related to Water supply and sanitary system; water pump monitoring and control.

UNIT 2	HVAC SYSTEM	12 Hrs
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Factors in HVAC Design – Ventilation - Duct Design - Heat Losses - Heat Gains - methods of heating buildings – methods of cooling and air conditioning - Air-Conditioning Plant – Refrigeration - Cycles - Air-Distribution Temperature for Cooling - Condensers – Compressor Units.

Cooling Equipment – Central Plant - Zoning - Packaged Air-Conditioning Units –Ducts - Variable Air Volume (VAV) Systems – Variable Frequency Drive (VFD) – dampers - Air-Water Systems - Industrial -Air Conditioning - Chemical Cooling - Energy efficiency techniques- Air conditioning in office, hospitals, malls, and laboratory etc. - Air conditioning for green buildings. Building; automation systems – components of BAS related to HVAC, Control of HVAC systems-Direct Digital Control – chiller pumps, BTU monitoring & control. Vibrations from A/C equipment- vibration isolation - all, floor & ceiling, AC ducts - noise sources in ducts & preventive measures, fan room treatment, hangers, noise control in water piping system.

UNIT 3	ELECTRICAL & FIRE FIGHTING SERVICES	9 Hrs
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Electrical - DC / AC system, electrical load and emergency power – electrical conductors and raceways – Substations – power distribution system – standby and alternate power supply system. Light and sight – quality of light – lighting methods – daylight – system design of lighting. Measuring Light and Illumination –selection of recommended Illuminance - Zonal Cavity Method of Calculating Illumination - Lamp characteristics and Selection Guide –Integration of services – Electrical power metering / monitoring.

Fire detection and Fire alarm system – fire protections and fire-fighting system and monitoring – sprinkler system - – Standpipes- Water Supplies – pump room design and system arrangements - safety and security systems – FAS, PAS – access control system- fire fighter telephone system – CCTV surveillance system – IBMS system. Components of BAS related to Electrical system and fire safety, security – Communication and Automation system

UNIT 4	VERTICAL TRANSPORTATION & EXTERNAL INFRASTRUCTURE SERVICES	9 Hrs
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Escalators - Elevator Installations - Electric Elevators - Hydraulic Elevators –MRL type elevators - Planning for Passenger Elevators – Elevator systems in high-rise buildings - Planning and design of elevator lobby areas- Dumbwaiters - Conveyers and Pneumatic Tubes - Mail Chutes, recent development in elevator technology.

External infrastructure services for residential and institutional complexes –planning, design, construction aspects of water supply, sewerage, solid wastes, roads and storm water drainage and RW harvesting. Telecommunications, Structured Cabling Systems - Blown Optical Fibre Technology (BOFT) - Central Station Supervisory Systems-Integration of services

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Case study and presentation of large construction projects. Understanding and presenting the schematic of services and their integration in the complex and large project environment. Study and Presentation of BAS integration of various internal and external services. Study and presentation of noise control measures taken for various services equipment used in construction projects. Exploring the building services provisions and operations during pandemic conditions.

Max. 45 Hours**COURSE OUTCOMES:**

CO1	Understand various concepts of ventilation systems, which includes, design, planning, execution, installation of the same in various building typologies.
CO2	Critically evaluate and study importance of lighting and appraisal of new technologies in design of lighting systems in complex buildings
CO3	Analyze and interpret various national and international codes for services and understand the concept of application of the same.
CO4	Integrate building services and demonstrate various energy saving practices.

CO5	Examine the various techniques for noise control and related construction methods.
CO6	Evaluate quantitative metrics for various building services.

TEXTS / REFERENCE BOOKS

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5th edition, 1994
2. Fred hall and Roger Greeno, Building Services Handbook, Routledge, 7th edition, 2013
3. M.David Egan, Architectural Acoustics, J. Ross Pub., 2007
4. Gurcharan Singh, JagdishSingh, Water Supply & Sanitary Engineering, Standard Publishers Distributors, 2007
5. Shri V.K. Jain, Fire Safety in Buildings, New age publishers, 2010
6. Shan Wang, Handbook of Air Conditioning and Refrigeration, 2nd Edition, McGraw Hill, 2000
7. Krieder, J. F., Handbook of Heating Ventilation and Air Conditioning, Taylor & Francis, 2005
8. Barrie Rigby, Design of Electrical Services for Buildings, 4th Edition, Routledge, 2013
9. W. E. Steward, T. A. Stubbs, Modern Wiring Practice Design and Installation; 14 edition, Newnes,2009
10. BIS, National Building Code 2005, New Delhi, 2005.

SAR 5103	FUNCTIONAL EFFICIENCY OF BUILDINGS	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES:

- To comprehend the physics behind thermal, air movement and acoustical dynamics in buildings.
- To understand the norms for Building envelope, including thermal, day lighting and acoustic performance requirements.
- To construct knowledge on the application of thermal and acoustical parameters in creating efficiency in buildings

UNIT 1 THERMAL BEHAVIOUR OF BUILDINGS**16 Hrs.**

Introduction to concept of Effective Temperature – Corrected Effective Temperature – Procedures- Comfort zone – Overheated Period – design of shading devices – resistance and conductance – transmittance – thermal gradient – Periodic heat flow – Time lag and decrement factor – Procedures - Thermal exchange in buildings – Building heat gain and heat loss.

UNIT 2 PLANNING FOR VENTILATION**12 Hrs.**

Functions of ventilation – Stack effect – calculations – provision for Air movement – air flow through buildings – calculation of indoor air velocity – ventilation rate - orientation, external features, cross ventilation – position of openings, size of openings, controls of openings- calculations- air flow around buildings – humidity control.

UNIT 3 DAYLIGHTING**10 Hrs.**

Principles of light- transmission, reflection and absorption – illumination – day lighting concepts - day lighting in the tropics – daylight requirements – daylight protractor – calculations – distribution of daylight.

UNIT 4 ACOUSTICS**10 Hrs.**

Acoustic considerations in Open plan offices, Lecture rooms, Lecture Halls, Seminar halls, Recording Studios, Broadcasting studios, Opera House, Worship places. Acoustic considerations in Ancient theatres, basic theatre stages, performance spaces and types. Design principles for Auditoriums- side wall, rear wall & ceiling treatment, sound reinforcing systems home theatres, digital media auditorium & auditorium for the future.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

CO1: Inquest in to thermal characteristics of building and the role of comfort

CO2: Explore the dynamics in thermal exchanges in buildings

CO3: Understand role of building design and the resultant environment on the articulation of air movement in and around buildings

CO4: Analyze the effectiveness of day light and the methods and principles behind day lighting

CO5: Investigate the role of acoustics in design of public and performance spaces.

TEXT / REFERENCE BOOKS

1. Koenigsberger, O. H., Ingersoll, T. G., Mayhew. A, Szokolay.S.V, Manual of Tropical Housing and Building, Part 1 – Climatic Design, Orient Longman Pvt. Ltd, Chennai, 2004
2. Martin Evans, Housing, Climate and Comfort, Architectural Press, London, 1980
3. Arvind Krishnan, Nick Baker, Simons Yannas, S V Szokolay, Climatic Responsive Architecture- A Design Handbook for Energy Efficient Buildings, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2001
4. BIS, SP 41: Handbook on Functional Requirements of Buildings (Other than Industrial Buildings), 1987
5. David Egan. M, Concepts in Thermal Comfort, Prentice Hall, 1975
6. Baruch Givoni, Climate considerations in building and urban design, John Wiley & Sons, New York, 1998

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA7305	FUNCTIONAL PERFORMANCE OF BUILDINGS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To comprehend the physics behind thermal, air movement and acoustical dynamics in buildings.
- To understand the norms for Building envelope, including thermal, day lighting and acoustic performance requirements.
- To construct knowledge on the application of thermal and acoustical parameters in creating efficiency in buildings

UNIT 1	THERMAL BEHAVIOUR OF BUILDINGS	9 Hrs
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Introduction to concept of Effective Temperature – Corrected Effective Temperature – Procedures- Comfort zone – Overheated Period

UNIT 2	PLANNING FOR VENTILATION	12 Hrs
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Functions of ventilation – Stack effect – calculations – provision for Air movement – air flow through buildings – calculation of indoor air velocity – ventilation rate - orientation, external features, cross ventilation – position of openings, size of openings, controls of openings- calculations- air flow around buildings – humidity control - Artificial ventilation systems and their applications.

UNIT 3	NATURAL AND ARTIFICIAL LIGHTING	9 Hrs
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Principles of light- transmission, reflection and absorption – illumination – day lighting concepts - day lighting in the tropics – daylight requirements – daylight protractor – calculations – distribution of daylight. Lighting need assessment; Day-Lighting and Electric-lighting concepts; Analysis and design tools; Lamps and Fixtures; Lighting system planning and Integration; Specialized lighting requirements; Smart Lighting, IT tools for illumination analysis and design.

UNIT 4	ACOUSTICS	9 Hrs
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Basics of Building Acoustics.– decibels scale and frequency spectrum – propagation of Sound – directional and non-directional sources – background noise criteria – criteria for acoustic quality – Acoustic Design Considerations. Design principles for Auditoriums- sidewall, rear wall & ceiling treatment, sound reinforcing systems, home theatres, digital media auditorium & auditorium for the future.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Understand and present the thermal behaviour of buildings in various climatic conditions. Analyse and propose an innovative and effective ventilation method for high-rise and low-rise buildings with the options. Also, analyse the requirement of artificial and natural lighting and acoustics for the selected building in various areas.

Max. 45 Hours

COURSE OUTCOMES:

CO1	Inquest in to thermal characteristics of building and the role of comfort
CO2	Explore the dynamics in thermal exchanges in buildings
CO3	Understand role of building design and the resultant environment on the articulation of air movement in and around buildings
CO4	Analyze the effectiveness of day light and the methods and principles behind day and artificial lighting
CO5	Investigate the role of acoustics in design of public and performance spaces.
CO6	Application of various techniques for lighting, ventilation and acoustics in the building design and assess the performance efficiency compared to the conventional building design.

TEXTS / REFERENCE BOOKS

1. Koenigsberger, O. H., Ingersoll, T. G., Mayhew, A, Szokolay, S.V, Manual of Tropical Housing and Building, Part 1 – Climatic Design, Orient Longman Pvt. Ltd, Chennai, 2004
2. Martin Evans, Housing, Climate and Comfort, Architectural Press, London, 1980
3. Arvind Krishnan, Nick Baker, Simons Yannas, S V Szokolay, Climatic Responsive Architecture- A Design Handbook for Energy Efficient Buildings, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2001
4. BIS, SP 41: Handbook on Functional Requirements of Buildings (Other than Industrial Buildings), 1987
5. David Egan. M, Concepts in Thermal Comfort, Prentice Hall, 1975
6. Baruch Givoni, Climate considerations in building and urban design, John Wiley & Sons, New York, 1998

SAR 5104	CONTRACT MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To expose the students to the selection process of different contract types, legal compliance and various international and national contract forms.
- To outline the contractual procedures including tendering process, pre-qualification of contractors, evaluation of contract bids, preparation of contract documents, and awarding of contracts.
- To discuss issues related to contract administration and dispute resolution.

UNIT 1 LEGAL FRAMEWORK, CONTRACTS AND CONTRACT DOCUMENTS**16 Hrs.**

Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Insurance and Bonding – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations. Indian Contracts Act – Types of Contracts – formation of contracts - Elements of Contracts – potential contractual problems – contracts for engineering and architectural services – contracts for construction. Introduction to construction Contract Documents – drawings as construction contract document – specifications as construction document – construction contract conditions – introduction to construction specification.

UNIT 2 TENDERS**8 Hrs.**

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act.

UNIT 3 CONTRACT ADMINISTRATION ISSUES**16 Hrs.**

Introduction – duties of employer, contractor, interpretation of contract, Breach of contract – changes during the contract – changes dealing with differing site conditions – Force majeure – delay analysis – claims - cost escalation – time delays and extensions, compensation, notices and termination.

UNIT 4 DISPUTES AND ARBITRATION**8 Hrs.**

Types of disputes in construction contracts – methods of dispute resolution processes – alternative dispute resolution and dispute review mechanisms – arbitration and conciliation act 1996 – managerial approach to dispute minimization – conduct of arbitration proceedings – arbitration award and termination proceedings – powers of arbitrator – setting aside of awards and enforcement of awards – appeal, revision and court proceedings.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1:** Understand legal requirements and compliance of construction contracts for the sale and use of urban and rural lands.
- CO2:** Classify different types of contract and tenders, and preparation of contract documents.
- CO3:** Categorize contract documents for contract administration and roles, responsibilities of the different stakeholders.
- CO4:** Analyze the causes of cost and time overruns and relating them to the relevant clauses of contract to prevent litigations.
- CO5:** Identify the process of negotiation, claims management, conflicts and dispute management.
- CO6:** Identify issues causing legal disputes between parties and resolution of disputes through arbitration.

TEXT / REFERENCE BOOKS

1. Gajaria G.T and Kishore Gajaria, Laws Relating to Building and Engineering Contracts in India, LexisNexis Butterworths India, 2000
2. Jimmie Hinze, Construction Contracts, 3rd Edition, McGraw-Hill, 2010
3. Joseph Bockrath and Fredric Plotnick Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw-Hill, 2010
4. Kwaku A. Tenah and Jose M Guevara., Fundamentals of construction Management and organization, Reston Publishing Company, 1985
5. Construction Specifications Institute, Construction Contract Administration Practice Guide, John Wiley & Sons, 2011
6. Greg Goldfay, Construction Contract Administration, UNSW Press, 2004.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**Exam Duration: 3 Hrs.****PART A : 2 questions from each unit, each carrying 4 marks.****: 08 x 05 = 40 Marks****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****: 04 x 15 = 60 Marks**

SARA5204	CONTRACT MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To expose the students to the selection process of different contract types, legal compliance, various international and national contract forms for different types of project.
- To outline the contractual procedures including tendering process, pre-qualification of contractors, evaluation of contract bids, preparation of contract documents, and awarding of contracts.
- To expose the students to the contractual issues and related contract administration and dispute resolution procedures.

UNIT 1	LEGAL FRAMEWORK AND CONTRACTS	9 Hrs
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Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Insurance and Bonding – Income Tax, Goods and Service Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations. Indian Contracts Act – Types of Contracts – formation of contracts - Elements of Contracts – potential contractual problems – contracts for engineering and architectural services – contracts for construction.

UNIT 2	CONTRACT DOCUMENTS AND TENDERS	12 Hrs
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Various types of construction contracts, general and special conditions of contract, comparative study of contract conditions - construction contract as a legal proposal, agreement, consideration, contract Planning, tender documents, tendering process - pre-tendering, bid organization, invitation, receipts and evaluation negotiations, award of work, - prequalification methods (rating/ evaluation and enlisting of construction agencies), bid review and evaluation, methods of subcontracting; Contract close-out; Defect liability and performance guarantee; Undertaking works at Contractor's risk and cost; Construction Contract Documents – drawings as construction contract document – specifications as construction document – construction contract conditions – construction specification_ list of approved materials and makes.

UNIT 3	LABOUR REGULATIONS, INSURANCES AND CONTRACT ADMINISTRATION	9 Hrs
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Construction specific labour laws and regulations, The Building and Construction Workers (regulation of employment and conditions of service) Act, 1996, Workmen's Compensation Act, Payment of Wages Act, The Employees Provident Fund and Miscellaneous provisions Act 1996;

Insurance in construction works; CAR (contractor all risk policy) Premium determination and risk reduction; duties of employer, contractor, interpretation of contract, Breach of contract – changes during the contract – changes dealing with differing site conditions – Force majeure – delay analysis – claims - cost escalation – time delays and extensions, compensation, notices and termination.

UNIT 4	DISPUTES AND ARBITRATION	9 Hrs
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Types of disputes in construction contracts – methods of dispute resolution processes – alternative dispute resolution and dispute review mechanisms – Dispute Resolution Board proceedings - arbitration and conciliation act 1996 – Arbitration proceedings - managerial approach to dispute minimization – conduct of arbitration proceedings – arbitration award and termination proceedings – powers of arbitrator – setting aside of awards and enforcement of awards – appeal, revision and court proceedings.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Study the conventional and emerging contract types like CPWD, MES, FIDIC, AIA, NEC, JCT and other international contract types and do the comparative analysis - Prepare a bidding model and strategies for medium / large-scale project cases. Critical appraisal of the conditions of contract for the project; Comparison of contract conditions; determination of special conditions of contract for the project and Professional Ethics.

Max. 45 Hours**COURSE OUTCOMES:**

CO1	Understand legal requirements and compliance of construction contracts for the sale and use of urban and rural lands.
CO2	Classify different types of contract and tenders, and preparation of contract documents.
CO3	Categorize the role of labor regulations, insurances in the contract documents for contract administration.
CO4	Analyze the causes and effect of cost and time overruns and relating them to the relevant clauses of contract to prevent litigations.
CO5	Identify the process of negotiation, claims management, conflicts and dispute management.
CO6	Identify issues causing legal disputes between parties and resolution of disputes through arbitration.

TEXTS / REFERENCE BOOKS

1. Gajaria G.T and Kishore Gajaria, Laws Relating to Building and Engineering Contracts in India, LexisNexis Butterworths India, 2000
2. Jimmie Hinze, Construction Contracts, 3rd Edition, McGraw-Hill, 2010
3. Joseph Bockrath and Fredric Plotnick Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw-Hill, 2010
4. Kwaku A. Tenah and Jose M Guevara., Fundamentals of construction Management and organization, Reston Publishing Company, 1985
5. Construction Specifications Institute, Construction Contract Administration Practice Guide, John Wiley & Sons, 2011
6. Greg Goldfay, Construction Contract Administration, UNSW Press, 2004.
7. CPWD-General conditions of contract 2019_construction works / specifications.

SAR 6530	BUILDING MANAGEMENT STUDIO I	L	T	P	Credits	Total Marks
		0	0	14	7	200

COURSE OBJECTIVES:

- To identify, reflect upon, evaluate and apply different types of information and knowledge on building services to arrive upon design solutions and recommendations.
- The final project report will comprise of an in-depth research and analysis of existing building services in the form of drawings & relevant details/codes, schematic charts & reports, photographs, documentation of the selected project and evaluation to appraise the efficiency with respect to design and energy.

COURSE CONTENT

The Building Management studio I aims to provide an opportunity for students to learn and understand the process of applying project management learning, techniques, efficient planning and co-ordination of building services (Plumbing, Fire Fighting and Vertical Transportation) in complex buildings.

The project involves two simultaneous case studies. Each case study shall be a piece of investigation work focused on the application of the concepts of project management and building services respectively. The focus shall be on an actual problem, in respect of design, techniques, installation, testing & commissioning and operation of buildings and the above mentioned related services.

Students shall gather information through their investigation from the live case studies related to the building techniques, building services and analyze the details with respect to industry standards and owner requirements to have better understanding on the key factors determining the process of project management at various stages of project life cycle. Students should prepare the logical work break down structure of a construction project and implement the duration along with resource allocation and leveling using MSP or Primavera with I understanding of preparation, crashing, and updating of schedule in major construction work.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1:** Prepare detailed report on an existing recently executed high rise project with respect to various management methods in design, planning, execution, installation of building services in various building typologies with single or mixed user (residential & commercial, or other combinations).
- CO2:** Demonstrate knowledge in the services with focus on water supply, fire safety, vertical transportation, noise control and automation with energy saving concepts.
- CO3:** Investigate case study with focus on the application of the concepts of project management and building services respectively.
- CO4:** Understand planning & organization issues, types of communication, direct & indirect controls, process of decision making, break-even analysis and material inventories.
- CO5:** Formulate a logical work break down structure of a construction project and implement the duration along with resource allocation and leveling using MSP or Primavera.
- CO6:** Analyze the issues identified at various stages of the project and recommend alternative solutions.

TEXT / REFERENCE BOOKS

1. Ludwig Sasse.,DEWATS: Decentralized waste water treatment in developing countries, BORDA publishers,1998.
2. Alaerts, Venestra, Bentvelsen.,M. Van Kujit ,Feasibility of Anaerobic Sewage treatment in Sanitation Strategies inDeveloping Countries, Et al, Delft publishers,1990.
3. Marshall Long- Architectural Acoustics, Elsevier Academic press,2006.

SARA9121	BUILDING MANAGEMENT STUDIO I	L	T	P	Credits	Total Marks
		0	0	12	6	300
Continuous Assessment		University Viva			Min Pass Marks	
200		100			150	

COURSE OBJECTIVES:

- To augment the knowledge imparted through lectures by discussion of practical cases to determine practice, critically analyze application of knowledge in the professional context, experience simulated application procedure in a limited context.
- Live case studies are to be undertaken and various aspects of the course to be taken up in the studios. Emphasis is given to interaction with project technical staff and other stakeholders. Application of software and other IT tools on actual real life cases are undertaken to enable hands on experience.

STUDIO BRIEF

The Building Management studio I aims to provide an opportunity for students to get introduced to project management and familiarize with the building project services through studies of project drawings & documents and extracting the inferences for group projects on the various aspects like Project brief - Area Usage - FAR / Area statement - Bye laws - Soil Investigation - Architectural appraisal, Configuration of spaces, plans, sections, elevations, levels, landscaping etc., -Structural appraisal: Foundation system, Structural system, Details on structural members including sizes and material specifications - MEP appraisal: Conceptual drawings, SLDs, and actual drawings showing location of services. Interaction of MEP with other aspects of project in terms of sequencing, layout etc. The study of internal and external co-ordination aspects required in various areas of construction and services to be understood practically through site visits.

Students shall gather information through their investigation from the live case studies related to the building techniques, building services and analyze the details with respect to industry standards and owner requirements to have better understanding on the key factors determining the process of project management at various stages of the project life cycle. The inferences of the study also to be compared with the building codes and standards and recommend the suitability.

DELIVERABLES

The students shall define and record the case study documentation in project management context with reference buildings and related services, infrastructure with the project phases, project stakeholders and project organization and their roles, responsibilities, scope and services of team. The final report to comprise in-depth analysis of existing building services in the form of drawings, sketches, photographs, relevant details, referral codes, schematic charts, reports, cognitive analysis diagram, empirical documentation, detailed narratives and appraise the suitability and efficiency of design and application. The proposal for modification and enhancement of system based on their case analysis.

TEXT / REFERENCE BOOKS

1. National Building Code of India 2016 (NBC Volume 1 & 2)
2. National Fire Prevention Association standards
3. Bureau of Indian Standards (BIS)
4. British Standards (BS)
5. Energy conservation building code (ECBC)
6. Bureau of Energy Efficiency (BEE)
7. American Society of Heating, Refrigeration and Air conditioning Engineers (ASHRAE)
8. SP 72: National Lighting Code 2010.

SAR 5105	PROJECT PLANNING AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand Project planning control of project realization processes.
- Develop awareness on network analysis, scheduling and costing in project planning process and introduce comprehensive planning in complex projects.

UNIT 1 NETWORK ANALYSIS**10 Hrs.**

Work break down structure -assessing duration -Project scheduling, Job layout, Bar charts, Milestone charts, Network schedule, time limited and resource limited schedule, schedule hierarchy. Activity Definition and Sequencing, Duration estimating – PERT, CPM, Network elements, Time Estimates, The critical path method - Calculations for critical path scheduling – PERT vs CPM , Activity float and schedules , Resource oriented scheduling – Scheduling with resource constraints - Use of Advanced Scheduling Techniques-Scheduling with uncertain durations.

UNIT 2 SCHEDULING**10 Hrs.**

Schedule development, Control – Factors affecting work scheduling, forecasting inputs and outputs, schedule hierarchy- Relevance of construction schedules, management through networks- Purpose of work scheduling, Bar chart method of work scheduling, Scheduling the network plan, Line of Balance technique of scheduling repetitive projects.

UNIT 3 COSTING AND CONTROL**14 Hrs.**

Cost planning: Cost Estimating Process, Inputs, Tools & Techniques classification of costs, financial forecasting, budgeting- BOQ-unit rate costing standards of resources, work-package standard cost, standard 'S' curve forecasting tool.

Cost control: Cost Accounting System, cost control preliminaries, Control approach, revenue or sales control, direct cost control, indirect cost control, project budgetary control systems, control responsibility, risk cost management.

Project time control: Time progress monitoring methodology, what if analysis, reviewing time progress, time-cost relationship, Time -Schedule control, Time reduction techniques, work progress reviewing procedure.

UNIT 4 COMPREHENSIVE PLANNING FOR COMPLEX PROJECTS**14 Hrs.**

Project definition–Objectives-Strategy-Technology and design-External factors, finance, and duration – Political and social issues-Planning and control, environmental, and economic factors – Attitudes–Implementation – Organization-Contract Strategy –Strategic issues for enterprises working on multiple projects with thrust on highrise constructions - Project closeout - Learning from past experience -Releasing people and equipment -Recognizing and rewarding people - Some guidelines for future projects -Questions for getting started.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1:** Familiarize on the work breakdown structure in a construction project and imparting knowledge on project scheduling.
- CO2:** Understand in-depth project scheduling with required inputs, tools and techniques applied and outputs achieved.
- CO3:** Practically apply CPM, PERT analysis in time scheduling through network diagram of construction activities.
- CO4:** Acquire knowledge on the relationship between cost and time, the pros and cons of cost overrun and cost under run and the techniques adopted for cost control.
- CO5:** Apply crashing in a construction project to understand the various costs involved and cost overrun through calculations and analysis.
- CO6:** Understand the comprehensive planning involved in complex projects through various parameters and creating a detailed schedule for a construction project.

TEXT / REFERENCE BOOKS

1. Chitkara, K.K. Construction Project Management, Planning, Scheduling and Controlling, 3rd Edition, Tata McGraw Hill Publishing Co., New Delhi, 2014
2. Calin M. Popescu, Chotchai Charoengnam, Project planning, Scheduling and Control in Construction: An Encyclopaedia of Terms and Applications, John Wiley, New York, 1995
3. JuriSutt , Manual of Construction Project Management for owners and clients, John Wiley and Sons, 2011
4. Willis., E.M., Scheduling Construction projects, John Wiley and Sons, 1986
5. George J. Ritz, Sidney M. Levy, Total Construction Project Management, Second Edition, McGraw-Hill Professional, 2013
6. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, Incorporated, 2013
7. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling and Controlling, 10th Edition, Wiley India Pvt. Ltd., 2013
8. Jonathan F. Hutchings, Project Scheduling Handbook (Civil and Environmental Engineering), CRC Press, 2003

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA5201	PROJECT PLANNING AND CONTROL	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand Project planning control of project realization processes.
- Develop awareness on network analysis, scheduling and costing in project planning process and introduce comprehensive planning in complex projects.

UNIT 1	NETWORK ANALYSIS	9 Hrs
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Work break down structure-assessing duration - Project scheduling, Job layout, Bar charts, Milestone charts, Network schedule, time limited and resource-limited schedule, schedule hierarchy. Activity Definition and Sequencing, The critical path method - Calculations for critical path scheduling – PERT vs CPM; Duration estimating – PERT, CPM, Network elements, Time Estimates, Activity float and schedules.

UNIT 2	SCHEDULING	12 Hrs
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Schedule development, Resource oriented scheduling – Scheduling with resource constraints – Use of Advanced Scheduling Techniques-Scheduling with uncertain durations., Control – Factors affecting work scheduling, forecasting inputs and outputs, schedule hierarchy- Relevance of construction schedules, management through networks- Purpose of work scheduling, Bar chart method of work scheduling, Scheduling the network plan, Line of Balance technique of scheduling repetitive projects.

UNIT 3	COSTING AND CONTROL	9 Hrs
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Cost planning: Cost Estimating Process, Inputs, Tools & Techniques classification of costs, financial forecasting, budgeting- BOQ-unit rate costing standards of resources, work-package standard cost, standard 'S' curve forecasting tool
 Cost control, Cost accounting system, cost control preliminaries, Control approach, revenue or sales control, direct cost control, indirect cost control, project budgetary control systems, control responsibility, risk cost management
 Project time control, Time progress monitoring methodology, what if analysis, reviewing time progress, time-cost relationship, Time -Schedule control, Time reduction techniques, work progress reviewing procedure.

UNIT 4	COMPREHENSIVE PLANNING FOR COMPLEX PROJECTS	9 Hrs
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Project definition–Objectives-Strategy-Technology and design-External factors, finance and duration – Political and social issues-Planning and control, environmental, and economic factors – Attitudes–Implementation – Organization-Contract Strategy –Strategic issues for enterprises working on multiple projects with thrust on high-rise constructions - Project closeout - Learning from past experience -Releasing people and equipment -Recognizing and rewarding people - Some guidelines for future projects -Questions for getting started.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Prepare work breakdown structure for the project and basis the understanding on the project execution sequence. List the sequential activities and workout the time required for accomplishing each task and activities. Develop a resource allocation data and optimise the timeline using the resource balancing techniques. Apply crashing techniques to reduce the timeline on the project while doing the tracking as a part of project control.

Max. 45 Hours**COURSE OUTCOMES:**

CO1	Familiarizing on the work breakdown structure in a construction project and imparting knowledge on project scheduling.
CO2	In-depth understanding on project scheduling with required inputs, tools and techniques applied and outputs achieved.
CO3	Practical application of CPM, PERT analysis in time scheduling through network diagram of construction activities.
CO4	Knowledge on the relationship between cost and time, the pros and cons of cost overrun and cost under run and the techniques adopted for cost control.
CO5	Application of crashing in a construction project to understand the various costs involved and cost overrun through calculations and analysis.
CO6	Understanding the comprehensive planning involved in complex projects through various parameters and creating a detailed schedule for a construction project.

TEXTS / REFERENCE BOOKS

1. Chitkara, K.K. Construction Project Management, Planning, Scheduling and Controlling, 3rd Edition, Tata McGraw Hill Publishing Co., New Delhi, 2014
2. Calin M. Popescu, ChotchaiCharoenngam, Project planning, Scheduling and Control in Construction: An Encyclopaedia of Terms and Applications, John Wiley, New York, 1995
3. JuriSutt , Manual of Construction Project Management for owners and clients, John Wiley and Sons, 2011

4. Willis., E.M., Scheduling Construction projects, John Wiley and Sons, 1986
5. George J. Ritz, Sidney M. Levy, Total Construction Project Management, Second Edition, McGraw-Hill Professional, 2013
6. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, Incorporated, 2013
7. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling and Controlling, 10th Edition, Wiley India Pvt. Ltd., 2013
8. Jonathan F. Hutchings, Project Scheduling Handbook (Civil and Environmental Engineering), CRC Press, 2003
9. Peter Fewings and Christian Henjewe, Construction Project Management, An Integrated Approach, 3rd edition, Swales & Willis Ltd, Exeter, Devon, UK, 2019.
10. Saleh Mubarak, Construction Project Scheduling and Control, Willey & Sons, 2015.

SAR 5107	QUALITY MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the different concepts of quality management systems and its principles.
- To study and understand quality management systems and its relevant applications to planning, design & construction of buildings.

UNIT 1 TOTAL QUALITY MANAGEMENT**14 Hrs.**

TQM: Introduction, Concept and philosophy of TQM - ISO standards, importance of control systems, elements of excellence – requirements of standards – advantages of documentation – general principles in documentation – types of documents – steps to get accreditation -Quality cost, Business process re-engineering, Benchmarking, Partnering - Quality Circles, Quality system standards for construction elements, Inspections & tests - Quality management tools, Environmental Management system Standards and their application in construction, EMS-QMS relationships.

UNIT 2 STATISTICAL QUALITY CONTROL**12 Hrs.**

Quality control operations – concepts – norms, techniques and procedures – quality and time – concept of quality in building design, construction and Project management - maintenance, Deming' s principles - Special features of construction vs. manufacturing sector - quality responsibilities and commitment of Architect, consultant, project managers and contractors - Practical aspects of quality control in building projects, quality during building's life – quality control in concrete – product quality inspection and tests, problems of rework, wastage and compromise in product quality approach, problems of inspections/test oriented approach in service quality, systems approach to quality.

UNIT 3 QUALITY ASSURANCE AND QUALITY CONTROL**10 Hrs.**

Quality assurance & control, information needs at different levels of project organization – organizational functions – types of information. Training QMS – objective – requirement – programmes – workers and operators – typical training programmes - Quality Audit – organization – interface.

UNIT 4 QUALITY MANAGEMENT SYSTEMS**12 Hrs.**

Quality management system and ISO 9000:2000 requirements, Quality System standards elements, Standards of quality management system, Contractual implications of quality systems– quality management systems – concepts and meaning – importance of quality management in construction projects – role of QMS in project management Quality concepts and stakeholders concerns for building and construction, Evolution of modern concept of Quality management process approach - Quality systems standards of BS 5750/QS 9000 series and their evolution - ISO 9000 Quality system standards; applicability of ISO 9000 series standards worldwide, India and Indian Building sector; Elements of ISO 9000 series standards.

Max. 48 Hours**COURSE OUTCOMES:**

On completion of the course the student will be able to

- CO1:** Understand the basics of quality management systems, standards, tools and their application in construction.
CO2: Evaluate various quality control operations, concepts techniques and procedures.
CO3: Analyze and understand need and application of various quality assurance and quality control principles.
CO4: Identify and understand various approaches in assuring quality in services and systems of different organization.
CO5: Comprehend various objectives and policies of quality management systems with reference to series of standards in India and worldwide.
CO6: Understand and bridge the gap in national and international quality management standards.

TEXT / REFERENCE BOOKS

1. Armand V. Feigenbaum, Total Quality Control, McGraw hill, 1991
2. Kwaku A. Tenah. & Jose M Guevara., Fundamentals of construction Management and organization, Brady Company, 1985
3. British Cement Association Staff, Planning for Quality on Site, British Cement Association, 1989
4. Mohamed A. El-Reedy, Concrete and Steel Construction: Quality Control and Assurance, CRC Press, 2013
5. G.A. Atkinson, Construction Quality and Quality Standards: The European Perspective, Routledge, 1995

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA7404	QUALITY MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the different concepts of quality management systems and its principles.
- To study and understand quality management systems and its relevant applications for planning, design, project management & construction of buildings.

UNIT 1	TOTAL QUALITY MANAGEMENT	9 Hrs
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Quality concepts; Evolution of modern concept of Quality management process approach; TQM. Introduction, Concept and philosophy of TQM - importance of control systems, elements of excellence – requirements of standards – advantages of documentation – general principles in documentation – types of documents – steps to get accreditation - Quality cost, Business process re-engineering, Benchmarking, Partnering - Quality Circles, Quality system standards for construction elements, Inspections & tests - Quality management tools and their application in construction.

UNIT 2	STATISTICAL QUALITY CONTROL	12 Hrs
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Quality control operations – concepts – norms, techniques and procedures – quality and time – concept of quality in building design, construction and Project management - maintenance, Deming' s principles – Concepts by Juran, Ishikawa, Crosby, Taguchi etc., organisation for quality management - Special features of construction vs. manufacturing sector - quality responsibilities and commitment of Architect, consultant, project managers and contractors - Practical aspects of quality control in building projects, quality during building's life – quality control in concrete – product quality inspection and tests, problems of rework, wastage and compromise in product quality approach, problems of inspections / test oriented approach in service quality, systems approach to quality.

UNIT 3	QUALITY ASSURANCE AND QUALITY CONTROL	9 Hrs
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Quality assurance & control, information needs at different levels of project organization – organizational functions – types of information. Training QMS – objective – requirement – programmes – workers and operators – typical training programmes - Quality Audit – organization – interface - Elements of quality systems standards elements; Aspects of quality control & assurance of major building items.

UNIT 4	QUALITY MANAGEMENT SYSTEMS AND STANDARDS	9 Hrs
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Quality management system, Quality System standards elements, Contractual implications of quality systems– quality management systems – concepts and meaning – importance of quality management in construction projects – role of QMS in project management-Quality concepts and stakeholders concerns for building and construction - Quality systems standards of BS 5750 / QS 9000 series and their evolution - ISO 9000 Quality system standards; applicability of ISO 9000 series standards worldwide, India and Indian Building sector; Elements of ISO 9000 series standards. ISO 14000 series - Environmental Management System standards; ISO 14000 standards as applied to building projects; Environment impact assessment for environmental quality.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Study and presentation of quality management procedures for the small / medium scale construction projects. Prepare checklists for the key construction activities and analyse the need for the Information technology in quality control of construction. Presentation of various ISO standards used for construction material selection and prepare a specification for various materials using the ISO standards and guidelines.

Max. 45 Hours**COURSE OUTCOMES:**

CO1	Understand the basics of quality management systems, standards, tools and their application in construction
CO2	Evaluate various quality control operations, concepts techniques and procedures.
CO3	Analyze and understand need and application of various quality assurance and quality control principles.
CO4	Identify and understand various approaches in assuring quality in services and systems of different organization.
CO5	Comprehend various objectives and policies of quality management systems with reference to series of standards in India and worldwide.
CO6	Understand and bridge the gap in national and international quality management standards.

TEXTS / REFERENCE BOOKS

1. Armand V. Feigenbaum, Total Quality Control, McGraw hill, 1991
2. KwakuA. Tenah. & Jose M Guevara., Fundamentals of construction Management and organization, Brady Company, 1985
3. British Cement Association Staff, Planning for Quality on Site, British Cement Association, 1989
4. Mohamed A. El-Reedy, Concrete and Steel Construction: Quality Control and Assurance, CRC Press, 2013

End semester examination question paper pattern**(To be distributed uniformly among all the units)****Max. Marks: 100****PART A : 2 questions from each unit, each carrying 4 marks****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SAR 5108	CONSTRUCTION EQUIPMENT MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand the necessity of equipment planning and management in a building construction.
- To familiarize the students with varied equipments commissioned at site during different phases of a project.

UNIT 1 EQUIPMENT PLANNING AND ECONOMICS**10 Hrs.**

Task considerations: Nature of work in construction projects, site constraints, rate of daily output, equipment suitability, equipment output capability, equipment productivity, future use of equipment.

Cost Considerations: equipment owning costs, equipment operating costs, equipment engineering Considerations - standard equipment, minor equipment, operating reliability repair and maintenance considerations, organize maintenance team, training, scheme for maintenance, monitoring and effectiveness of management, safety features - safety management- log book - equipment acquisition options: purchasing plant /equipment, hiring equipment, leasing and hire-purchase equipment, replacing equipment, depreciation Analysis.

UNIT 2 EARTH MOVING EQUIPMENTS**12 Hrs.**

Earth moving equipment's, excavating , hauling, compacting - Excavation and lifting equipment- backactor or backhoes, face shovels, draglines, grabs or clamshell and trenchers - Earth cutting and moving equipment- bulldozers, scrapers, front-end loaders - transportation equipment: tippers dumps truck, scrapers rail wagons and conveyors - Compacting and finishing equipment- tamping foot rollers, smooth wheel rollers, pneumatic rollers, vibratory rollers, plate compactors, impact compactors and graders.

UNIT 3 CONCRETING EQUIPMENTS**10 Hrs.**

Production Equipment: batching plants, concrete mixers, transportation equipment's such as truck mixers, concrete dumpers. Placing equipment's: concrete pumps, concrete buckets, elevators, conveyors, hoists, grouting equipment, Pre-casting special equipment: vibrating and tilting tables, battery moulds, surface finishes equipment, pre-stressing equipment, GRC equipment, steam curing equipment, shifting equipment, erection equipment - concrete vibrating, repairing and curing equipment, concrete laboratory testing equipment.

UNIT 4 MATERIALS HANDLING AND OTHER EQUIPMENTS**16 Hrs.**

Material hoisting plant- mobile cranes, tower cranes and hoists - support and utility services equipment's- Pumping equipment's, Sewage treatment and Pipeline laying equipment's, compressed air equipment, heating, ventilation and air-conditioning equipment, wood working equipment - Special purpose heavy construction plant- aggregate production plant & rock blasting equipment, Piles and Pile Driving equipment's.

Max. 48 Hours**COURSE OUTCOMES:**

On completion of the course the student will be able to

- CO1:** Understand the need and importance of equipment management under different task considerations
- CO2:** Explore the cost considerations and evaluating the economics of equipment for rental and owning.
- CO3:** Analyze the options in earth moving equipments, selection and commissioning of the correct equipment.
- CO4:** Understand the different methods of concrete production and laying under different site conditions.
- CO5:** Comprehend the role of material handling equipment with the progress of the project.

TEXT / REFERENCE BOOKS

1. Peurifoy, R.L., Ledbetter, Schexnayder, C.W.B., Construction Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore, 1995
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers New Delhi, 1988
3. Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company, New Delhi, 1983
4. Frank Harris and Ronald McCaffer, Management of Construction equipment, Macmillan Publication, 1991
5. Chitkara K.K., Construction Project Management: Planning, Scheduling and Controlling, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2014.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SAR 5201	HUMAN RESOURCE AND MATERIALS MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To impart and train rigorously the students for human resources management in construction projects.
- To familiarize the knowledge of Personnel Management and labour service rules and laws and to incorporate in construction field.
- To expose and emphasize the need of material management through inventory management and control at site.

UNIT 1 HUMAN RESOURCE DEVELOPMENT**8 Hrs.**

Introduction – organization – fulcrum of the modern enterprise – informal groups – management – employees – human resource management.

UNIT 2 MANAGING PERSONNEL AND RELATIONS**14 Hrs.**

Personnel management – nature and scope – personnel plan – personnel department – manpower planning, recruitment and selection In-service training – training inputs – principles – types – assessments. Wages and salary administration – wage rate – wage payment methods – incentive plan – fringe benefits – productivity earnings and profit sharing – bonus payment – wage legislation - wage administration. Productivity in construction – measuring productivity – factors affecting productivity – responsibility for productivity. Employees relation in an organization – characteristics of groups – roles of project manager – communication - types of communication – communication process – effective communication – the art of listening – Motivating employees – hierarchy of motivation.

UNIT 3 INDUSTRIAL RELATIONS AND LABOUR LAWS**12 Hrs.**

Labour legislation – nature and scope – Indian constitution and labour – labour laws for the building Industry – laws regulating wages and payments to workers – social security laws – industrial relations laws – miscellaneous laws - Industrial relations and trade unions.

UNIT 4 CONSTRUCTION MATERIALS MANAGEMENT**14 Hrs.**

Importance of material management - Classification and Codification of materials, Inventory control - managing the inventory and flow of raw materials, work-in-process, finished goods, and supplies to ensure/enhance the organization's competitiveness and profitability, Application of ABC analysis in inventory control, Inventory Management safety stock , stock outs. Stores Management: Quality Control, Use of Materials Management Systems - Purchase order - indents - marketing, registration of sellers - selection, placement of order - follow up - physical training - contract materials - physical inspection and verification - fixation of the re-order level.

Max. 48 Hours**COURSE OUTCOMES:**

On completion of the course the student will be able to

- CO1:** Summarize the role of HRM in an organization structure and to develop organizational matrix.
CO2: Survey the factors influencing the labour productivity and applying the same in the construction site.
CO3: Understand the theories of motivation to the employees for improving the productivity.
CO4: Get exposure to the industry laws and trade union rules applicable in the construction projects.
CO5: Understand the necessity for material management in the aspects of project control.
CO6: Comprehend the procedures to be adopted in purchasing materials, stores management and inventory control.

TEXT / REFERENCE BOOKS

1. Carleton Coulter and Jill Justice Coutler, The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989
2. Mamoria C.B and S. V. Gankar, Personnel Management, Himalaya Publishing House., 2003
3. Stephen E. Condrey, Handbook of Human Resources Administration, Jossey - Bass, 2010
4. Dwivedi R.S., Human Relations and Organisational Behaviour, Macmillan 2001
5. Austen A. D., Managing construction projects: A Guide to Processes and Procedures, International Labour Organization, 1984
6. Geoffrey D. Taylor, Materials in Construction, Longman, 2002
7. Gopalakrishnan, Handbook of Materials management, PHI Learning Pvt. Ltd., 1993.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA5202	RESOURCE MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand the necessity of resource like men, materials and equipment management construction industry.
- To familiarize the students with varied equipment commissioned for various activities at site during different phases of a project.
- To impart and train rigorously the students for human resources management and to familiarize the knowledge of labour regulations and laws to manage the construction activities.

UNIT 1	EQUIPMENT PLANNING AND ECONOMICS	9 Hrs
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Nature of work in construction projects, site constraints, rate of daily output, equipment suitability, equipment output capability, equipment productivity, future use of equipment; equipment owning costs, equipment operating costs, equipment engineering - standard equipment, minor equipment, operating reliability repair and maintenance considerations, safety features - safety management - equipment acquisition - purchasing plant / equipment, hiring equipment, leasing and hire-purchase equipment, replacing equipment, depreciation analysis.

UNIT 2	CONSTRUCTION EQUIPMENT MANAGEMENT	12 Hrs
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Earth moving equipment - excavation and lifting equipment- earth cutting and moving equipment- transportation equipment - Compacting and finishing equipment. Production Equipment - concrete batching plants, concrete mixers, and transportation equipment – concrete placing equipment - Pre-casting special equipment - pre-stressing equipment, GRC equipment, steam curing equipment, shifting equipment, erection equipment - concrete vibrating, repairing and curing equipment, concrete laboratory testing equipment.

Material hoisting plant- cranes - support and utility services equipment's- pumping equipment's, sewage treatment, compressed air equipment, carpentry equipment - special purpose heavy construction plant- aggregate production plant & rock blasting equipment, piles and pile driving equipment.

UNIT 3	CONSTRUCTION MATERIALS MANAGEMENT	9 Hrs
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Importance of material management - classification and codification of materials, Inventory control - managing the inventory and flow of raw materials, work-in-process, finished goods, and supplies for competitiveness and profitability, ABC analysis in inventory control, Inventory management safety stock, stock outs. stores management- quality control, use of materials management systems - purchase order - indents - marketing, registration of sellers - selection, placement of order - follow up - physical training - contract materials - physical inspection and verification - fixation of the re-order level.

UNIT 4	HUMAN RESOURCES AND MANAGEMENT	9 Hrs
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Introduction – organization– management – employees – human resource management - personnel management – manpower planning, recruitment and selection, in-service training – training inputs, principles, types and assessments. Wages and salary administration – wage rate, wage payment methods, incentive plan, fringe benefits, productivity earnings, profit sharing, bonus payment, wage legislation and wage administration. Productivity in construction, measuring productivity, factors affecting productivity, responsibility for productivity. Employee's relation in an organization, motivating employees, hierarchy of motivation; Labour legislation, labour laws in construction, laws regulating wages, social security law, Industrial relations and trade unions.

UNIT 5	CONSTRUCTIVE ASSESSMENTS	6 Hrs
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Prepare and present equipment and material planning schedule, checklist and productivity analysis for various earth moving equipment, production equipment, Material hoisting for a high rise building. Also prepare and justify the requirement of human resources with the help of histogram and organisation chart for the major construction site.

Max. 45 Hours

COURSE OUTCOMES:

CO1	Understanding the need and importance of equipment management under different task considerations in projects
CO2	Analysis of the options in selection of equipment and commissioning of the correct type of equipment at project site.
CO3	In-depth understanding on the different methods of production & material hoisting equipment, working under different site conditions.
CO4	Exposure towards material management techniques with the inventory control procedures at construction site
CO5	Surveying the factors influencing the labour productivity and applying the same in the construction site.
CO6	Comprehending the role of human resources including the various regulations to be followed in construction projects

TEXTS / REFERENCE BOOKS

1. Peurifoy, R.L., Ledbetter, Schexnayder, C.W.B., Construction Planning, Equipment and Methods, 5th Edition, McGraw Hill, Singapore, 1995
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers New Delhi, 1988
3. Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company, New Delhi, 1983
4. Frank Harris and Ronald McCaffer, Management of Construction equipment, Macmillan Publication, 1991
5. Chitkara K.K. Construction Project Management: Planning, Scheduling and Controlling, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2014.
6. Mamoria C.B and S. V. Gankar, Personnel Management, Himalaya Publishing House., 2003
7. Stephen E. Condrey, Handbook of Human Resources Administration, Jossey - Bass, 2010
8. Gopalakrishnan, Handbook of Materials management, PHI Learning Pvt. Ltd., 1993.
9. Carlton Coulter and Jill Justice Coulter, The complete standard handbook of construction personnel management, Prentice-Hall, Inc., New Jersey, 1989.
10. Mamoria C.B and S.V.Gankar, Personnel Management, Himalaya Publishing House. 2003.
11. Stephen E. Condrey, Handbook of Human Resources Administration, Jossey – Bass, 2010
12. Dwivedi R.S., Human Relations and Organisational Behaviour, Macmillan 2001.
13. Austen A.D., Managing Construction Projects: A guide to Processes and Procedures, International Labour Organisation, 1984.
14. Geoffrey D.Taylor, Materials in Construction, Longman, 2002.
15. Gopala Krishnan, Handbook of Materials management, PHI Learning Pvt. Ltd., 1993.

SAR 6531	BUILDING MANAGEMENT STUDIO II	L	T	P	Credits	Total Marks
		0	0	15	8	300

COURSE OBJECTIVES:

- To identify, reflect upon, evaluate and apply different types of information and knowledge on building services to arrive upon design solutions and recommendations.
- The final project report will comprise of an in-depth research and critical analysis of existing building services documentation of the selected project and evaluation to appraise the efficiency with respect to design and energy.

COURSE CONTENT

The Building Management studio II aims to provide an opportunity for students to learn and understand the process of applying project management learning's, techniques, efficient planning and co-ordination of building services (HVAC, Electrical, Building Automation, Infrastructure services) in complex buildings. The project involves two simultaneous case studies. Each case study shall be a piece of investigation work focused on the application of the concepts of quality management systems and building services respectively. The focus shall be on an actual problem, in respect of design, techniques, installation, testing & commissioning and operation of buildings and the above mentioned related services.

Students shall gather information through their investigation from the live case studies related to the building techniques, building services and analyse the details with respect to industry standards and owner requirements to have better understanding on the key factors determining the process of quality management systems at various stages of project life cycle.

Students should analyse and prepare the quality control / quality assurance plan for the selected project & services studied to have better quality standards, compare and infer the quality management system adopted for the investigated project.

COURSE OUTCOMES:

On completion of the course the student will be able to

- CO1:** Prepare a detailed report on an existing recently executed high rise project with respect to various management methods in design, planning, execution, installation of building services in various building typologies with single or mixed use.
- CO2:** Demonstrate knowledge in the services with focus on HVAC, Electrical, Building Automation and Infrastructure services with energy saving concepts.
- CO3:** Undertake case study as a piece of investigation work in the form of drawings, relevant details/codes, schematic charts, reports and photographs.
- CO4:** Understand of planning & organization issues, types of communication, direct & indirect controls, process of decision making, break-even analysis and material inventories.
- CO5:** Formulate a logical work break down structure along with resource allocation and leveling and scheduling using MSP or Primavera.
- CO6:** Analyze the issues identified at various stages of the project and recommend alternative solutions.

SARA9221	BUILDING MANAGEMENT STUDIO II	L	T	P	Credits	Total Marks
		0	0	11	6	300
Continuous Assessment		University Viva			Min Pass Marks	
200		100			150	

COURSE OBJECTIVES:

- To augment the knowledge acquired through lectures and through live case studies, critically analyze the application of knowledge in the Project Management context with reference to building construction and related infrastructures with topics on project phases, characteristics of the project life cycle, project stakeholders and project organization their roles, responsibilities, scope and services of team members.
- To ensure the logical understanding of the project management procedures and the use of software to prepare, monitor and track the project activities with schedule.
- To understand and devise the quality parameters for the execution of construction activities, services, external infrastructure and co-ordination basis the live case studies and interaction with the construction professionals and consultants.

STUDIO BRIEF

Time Management; Development of Construction Logic; Work out alternatives of construction sequence logic considering project and site constraints, design requirement, services interaction, resource requirement etc.; Study of existing approach to construction logic; Analyse strengths and weaknesses; Preparation of Work Breakdown Structure (WBS).

Visualizing strategic breakdown of project into work packages; Identify approach of work breakdown for the project considering ease of coordination, cost savings etc.; Developing and presenting WBS of respective projects as a hierarchy of deliverables that collectively constitute the project; Presenting WBS in MS-Project with appropriate linkages; Project Planning & Scheduling; Identification of Activities, Milestones and Construction Sequencing considering: Activities, Non work activities, Characteristics of repetitive activities and projects, Typical and non-typical activities, Repetitive and non-repetitive activities.

Development of hierarchy of networks showing detailed activities, milestones using MS project; Calculation of quantities, cost and productivity data; Determine activity durations based on productivity data; Determining activity durations through deterministic and probabilistic durations; Parametric Estimating; Analogous Estimating (Top Down Estimating); Expert Judgement; Three Point Estimates etc.; Determining time duration and labour/equipment resources of all activities in the project using MS project; Utilization of network techniques for project planning, scheduling and control like; Time calculation of AON Network, PERT, PNET, Line of Balance Method and Monte Carlo simulation; Developing Project Schedule on MS Project.

Time Cost Analysis; Calculation of costs related to activities for calculating the cost of crashing a project; Determining costs associated with activities over a time graph; Calculate the costs associated with crashing the activities; Develop project and activity costing schedule on MS Project; Earned Value Management; Developing Planned Value, Actual Cost, Earned Value and Variances; EVM application for project progress; Resource and Material Management; Resource Histograms and Resource levelling; Developing resource histograms for projects; Achieve uniform resource allocation; Application of Multiple Resource Allocation Procedure, PACK method, Branch and Bound Method; Developing a revised resource based schedule; Application of MS Project.

TQM approach for the projects using quality parameters for the project; develop / devise project specific specifications; role of BOQ / contract conditions / special conditions / make of materials; develop quality check parameter for activities / trade packages; activities to be followed for ensuring quality in project execution. Discussion on the current practices and proposal for new techniques to be employed / suggested for quality. Quality test procedures for various construction activities – Site test – Lab test – Interpretation of test results. Procedure for rejecting non-quality / Non-conforming works. NCN procedures. etc.

DELIVERABLES

The students shall define and record the case study documentation in project management context with reference to buildings and related services, infrastructure considering different project phases. The final report to comprise in-depth analysis of project management approach and preparation of schedule using MSP, Cost Analysis, EVM, Resource Analysis and balancing, schedule crashing with time cost tradeoff. Students should also analyze and prepare the quality control / quality assurance plan for the selected project & services studied to have better quality standards, compare and infer the quality management system adopted for the investigated project.

TEXT / REFERENCE BOOKS

1. National Building Code of India 2016 (NBC Volume 1 & 2)
2. National Fire Prevention Association standards
3. Bureau of Indian Standards (BIS)
4. British Standards (BS)
5. Energy conservation building code (ECBC)

6. Bureau of Energy Efficiency (BEE)
7. American Society of Heating, Refrigeration and Air conditioning Engineers (ASHRAE)
8. SP 72: National Lighting Code 2010.

S89 INT	PROFESSIONAL TRAINING	L	T	P	Credits	Total Marks
		0	0	0	5	200

COURSE OBJECTIVES:

- To undergo professional training in a project a management firm to get an on-site experience of handling services in an existing recently executed or under construction high rise project in an urban area, with single or mixed user (residential & commercial, or other combinations).
- To utilize the forum to discuss key issues in the projects, keep track of the different scheduled activities, communicate with the stakeholders and get an overall view of the contract administration.
- The final project report will comprise of an in-depth research and analysis of activities in the form of drawings & relevant details, schematic charts & reports, photographs, documentation of the project, comments, suggestions, etc to appraise the efficiency in progress of work.

COURSE CONTENT

A candidate has to undergo practical training for 30 Working days in an approved Building services / management organization established not less than five years. The organizations train the students in specialised core areas of Building Services / Management and assist the candidates in identifying the area of study for dissertation.

COURSE OUTCOMES:

On completion of the course the student will be able to

- CO1:** Accumulate lessons or skills during practical training, with access to leading experts with specialized knowledge and experience.
- CO2:** Obtain basic knowledge in understanding and using an effective performance management system in managing technical projects effectively.
- CO3:** Manage projects using a proven, effective performance measurement technique.
- CO4:** Analyze and recommend project decisions concerning scope, cost and schedule parameters faster, more effectively and more confidently.
- CO5:** Stay on top of schedules, budgets, workloads and human resources issues and delegate practically and fairly.
- CO6:** Learn to avoid the pitfalls of project management by quickly identifying potential project risks and mitigate them as early as possible.

S84APT	PROFESSIONAL TRAINING	L	T	P	Credits	Total Marks
		0	0	0	3	100
Continuous Assessment		University Viva			Min Pass Marks	
50		50			50	

COURSE OBJECTIVES:

- To undergo professional training in a project a management firm to get an on-site experience of handling services in under construction high rise projects.
- To utilize the forum to discuss key issues in the projects, keep track of the different scheduled activities and communicate with the stakeholders.
- To get an overall view of the contract administration.

COURSE CONTENT

A candidate has to undergo practical training for 30 working days in an approved Project management organization, reputed in property development or infrastructure and established not less than five years. Companies for practical training are carefully selected.

The organizations train the students in specialised core areas of Building Services / Management and assist the candidates in identifying the area of study for dissertation. During this period the student is advised to study the live projects of the concerned company / industry. The training internship is intended to provide students with practical insights into the world of real business of the construction industry. The Institute looks for meaningful and supervised work experience for the student. The final project report will comprise of an in-depth research and analysis of activities in the form of drawings & relevant details, schematic charts & reports, photographs, documentation of the project, comments, suggestions, etc to appraise the efficiency in progress of work.

COURSE OUTCOMES:

CO1	Accumulate concepts or skills with access to leading experts with specialized knowledge and experience.
CO2	Obtain basic knowledge using an effective performance management system in managing technical projects effectively.
CO3	Manage projects using a proven, effective performance measurement technique.
CO4	Analyze and recommend project decisions concerning scope, cost and schedule parameters faster, more effectively and more confidently.
CO5	Stay on top of schedules, budgets, workloads and human resources issues and delegate practically and fairly.
CO6	Learn to avoid the pitfalls of project management by quickly identifying potential project risks and mitigate them as early as possible.

SAR 6532	DISSERTATION	L	T	P	Credits	Total Marks
		0	0	18	9	300

COURSE OBJECTIVES:

- To critic the existing practices in building management / services based on the previous modules and question existing industry practices, formulate new thought process in improving the efficiency of the construction scenario.

COURSE CONTENT

The Dissertation is an individual research project that is a major piece of work undertaken by the students. At the beginning of the third semester the students are required to be associated with a firm (Architects, engineers, project managers) for a period 30 working days within which they are expected to identify the topic of interest.

The Dissertation involves critical problem statements and aims to

- Introduce strategies for bridging the gap between the beginning research and thesis writing.
- Understand the rhetorical situation of the thesis proposal and common elements of such proposals.
- Introduce practical rhetorical and grammatical principles of writing effective proposals.
- Provide with tips for drafting and revising individual sections of the proposal

COURSE OUTCOMES:

On completion of the course the student will be able to

- CO1:** Pursue an idea of research with depth of inquiry, criticality and logic and carry out an in-depth investigation of an area of building services or management that he/she is interested in.
- CO2:** Be able to demonstrate a high level of technical understanding of the design of buildings and associated construction processes and solutions.
- CO3:** Understand a broad range of management theories underpinning its practical application in the delivery of construction projects to meet the client's cost, time and quality.
- CO4:** Recognize and understand how projects are evaluated, structured and delivered.
- CO5:** Develop an ability to research, analyzes, evaluate and discuss a wide range of construction tools, technologies and management strategies applicable to the practice of construction management.
- CO6:** Propose alternative updated strategies to improve efficiency of construction scenario.

TEXT / REFERENCE BOOKS

1. Iain Borden, KaaterinaRuedi, The Dissertation: An Architecture Student's Handbook, Architectural Press, 2000.
2. Pilcher R -Project Cost Control in construction; Collins Publishers.
3. Dunkan, Thorpe & Summer -Quality Assurance in Construction,Gower Publishers.
4. Prasanna Chandra,-Projects: Appraisal, Analysis, Financing, Implementation & Review; TMH Publishers.
5. Koontz, O' Donnel and Weibrich,Management-McGraw Hill.
6. Young David W.-Techniques of management accounting,Tata McGraw Hill.

S84PROJ1	DISSERTATION	L	T	P	Credits	Total Marks
		0	2	10	6	300
Continuous Assessment		University Viva			Min Pass Marks	
200		100			150	

COURSE OBJECTIVES:

- To critic the existing practices in building management / services based on the previous modules and question existing industry practices, formulate new thought process in improving the efficiency of the construction scenario.
- To provide students an opportunity to cultivate specialization in the areas of their own interest and undertake academic research independently.

COURSE CONTENT

Research Content: The Dissertation is an individual research project that is a major piece of work undertaken by the students. At the beginning of the third semester the students are required to be associated with a firm (Architects, engineers, project managers) for a period 30 working days within which they are expected to identify the topic of interest.

It starts with an introduction to the importance of basic competencies in industry, when working as techno managers. The aim is to prepare state of art report on the chosen topic and develop hypothesis to be tested through the research methodology designed for the purpose. Students are required to test their outcome proposals through various methods, including questionnaire surveys and case studies. It is encouraged that students identify topics for the Dissertation work which can be further developed into a Thesis Project with research in the next semester for more in-depth research. Alternatively, this Dissertation Project can be an independent research topic. Students must create an innovative insight on the specific issues.

Research Process: Dissertation work includes processes such as: Research area identification; hypothesis of research topic; literature sourcing and search; aim and objective definition; formulation of methodology; field study planning; survey data collection, analysis and result presentation; literature study; conceptual an empirical :compilation and inference drawing; research study validation through case studies, field application and simulation models; discussion of findings of research findings; study conclusion and recommendation formulations.

The progress of the Dissertation work is presented and discussed by the student periodically in the classroom environment and progress monitored continuously. This work develops the comprehension and presentation skills of the students. The students are provided guidance from the faculty to channelize their thoughts.

Area of Research: Some of the area for Dissertation are land use and planning, financial management, lean construction, quality control and safety procedures, real estate regulations and laws, advanced technologies, project management knowledge areas, PPP projects and business environment.

Presentation: The final presentation is in the form of state of art report and poster size display sheets.

COURSE OUTCOMES:

CO1	Pursue an idea of research with depth of inquiry, criticality and logic and carry out an in-depth investigation of an area of building services or management that he/she is interested
CO2	Be able to demonstrate a high level of technical understanding of the design of buildings and associated construction processes and solutions.
CO3	Understand a broad range of management theories underpinning its practical application in the delivery of construction projects to meet the client's cost, time and quality.
CO4	Recognize and understand how projects are evaluated, structured and delivered.
CO5	Develop an ability to research, analyze, evaluate and discuss a wide range of construction tools, technologies and management strategies applicable to the practice of construction management.
CO6	Propose alternative updated strategies to improve efficiency of construction scenario.

TEXT / REFERENCE BOOKS

1. Iain Borden, Katerina Ruedi, (2000) *The Dissertation: An Architecture Student's Handbook*, MA: Architectural Press.
2. Pilcher R (1994) *Project Cost Control in construction*. Maryland: Wiley-Blackwell.
3. Dunkan, Thorpe & Sumner -*Quality Assurance in Construction*. New York: Gower Publishers.
4. Prasanna Chandra (2017) *Projects: Appraisal, Analysis, Financing, Implementation & Review*; New Delhi: McGraw Hill Education India Pvt Ltd.
5. Qiyong Kiki Cai (2017) *Business Process Model for Process Improvement: An Investigation of the Tendering Process in a Construction Company*. Hong Kong :Open Dissertation Press.
6. Elizabeth Laycock, Tim Howarth, Paul Watson(2016) *The Journey to Dissertation Success: For Construction, Property, and Architecture Students*. Oxfordshire: Routledge.

S89 PROJ1	PRE THESIS	L	T	P	Credits	Total Marks
		0	0	0	4	100

COURSE OBJECTIVES:

- The objective of the Pre- thesis is to provide an opportunity to the students select a topic for Thesis to prepare independent and original study of special project of his/her own choice.
- Offers scope to adopt a fresh approach in formulating a concept of developing a methodology effective and useful.

COURSE CONTENT

The intent of pre thesis is to initiate the selection of Thesis topic in the beginning of the third semester itself. The students shall work three alternative topics by studying and analysing the published research papers of their interest area and give justification for the selection of the topics which will be assigned to him / her to proceed to the next phase.

The subject for special study conceptual or practical but pertaining to building design and construction management like BIM, construction management procedures, land use and planning, financial management, lean construction, quality control, value engineering and safety procedures and construction Laws.

Each student will prepare the Pre-Thesis with regular reviews by the faculty of the department. The Thesis will be presented in the accepted form of a Pre-thesis report duly supported by copious references, sketches, graphs, proposed statistical data, proposed details of survey, tools and techniques and methodology to be adopted and detailed account of experimental analytical procedures to be adopted.

Each student is required to defend his/her Pre-Thesis at a Viva Voce Examination by jury. The Pre-Thesis shall consist of literature, survey on the topic chosen in the relevant field, theoretical and or experimental work based on the literature and discussion.

COURSE OUTCOMES:

On completion of the course the student will be able to

Comprehend application of knowledge, techniques, skills, and tools of the construction industry in construction activities.

CO1: Perform standard tests, organize and interpret test data, and apply test results to improve construction processes.

CO2: Demonstrate a disposition to engage in self-directed continuing professional development, an understanding of professional and ethical responsibilities and commitment to quality, timeliness, and continuous improvement.

TEXT / REFERENCE BOOKS

1. Iain Borden, KaaterinaRuedi, The Dissertation: An Architecture Student's Handbook, Architectural Press, 2000.
2. Ranjith Kumar, Research Methodology - A step by step guide for beginners, Sage Publications, 2005.
3. John W Creswell, Research design: Qualitative, Quantitative and Mixed method approaches, Sage Publications, 2002.

S84PROJ2	PRE THESIS	L	T	P	Credits	Total Marks
		0	2	4	3	200
Continuous Assessment		University Viva			Min Pass Marks	
100		100			100	

COURSE OBJECTIVES:

- The objective of the Pre- thesis is to provide an opportunity to the students select a topic for Thesis and to prepare independent and original study of special project of his/her own choice.
- Offers scope to adopt a fresh approach in formulating a concept of developing a methodology effective and useful.

COURSE CONTENT**Research Content:**

The intent of pre thesis is to initiate the selection of Thesis topic in the beginning of the third semester itself. The students shall work three alternative topics by studying and analysing the published research papers of their interest area and give justification for the selection of the topics which will be assigned to him / her to proceed to the next phase.

Research Process:

Each student will prepare the Pre-Thesis with regular reviews by the faculty of the department. . It is encouraged that students identify topics for the Pre Thesis work which can be further developed into a Thesis Project with research in the next semester for more in-depth research. .

The Pre Thesis will be presented in the accepted form of a Pre-thesis report duly supported by copious references, sketches, graphs, proposed statistical data, proposed details of survey, tools and techniques and methodology to be adopted and detailed account of experimental analytical procedures to be adopted.

Each student is required to defend his/her Pre-Thesis at a Viva Voce Examination by jury. The Pre-Thesis shall consist of literature, survey on the topic chosen in the relevant field, theoretical and or experimental work based on the literature and discussion.

Area of Research:

The subject for special study may be conceptual or practical but should pertain to building design and construction management like BIM, construction management procedures, land use and planning, financial management, lean construction, quality control, value engineering and safety procedures and construction Laws.

Presentation:

The final presentation is in the form of a state-of-art report.

COURSE OUTCOMES:

CO1	Comprehend application of knowledge, techniques, skills, and tools of the construction industry in construction activities.
CO2	Perform standard tests, organize and interpret test data, and apply test results to improve construction processes.
CO3	Demonstrate a disposition to engage in self-directed continuing professional development,
CO4	Understanding of professional and ethical responsibilities and commitment to quality, timeliness, and continuous improvement.

TEXT / REFERENCE BOOKS

1. Ranjith Kumar (2005.) *Research Methodology- A step by step guide for beginners*, California : Sage Publications.
2. John W Creswell, (2002). *Research design: Qualitative, Quantitative and Mixed method approaches*. California : Sage Publications,.
3. Kate Turabian. (2018) *A Manual for Writers of Research Papers, Theses, and Dissertations*. Chicago:Chicago Guides to Writing, Editing, and Publishing.

SAR 5202	FINANCIAL MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- The objective of the course to familiarize the fundamentals of financial management concepts and their applications in the various phases of the project cycle of construction projects.
- To provide a basic knowledge to carry out the financial feasibility of projects, selection of building systems and equipment's and evaluation of project investment decisions.

UNIT 1 PRINCIPLES OF FINANCIAL MANAGEMENT**10 Hrs.**

Nature of finance management - objectives and principles - various financing decision - Business firms and their financing - types of business units - capital sources and structures - marginal cost of capital - optimum capital structures.

UNIT 2 TIME VALUE OF MONEY**16 Hrs.**

Evaluation of alternatives – present worth method – rate of return method – cost benefit analysis - return on investment – time value of money – life cycle costing – structural cost – finishing cost – operating cost- working capital management.

UNIT 3 BUDGETING**12 Hrs.**

Budget as management control techniques - requirement of a good budget - budget planning - budget process - working capital management - cash management - cash flow analysis - financial ratio analysis - interpretation and return on investment- Basis of accounting – Percentage completion method – completed contract method – accounting for tax reporting & financial reporting purposes.

UNIT 4 PROJECT FINANCE**10 Hrs.**

Stages of project finance management - method of recording - cash method, accrual method, percentage of completion method, completed contract method. Financing international projects - project cash flow - progress payments and expenditures risk in international contracts - accounting and economic exposure -joint ventures and BOT projects.

Max. 48 Hours**COURSE OUTCOMES:**

On completion of the course the student will be able to

CO1: Apply the acquired knowledge in mobilizing best possible sources of fund and its effective utilization.

CO2: Combat with current changing economic condition and be able to predict and estimate the future financial requirement.

CO3: Identify best project proposal to invest.

CO4: Involve in international projects.

TEXT / REFERENCE BOOKS

1. Kuchhal. S.C., Financial Management; an Analytical and Conceptual Approach, Chaitanya Publishing House, 1999
2. Hillebrandt P.M., Economic Theory and Construction Industry, Macmillan, London, 2000
3. Bill G. Tompkins., Project cost control for managers, Gulf Pub. Co., 1985
4. Kwaku A. Tenah. & Jose M Guevara., Fundamentals of Construction Management and organization, Brady Company, 1985
5. Andrew Ross and Peter Williams, Financial Management in Construction Contracting, Wiley &Blackwell, 2012
6. Steven J. Peterson, Construction Accounting and Financial Management, Pearson Education, 2010

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SBAA5141	FINANCIAL MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- The objective of the course is to familiarize the fundamentals of financial management concepts and their applications in the various phases of the project cycle of construction projects.
- To provide a basic knowledge to carry out the financial feasibility of projects, selection of building systems and equipment's and evaluation of project investment decisions.

UNIT 1	PRINCIPLES OF FINANCIAL MANAGEMENT	9 Hrs
Nature of finance management - objectives and principles - various financing decisions - Business firms and their financing - types of business units - capital sources and structures - marginal cost of capital - optimum capital structures.		
UNIT 2	PROJECT EVALUATION	12 Hrs
Evaluation of alternatives – present value method – rate of return method -time value of money –Net present value method, Profitability index and IRR method, Cost Volume benefit analysis - life cycle costing – structural cost – finishing cost – operating cost.		
UNIT 3	BUDGETING AND ESTIMATION	9 Hrs
Budget as management control techniques - requirement of a good budget - budget planning - budget process - cash budget - cash flow analysis - financial ratio analysis - interpretation and return on investment- Contract costing estimation of profit -Percentage completion method – completed contract method. Basis of accounting – accounting for tax reporting & financial reporting purposes. method of recording - cash method, accrual method. Taxation on construction contract.		
UNIT 4	PROJECT FINANCE	9 Hrs
Working capital management needs and computation. Long term fund- Stages of project finance management. - Financing international projects - project cash flow - progress payments and expenditures risk in international contracts - accounting and economic exposure - joint ventures and BOT projects.		
UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
Case study and Presentation on -Interpretation on performance of a company through ratios. Presentations on - How capital structure of various companies are arranged and suggesting the best capital structure, how to choose the best project from alternatives & how to decide profit on a contract, identifying various sources available for both domestic and international projects and the risk associated with it. Presentation on joint venture and BOT.		

Max. 45 Hours**COURSE OUTCOMES:**

CO1	Able to apply the acquired knowledge in mobilizing best possible sources of fund and its effective utilization
CO2	Combat with current changing economic conditions and be able to predict and estimate the future financial requirement.
CO3	Identification of best project proposal to invest.
CO4	Involve in international projects.

TEXTS / REFERENCE BOOKS

1. Andrew Ross, & Williams, P. (2012). Financial Management in Construction Contracting. Wiley & Blackwell,.
2. Hillebrandt P.M. (2000). Economic Theory and Construction Industry. London: Macmillan Publishing House.
3. Kuchhal. S.C. (1999). Financial Management; an Analytical and Conceptual Approach,. Chaitanya Publishing House.
4. Levinson, M. (2001). Guide to financial markets. London.: Economist Profile Books.
5. Madura, J. (2008). Financial markets and institutions. Ohio: Thomson Publications.
6. Peterson, S. J. (2010). Construction Accounting and Financial Management. Pearson Education.
7. Tenah, K. A., & Guevara, J. M. (1985). Fundamentals of Construction Management and organization,. Brady Company.
8. Tompkins., B. G. (1985). Project cost control for managers, . Gulf Pub. Co., .
9. Block. Stanley, B. and Geoffrey, A. (2001), Foundations of financial management. London : McGraw- Hill.
- 10.Chandra. P. (2008). Financial management -Theory of practice. New Delhi : Tata McGraw - Hill.
- 11.Damodaran, A. (2008). Corporate finance theory and practice. New Delhi.: Wiley India.
- 12.Khan. M. and Jain. P. (2008). Financial management. New Delhi. Tata McGraw-Hill,
- 13.Myers, B.. Allen, S. and Mohanty, P. (2010). Principles of corporate finance. New Delhi. Tata McGraw -Hill,
- 14.Pandey, 1. (2009). Financial management. New Delhi. Vikas Publishing House,

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100

Exam Duration: 3 Hrs

PART A : 2 questions from each unit, each carrying 4 marks

: 08 x 05 = 40 Marks

PART B : 2 questions from each unit with an internal choice, each carrying 15 marks

: 04 x 15 = 60 Marks

S89 PROJ2	THESIS	L	T	P	Credits	Total Marks
		0	0	0	18	600

COURSE OBJECTIVES:

- The project provides students an opportunity for academic research to cultivate specialization in the areas of their own interest under the overall guidance of the faculty.
- The objective of the seminar work is to train the students to prepare state of art report by assimilation of concepts / ideas on a chosen topic in the area of Building Engineering and Management.

COURSE CONTENT

The thesis proposal should include an overview of the proposed plan of work, including the general scope of your project, your basic research questions, research methodology, and the overall significance of your study. In short, the proposal should explain what to study, how to study this topic, why this topic needs to be studied.

Thesis proposals are designed to

- Justify and plan (or contract for) a research project.
- Show how your project contributes to existing research.
- Demonstrate to your advisor and committee that you understand how to conduct discipline specific research within an acceptable time-frame.

COURSE OUTCOMES:

On completion of the course the student will be able to

- CO1:** Perform an extensive literature study and data collection from the field and presentation in the form of drawings, relevant details/codes, schematic charts, reports and photographs.
- CO2:** Develop an hypothesis to be tested through the research methodology designed for the purpose with innovative insight on specific issues thereby undertaking academic research independently
- CO3:** Experiment with processes such as: Research area identification; hypothesis of research topic; literature sourcing and search; aim and objective definition; formulation of methodology; field study planning; survey data collection, analysis and result presentation; literature study; compilation and inference drawing; research study validation through case studies, field application and simulation models; discussion of findings of research findings; study conclusion and recommendation formulations
- CO4:** Identify areas for further research and development.

S84PROJ3	THESIS	L	T	P	Credits	Total Marks
		0	4	20	12	600
Continuous Assessment		University Viva			Min Pass Marks	
400		200			300	

COURSE OBJECTIVES:

- The objective of the thesis is to provide an opportunity to the students to prepare independent and original study of a special project of his/her own choice.
- The project provides students an opportunity for academic research to cultivate specialization in the areas of their own interest under the overall guidance of the faculty.
- The objective of the seminar work is to train the students to prepare state of art report by assimilation of concepts / ideas on a chosen topic in the area of Building Engineering and Management.

COURSE CONTENT

Research Content: The Thesis is an individual research project that is a major piece of work undertaken by the students. It is a continuation of the Pre Thesis of the previous semester. They are expected to select a topic on a live problem in the industry or a macro-issue having a bearing on performance of the real estate, construction or urban infrastructure industry. The topic should be researchable and involve scientific design of a study, collection and analysis. The aim is to prepare state of art report on the chosen topic and develop hypothesis to be tested through the research methodology designed for the purpose.

The thesis proposal should include an overview of the proposed plan of work, including the general scope of your project, your basic research questions, research methodology, and the overall significance of your study. In short, the proposal should explain what to study, how to study this topic, why this topic needs to be studied.

Thesis proposals are designed to

- Justify and plan (or contract for) a research project.
- Show how your project contributes to existing research.
- Demonstrate to your advisor and committee that you understand how to conduct discipline specific research within an acceptable time-frame.
- Recommend future study areas for research.

Research Process: Students are required to test their outcome proposals through various methods, including questionnaire surveys and case studies. Students must create an innovative insight on the specific issues.

Thesis work includes processes such as: Research area identification; hypothesis of research topic; literature sourcing and search; aim and objective definition; formulation of methodology; field study planning; survey data collection, analysis and result presentation; literature study; conceptual and empirical :compilation and inference drawing; research study validation through case studies, field application and simulation models; discussion of findings of research findings; study conclusion and recommendation formulations. The progress of the Thesis work is presented and discussed by the student periodically in the classroom environment and progress monitored continuously. This work develops the comprehension and presentation skills of the students. The students are provided guidance from the faculty to channelize their thoughts.

Area of Research: The subject for special study may be conceptual or practical but pertaining to Building Engineering and Management in areas like Building Engineering, Construction technology ,Structural systems , Energy efficient building materials & techniques , Construction project management, Time management, Cost management, Quality management, Safety management, Contract Administration, Design management, Construction financial management, Human resource management, Quantitative techniques, Energy management, Building services, Building management systems, Infrastructure services , Management information systems , Project planning and feasibility and Disaster management

Presentation: The final presentation is in the form of state of art report and poster size display sheets.

COURSE OUTCOMES:

CO1	Perform an extensive literature study and data collection from the field and presentation in the form of drawings, relevant details/codes, schematic charts, reports and photographs.
CO2	Develop an hypothesis to be tested through the research methodology designed for the purpose with innovative insight on specific issues thereby undertaking academic research independently.
CO3	Experiment with research processes.
CO4	Identify areas for further research and development.

TEXT / REFERENCE BOOKS

1. Ranjith Kumar (2005.) *Research Methodology- A step by step guide for beginners*, California : Sage Publications.
2. John W Creswell, (2002). *Research design: Qualitative, Quantitative and Mixed method approaches*. California : Sage Publications.
3. Kate Turabian. (2018) *A Manual for Writers of Research Papers, Theses, and Dissertations*. Chicago:Chicago Guides to Writing, Editing, and Publishing.

SAR 5601	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To understand the need and importance of structural maintenance, extending the serviceability and durability of structures.
- To explore the techniques for repairing of structures, selection of suitable materials and enhancement of strength of structural elements.

UNIT 1 INFLUENCE ON SERVICEABILITY AND DURABILITY**10 Hrs.**

Effects due to climate, temperature, chemicals, wear and erosion - Design and construction errors, corrosion mechanism - Effects of cover thickness and cracking - Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT 2 MAINTENANCE AND REPAIR STRATEGIES**14 Hrs.**

Definitions: Maintenance, repair and rehabilitation - Facets of Maintenance importance - Maintenance Preventive measures on various aspects – Inspection - Assessment procedure for evaluating a damaged structure - Causes of deterioration - testing techniques.

UNIT 3 MATERIALS AND TECHNIQUES FOR REPAIR**14 Hrs.**

Special concretes and mortar, concrete chemicals - Special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferrocement, fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete - Guniting and shotcrete epoxy injection, mortar repair for cracks, shoring and underpinning.

UNIT 4 EXAMPLES OF REPAIR TO STRUCTURES**10 Hrs.**

Repairs to overcome low member strength - Deflection, cracking, chemical disruption, weathering wear, fire, leakage, marine exposure - Engineered demolition techniques for dilapidated structures - Case studies

Max. 48 Hours**COURSE OUTCOMES****On completion of the course the student will be able to**

- CO1:** Understand the requirements for governance of good serviceability and longevity of structures.
CO2: Acquire exposure to various types of engineering maintenance and evaluation of damaged structures.
CO3: Identify suitable materials for repair and selection of appropriate techniques to mitigate the faulty structures.
CO4: Develop knowledge about various types of special concrete to meet specific requirements of structures.
CO5: Identify enhancement techniques for structural strengths of different members and knowledge about the modern demolition techniques.

TEXT / REFERENCE BOOKS

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991
2. Allen R.T. and Edwards S.C., Repair of Concrete Structures, Blahie and Sons, UK, 1993
3. Shetty M.S., Concrete Technology- Theory and Practice, Chand and Company, New Delhi, 2000
4. Verghese P.C., Maintenance, Repair & Rehabilitation & Minor Works of Buildings, Prentice Hall, 2014
5. Samuel Y. Harris, Building Pathology- Deterioration, Diagnostics and Intervention, John Wiley & sons, 2001.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SAR 5602	FACILITIES PLANNING AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To develop students capability to manage various building services to increase safe and healthy utilisation of buildings and properties with minimal breakdown time.

UNIT 1 FUNDAMENTALS OF FACILITIES MANAGEMENT**12 Hrs.**

Principle duties of a facility manager - Business aspects of facilities management - Diverse responsibilities and decision-making processes from building infrastructure to fleet services – Architectural Programming.

UNIT 2 FACILITIES DESIGN AND SPACE PLANNING**14 Hrs.**

Applications of facilities design in defining the requirements of a project- Developing design strategies, implementing corporate philosophies and methodologies, and understanding the Project Development Process - Flexibility and facilities planning - Optimal space planning and cost minimization through facility layout.

UNIT 3 FACILITY PLANNING AND DECISION SUPPORT SYSTEM**10 Hrs.**

Knowledge based facility planning and decision support system - Application of artificial intelligence – Graphical & theoretic approach to multi-floor building design - Facility layout algorithm using graphics - Simulation in facility planning and efficiency analysis.

UNIT 4 FACILITY MANAGEMENT DURING CONSTRUCTION PHASE AND HANDOVER**12 Hrs.**

Types of facility management options - Functionality of Building Automation systems - Wear and Tear of technical installations, recording operating costs, safety concepts, energy supply and waste management - Service tenders and contracts.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

CO1: Acquire knowledge on the role of facility manager and the decision making processes involved.

CO2: Understand the Architectural programming in detail with relation to facilities from building infra-structure to fleet services.

CO3: Apply and evaluate the facilities design and space planning through overlays.

CO4: Upgrade on the facilities planning and decision support system with the upcoming technologies like intelligent building management system.

CO5: Analyze the given facilities planning, design and its efficiency realization.

CO6: Evaluate the processes undergone during construction and handing over stage by facility manager.

TEXT / REFERENCE BOOKS

1. David G. Cotts, Kathy O. Roper, The Facility Management Handbook, Amacom, 2009
2. Bernard Lewis and Richard Payant, Facility Manager's Maintenance Handbook, McGraw Hills, 2007
3. Keith Alexander, Brian Atkin, Jan Bröchner, and Tore Haugen, Facilities Management: Innovation and Performance, Routledge, 2004
4. Eric Teicholz, Facility Design and Management Handbook, McGraw Hill Professional, 2001
5. Frank Booty, Facilities Management Handbook, Fourth Edition, Butterworth- Heinemann, 2006

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA7306	FACILITIES PLANNING AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To introduce the fundamentals of facilities planning and an effective management.
- To develop students capability to manage various building services in the built facility to increase safe and healthy utilisation of building properties.

UNIT 1	INTROUCTION	9 Hrs.
Principle duties of a facility manager - Business aspects of facilities management - Diverse responsibilities and decision-making processes from building infrastructure to fleet services – Architectural Programming.		
UNIT 2	FACILITIES DESIGN AND SPACE PLANNING	12 Hrs.
Applications of facilities design in defining the requirements of a project- Developing design strategies, implementing corporate philosophies and methodologies, and understanding the Project Development Process - Flexibility and facilities planning - Optimal space planning and cost minimization through facility layout.		
UNIT 3	FACILITY PLANNING AND DECISION SUPPORT SYSTEM	9 Hrs.
Knowledge based facility planning and decision support system - Application of artificial intelligence – Graphical & theoretic approach to multi-floor building design - Facility layout algorithm using graphics - Simulation in facility planning and efficiency analysis.		
UNIT 4	FACILITY MANAGEMENT DURING CONSTRUCTION PHASE AND HANDOVER	9 Hrs.
Types of facility management options - Functionality of Building Automation systems - Wear and Tear of technical installations, recording operating costs, safety concepts, energy supply and waste management - Service tenders and contracts.		
UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs.
Understand and present the importance of design and space planning requirement in building facilities. To analyse and present the facility planning aspects to be considered in design and space planning of large building facility and discuss / debate on the various facility management aspects required during post occupancy of building facilities.		

Max.45 Hours**COURSE OUTCOME:**

CO1	Understand the concept of facilities planning of large building facilities.
CO2	Comprehensive understanding of building and other services for the better management of facilities.
CO3	Explore the best space planning measures to be taken during design stage for the best built facilities
CO4	Analyse the importance of facilities planning requirements during construction and handing over phase of buildings
CO5	Critical analysis of facilities planning and its impact over the post occupancy of buildings.
CO6	Comprehend the understanding with the recommendation of best practices for effective functioning of building facilities.

TEXT / REFERENCE BOOKS

1. David G. Cotts, Kathy O. Roper, *The Facility Management Handbook*, Amacom, 2009
2. Bernard Lewis and Richard Payant, *Facility Manager's Maintenance Handbook*, McGraw Hills, 2007
3. Keith Alexander, Brian Atkin, Jan Bröchner, and Tore Haugen, *Facilities Management: Innovation and Performance*, Routledge, 2004
4. Eric Teicholz, *Facility Design and Management Handbook*, McGraw Hill Professional, 2001
5. Frank Booty, *Facilities Management Handbook, Fourth Edition*, Butterworth- Heinemann, 2006

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SAR 5604	STRUCTURAL SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To address the design factors pertaining to high rise structures and types of analysis.
- To understand the special concrete to meet the requirements of high rise and special structures.
- To explore new techniques in construction such as Pre-engineered buildings and design of special structures.

UNIT 1 INTRODUCTION TO HIGH-RISE BUILDINGS AND STRUCTURAL SYSTEMS**14 Hrs.**

Height analysis, plan shapes, grids and core design - Foundations and soil conditions - Construction sequencing, building skin and envelope - Design philosophy, structural loading, sequential loading, materials, high performance concrete – Fibre reinforced concrete, High strength concrete, Light weight concrete - Loading and movement Gravity Loading, Dead and Live load - Methods of Live load reduction – impact, gravity loading, construction loads, wind loading – Static and dynamic approach – Earth quake loading – Equivalent lateral force, model analysis, combinations of loading – Working stress design, limit state design, plastic design - Codes & Standards - Tensile structures in high-rise

UNIT 2 BEHAVIOR OF VARIOUS STRUCTURAL SYSTEMS**12 Hrs.**

Factors affecting growth, height and structural form – High rise behaviour, rigid frames, braced forms, infilled frames, shear walls, coupled shear walls, wall frames, tubular, cores, outrigger- braced and hybrid mega systems.

UNIT 3 DISASTER RESISTANT STRUCTURES**10 Hrs.**

Overall buckling analysis of frames, wall frames - Approximate methods, second order effects of gravity of loading, simultaneous first order and P delta analysis, translational, torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation - Case study of a high-rise structure with 3D model analysis.

UNIT 4 PREFABRICATED STRUCTURES**12 Hrs.**

Specific requirements for planning and layout of prefabricates plant, IS code specification - Design Principles, modular coordination, standardization, disuniting of prefabricates production, transportation and erection, stages of loading and code provisions, safety factors - Reinforced concrete - Prefabricated structures, wall panel types and two way fabricated slabs, partial and curtain walls, trusses, shells, crane - gantry systems - Floor slabs and roofs, types of floor slabs, cored and panel types and two way systems, stair case slab , insulation requirements, joints, their behaviour and reinforcement requirements – Walls, types of wall panels blocks and large panels, curtain - Partition and load bearing walls, wall joints - Behaviour and design, leak prevention, joint sealant, sandwich wall panels.

Max. 48 Hours**COURSE OUTCOMES****On completion of the course the student will be able to**

- CO1:** Get exposure to different types of loads and analysis methods while designing high rise structures.
CO2: Explore various types of special concrete to meet the specific purpose for high rise structures.
CO3: Establish knowledge about the behaviour of high rise structural systems during analysis and design.
CO4: Understand the design of high rise structures to resist disaster loading.
CO5: Acquire knowledge about different types of special structures and prefabricated structures.
CO6: Design structures against leak, joint sealants and other issues.

TEXT / REFERENCE BOOKS

1. Gupta Y.P, Proceedings National Seminar on High Rise Structures – Design and Construction Practices for mid- level cities, New Age International Limited, Publishers, 1995
2. Wolfgang Schueller, High Rise Building Structures, John Willey and Sons, 1977
3. Bryan Stafford Smith and Alex Coull, Tall building structures, Analysis and Design, John Willey and Sons, 1991
4. Lin T.Y. and Sidney D. Stotesbury, Structural Concepts and systems for Architects and Engineers, John Wiley & Sons, 1981
5. Bungalow Taranath, Steel, Concrete, and Composite Design of Tall Buildings, McGraw Hill, 1997

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA7301	ADVANCED STRUCTURAL SYSTEMS & MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To address the design factors pertaining to various building structure typologies and to explore new techniques in construction such as pre-engineered and prefabricated buildings.
- To understand the need and importance of structural maintenance and extending the serviceability and durability of structures. And to explore the techniques for repairing structures, selection and use of suitable materials for maintenance to enhance the life of structure.

UNIT 1	INTRODUCTION TO BUILDING STRUCTURAL SYSTEMS	9 Hrs
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Height analysis, plan shapes, grids and core design - Construction sequencing, building skin and envelope - structural loading, sequential loading, materials, high performance concrete – Fibre reinforced concrete, High strength concrete, Lightweight concrete - Loading and movement Gravity Loading, Dead and Live load - Methods of Live load reduction – impact, gravity loading, construction loads, wind loading – Static and dynamic approach – Earthquake loading – Equivalent lateral force, model analysis, combinations of loading – Working stress design, limit state design, plastic design - Codes & Standards - Tensile structures in high-rise. High rise behaviour.

UNIT 2	PRE- FABRICATED STRUCTURES AND THEIR APPLICATION	12 Hrs
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Specific requirements for planning and layout of prefabricated plant, Design Principles, modular coordination, standardization, disuniting of prefabricated production, transportation and erection, stages of loading, safety factors - Reinforced concrete - Prefabricated structures, wall panel types and two way fabricated slabs, partial and curtain walls, trusses, shells, crane - gantry systems - Floor slabs and roofs, types of floor slabs, cored and panel types and two way systems, staircase slab , insulation requirements, joints, their behaviour and reinforcement requirements – Walls, types of wall panels blocks and large panels, curtain - Partition and load bearing walls, wall joints - Behaviour and design, leak prevention, joint sealant, sandwich wall panels.

UNIT 3	SERVICEABILITY, MAINTENANCE AND REPAIR OF STRUCTURES	9 Hrs
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Effects due to climate, temperature, chemicals, wear and erosion - Design and construction errors, corrosion mechanism - Effects of cover thickness and cracking - Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathode protection. Maintenance, repair and rehabilitation - Facets of Maintenance importance - Maintenance preventive measures on various aspects – Inspection and assessment procedure for evaluating a damaged structure - Causes of deterioration - testing techniques.

UNIT 4	MATERIALS & REPAIRING TECHNIQUES	9 Hrs
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Special concretes and mortar, concrete chemicals - Special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, fibro cement, fibre reinforced concrete. Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete - Guniting and shotcrete epoxy injection, mortar repair for cracks, shoring and underpinning. Repairs to overcome low member strength - Deflection, cracking, chemical disruption, weathering wear, fire, leakage, marine exposure - Engineered demolition techniques for dilapidated structures - Case studies

UNIT 5	CONSTRUCTIVE ASSESSMENTS	6 Hrs
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Study and propose a building with the suitable structural system and carry out a thorough case study analysis and identify the areas where it could be improved along with the alternative construction techniques. Also identify an old building with the damages and propose a suitable material & techniques for repairing the selected structure to enhance the life span.

Max. 45 Hours

COURSE OUTCOMES:

CO1	Get exposure to different types of loads and analysis methods while designing the building structures.
CO2	Acquire knowledge about different types of special structures, pre-engineered and prefabricated structures.
CO3	In depth understanding on the requirements of good serviceability and longevity of structures.
CO4	Acquire knowledge and exposure to damages in the structure and their evaluation and maintenance procedures.
CO5	Identify suitable materials for repair and selection of appropriate techniques to enhance the life of faulty structures.
CO6	Comprehensive knowledge in the design and maintenance aspect of all types of structures with suitable materials and techniques to improve the life span of the structure.

TEXTS / REFERENCE BOOKS

1. Wolfgang Schueller, High Rise Building Structures, John Wiley and Sons, 1977
2. Bryan Stafford Smith and Alex Coull, Tall building structures, Analysis and Design, John Wiley and Sons, 1991
3. Lin T.Y. and Sidney D. Stotesbury, Structural Concepts and systems for Architects and Engineers, John Wiley & Sons, 1981

4. Bungale Taranath, Steel, Concrete and Composite Design of Tall Buildings, McGraw Hill, 1997.
5. Denison Campbell, Alien and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991
6. Allen R.T. and Edwards S.C., Repair of Concrete Structures, Blahie and Sons, UK, 1993
7. Shetty M.S., Concrete Technology- Theory and Practice, Chand and Company, New Delhi, 2000
8. Verghese P.C., Maintenance, Repair & Rehabilitation & Minor Works of Buildings, Prentice Hall, 2014
9. Samuel Y. Harris, Building Pathology – Deterioration, Diagnostics and Intervention, John Wiley & Sons, 2001.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100

Exam Duration: 3 Hrs

PART A : 2 questions from each unit, each carrying 4 marks

: 08 x 05 = 40 Marks

PART B : 2 questions from each unit with an internal choice, each carrying 15 marks

: 04 x 15 = 60 Marks

SAR 5605	BUILDING ENERGY ANALYSIS AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To achieve higher standards in building design and operation with a solid foundation of energy engineering and sustainability principles.
- To use building performance modelling as an investigative tool to improve overall energy efficiency of the building.

UNIT 1 INTRODUCTION**8 Hrs.**

Energy sources, energy demand and supply, energy crisis, future scenario, alternate sources of energy - Energy system efficiency; energy conservation aspects - Principles of energy management and energy audit - General principles, planning and program - Introduction to energy audit - General methodology, site surveys, energy systems survey, energy audit - Instrumentation and measurement, analysis of data and results.

UNIT 2 ENERGY AND BUILDING SERVICES**14 Hrs.**

Thermal performance characteristics of building elements/enclosure - Energy efficiency in design and operation of building services - Energy audit in different types of buildings and energy Management - Recycling and reuse of water products - Concepts of Green and Sustainable Buildings HVAC : Heating And Cooling Management, General principles of energy managements in HVAC systems, energy management opportunities, modeling of heating and cooling loads in buildings - Electrical load and Lighting management, General principles, illumination and human comfort; lighting systems, equipments, energy management opportunities, electrical load analysis, peak load controls - Process energy management, principles; modeling of electrical and lighting loads in buildings.

UNIT 3 INTEGRATED BUILDING SYSTEMS**10 Hrs.**

General principles, environment conformation - Passive design considerations, building envelope design consideration, integration of building system, energy storage - cold storage techniques - Economic analysis, economic aspects of energy management, general considerations - Economic analysis methods, life-cycle costing, break even analysis, benefit cost analysis, payback period analysis, present worth analysis, equivalent annual cost analysis.

UNIT 4 BUILDING INFORMATION MODELING (BIM)**16 Hrs.**

Use of computers, Building information management of energy with environment aspects - Building information modeling (BIM) - Facilitates documentation, design exploration, model-based quantity take off and estimating, interference checking, construction coordination and sequencing, digital fabrication and 3- D building information capture and visualization. - Examine geometry, spatial relationships, building information, quantities and properties of building components - Integrating people, systems, business structures and practices for maximizes efficiency through all phases of design, fabrication, construction and life cycle of the structure.

Max. 48 Hours**COURSE OUTCOMES****On completion of the course the student will be able to**

- CO1** : Demonstrate a broad understanding of energy sources, principles of energy management and energy auditing.
CO2 : Clearly articulate an understanding of energy efficiency in design and operation of building services.
CO3 : Develop an integrated building system approach to energy management using passive design techniques.
CO4 : Demonstrate the advanced ability to critically analyze the feasibility of energy efficient systems through economic analysis methods,
CO5 : Generate a building energy information, performance and analysis model using energy simulation software tools.

TEXT / REFERENCE BOOKS

1. Koenigsberger, O.H, Ingersoll, T. G., Mayhew, A, Szokolay.S.V, Manual of Tropical Housing and Building Part 1 - Climatic Design, Orient Longman Pvt. Ltd, Chennai, 2004
2. W R Murphy, G Mckay, Energy Management, Butterworth-Heinemann Ltd, 1981
3. Steve Doty and Wayne C. Turner, Energy Management Handbook, Fairmont Press, 2012
4. Clive Beggs, Energy: Management, Supply and Conservation, Routledge, 2009
5. Douglas Harris, A Guide to Energy Management in Buildings, Routledge, 2011
6. LalJayamaha, Energy-Efficient Building Systems: Green Strategies for Operation and Maintenance, McGraw-Hill Professional, 2006
7. Tarik Al-Shemmeri, Energy Audits: A Workbook for Energy Management in Buildings, Wiley, 2011

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SAR 5607	RISK AND SAFETY MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the planning procedures involved in Risk management and enable creating a plan through analysis
- To explain the implications and parameters involved in the project procedures with respect to safety, monitoring, controlling and assessment.

UNIT 1 INTRODUCTION TO RISK MANAGEMENT**12 Hrs.**

Definitions of risk - Elements of risk management - Causes of risk - Components of risk management - Planning for risk management – Project charter – Risk management policies, roles and responsibilities, examining stakeholder tolerance, risk management plan template – Revisiting the work breakdown structure - Risk management plan, creating the risk management plan, risk analysis, tracking.

UNIT 2 RISK IDENTIFICATION, RESPONSE AND COMMUNICATION**16 Hrs.**

Identifying risk, preparing for risk identification, risk categories, referring to historical information - Identifying the project risk – Reviewing project documents, brainstorming, the Delphi technique, analyzing SWOT – diagrammatic techniques - Examining the results of risk identification, qualitative and quantitative risk analysis - Preparing for Risk response, creating risk response, results of risk response planning. Risk monitoring and control - Risk communication, informing public about risk and responding to expressed concerns, education.

UNIT 3 CONSTRUCTION ACCIDENTS AND SAFETY PROGRAMMES**10 Hrs.**

Accidents and their causes - Human factors in construction safety - Cost of construction injuries - Occupational and Safety hazard assessment - Legal implications - Problem areas in construction safety - Elements of an Effective in safety programme - Job site safety assessment, safety meetings, safety incentives.

UNIT 4 SAFETY IN CONSTRUCTION SITES**10 Hrs.**

Safety in construction contracts - Safety record keeping - Safety culture - Safe workers - Safety and first line supervisors, safety and middle managers, top management practices - Company activities and safety - Safety Personnel - Contractual obligation - Project Coordination and Safety Procedures - Workers Compensation.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

CO1: Understand the components and policies involved in risk management

CO2: Perform Critical analysis through quantitative and qualitative assessment.

CO3: Outline the implications involved from start to end of project from identifying problem areas, concerns to required procedures to be followed throughout.

CO4: Analyze various elements of an effective safety programme and contractual obligations.

CO5: Comprehend procedures, legal implications and practices currently followed in Projects.

CO6: Understandingsimplified concepts and the tools necessary to assess, prioritise, and manage high-risk projects and tasks

TEXT / REFERENCE BOOKS

1. Bruce Barkley, Project Risk Management (Project Management), McGraw-Hill Professional, 2004
2. John R. Schuyler, Risk and Decision Analysis in Projects (Cases in project and program management series), Project Management Institute, 2002
3. Chris Chapman and Stephen Ward, Project Risk Management: Processes, Techniques and Insights, Wiley, 2003
4. Dale F. Cooper, Stephen Grey, Geoffrey Raymond, and Phil Walker, Project Risk Management Guidelines: Managing Risk in Large Projects and Complex Procurements, Wiley, 2004
5. James B. Atkins and Grant A. Simpson, Managing Project Risk: Best Practices for Architects and Related Professionals, Wiley, 2008
6. Jimmie W. Hinze, Construction Safety, Prentice Hall, 1996
7. Richard J. Coble, Jimmie W. Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall, 2000
8. Raymond Elliot Levitt and Nancy Morse Samelson, Construction Safety Management, Wiley, 1993.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA7302	RISK AND SAFETY MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To outline the planning procedure involved in project risk assessment and mitigation procedures.
- To explain the risk implications and impact on various parameters involved in project risk management.
- To explain the procedures to be followed on the project safety planning, monitoring, controlling.

UNIT 1	INTRODUCTION TO RISK MANAGEMENT	9 Hrs
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Definitions of risk - Elements of risk management - Causes of risk - Components of risk management - Planning for risk management – Project charter – Risk management policies, roles and responsibilities, examining stakeholder tolerance, risk management plan template – Revisiting the work breakdown structure - Risk management plan, creating the risk management plan / risk mitigation plan, risk analysis, tracking.

UNIT 2	RISK IDENTIFICATION, RESPONSE AND COMMUNICATION	12 Hrs
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Identifying risk, preparing for risk identification, risk categories, referring to historical information - Identifying the project risk – Reviewing project documents, brainstorming, the Delphi technique, analysing SWOT – diagrammatic techniques - Examining the results of risk identification, qualitative and quantitative risk analysis - Preparing for Risk response, creating risk response action, mitigation plan, results of risk response planning. Risk monitoring and control - Risk communication, informing public about risk and responding to expressed concerns, education –

Insurance as a form of Risk Transfer; Assessing risk profile of project; Mapping stakeholders risk profile by applying risk Iceberg model/Theory; As Low as Reasonably Possible (ALARP) principle - Basic principles of Insurance; Mandatory Insurance at work, International risk policy in projects, Insurance at project level and site level, insurance from project life cycle perspective, claims and settlement process.

UNIT 3	CONSTRUCTION ACCIDENTS AND SAFETY PROGRAMMES	9 Hrs
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Accidents and their causes - Human factors in construction safety - Cost of construction injuries - Occupational and Safety hazard assessment - Legal implications - Problem areas in construction safety - Elements of an Effective in safety programme - Job site safety assessment, safety meetings, safety incentives - OHSAS 18001:2007 occupational health and safety certification procedures for organisations.

UNIT 4	SAFETY IN CONSTRUCTION SITES	9 Hrs
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Safety in construction contracts - Safety record keeping - Safety culture - Safe workers - Safety and first line supervisors, safety and middle managers, top management practices - Company activities and safety - Safety Personnel - Contractual obligation – Contractor's safety policies and procedures – Contractor's job safety plan - Project Coordination and Safety Procedures - Workers Compensation.

UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
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Select a small / medium scale construction project, list the possible risks involved in the execution of project, list the mitigation activities, and list possible impact of the risk over the time / cost / quality of the project. For the same project students to list the various safety and precautionary measures to be taken for the execution of the project safely. Also list the various violations that tend to happen while insisting safety and mitigation strategies to be followed.

Max. 45 Hours**COURSE OUTCOMES:**

CO1	Understand the components and policies involved in risk management
CO2	Perform Critical analysis through quantitative and qualitative assessment.
CO3	Outline the implications involved from start to end of project from identifying problem areas, concerns to required procedures to be followed.
CO4	Analyse various elements of an effective safety programme and contractual obligations.
CO5	Comprehend procedures, legal implications and practices currently followed in Projects.
CO6	Understanding simplified concepts and the tools necessary to assess, prioritise, and manage high-risk projects and tasks

TEXTS / REFERENCE BOOKS

1. Bruce Barkley, Project Risk Management (Project Management), McGraw-Hill Professional, 2004
2. John R. Schuyler, Risk and Decision Analysis in Projects (Cases in project and program management series), Project Management Institute, 2002
3. Chris Chapman and Stephen Ward, Project Risk Management: Processes, Techniques and Insights, Wiley, 2003
4. Dale F. Cooper, Stephen Grey, Geoffrey Raymond, and Phil Walker, Project Risk Management Guidelines: Managing Risk in Large Projects and Complex Procurements, Wiley, 2004

5. James B. Atkins and Grant A. Simpson, Managing Project Risk: Best Practices for Architects and Related Professionals, Wiley, 2008
6. Jimmie W. Hinze, Construction Safety, Prentice Hall, 1996
7. Richard J. Coble, Jimmie W. Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall, 2000
8. Raymond Elliot Levitt and Nancy Morse Samelson, Construction Safety Management, Wiley, 1993
9. Kendrick, Tom. (2015). Identifying and Managing Project Risk : Essential Tools for Failure – Proofing Your Project, Harper Collin Publisher, Published by AMACOM.
10. Hillson, David (2017). Managing Risk in Projects, Ashgate Publishing Group (Web Version)
11. Loosemore, M. (2006). Risk management in projects. Taylor & Francis, London.

SAR 5608	REAL ESTATE MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To offer hands on experience that is vital to excel in the real estate market by understanding the principles and practices of real estate.
- To explore real-world scenarios, best practices and effective management techniques for competing successfully in today's dynamic global markets.

UNIT 1 REAL ESTATE MARKET**10 Hrs.**

Real Estate Scope, classification of real estate activities and peculiarities - Factors affecting real estate market - Role of government in real estate market, statutory provisions, laws, rules, and regulations application, land use controls in property development, registration and licensing requirements - Knowledge base for assessment and forecasting the Real Estate market - Environmental issues related to real estate transactions.

UNIT 2 PARTICIPANTS AND STAKE HOLDERS**12 Hrs.**

Role, scope, working characteristics and principal functions of real estate participants and stakeholders - Real estate consultants and their activities - Roles and responsibilities of property managers, code of ethics for real estate participants - Good practices and managerial responsibilities.

UNIT 3 REAL ESTATE DEVELOPMENT**14 Hrs.**

Functions of Real Estate development like project formulation, feasibility studies, developing, costing and financing, managing including planning, scheduling and monitoring of real estate projects, risk management, facilities management, marketing/advertising, post construction management etc - Real estate investment, sources and related issues.

UNIT 4 DOCUMENTATION**12 Hrs.**

Interest rates in real estate - Documentation in real estate processes - Transfer of titles and title records - Real estate appraisal and valuation - Types of agreements between the consultants and principal - Closing the real estate transactions.

Max. 48 Hours**COURSE OUTCOMES****On completion of the course the student will be able to**

- CO1** : Summarize the scope of the existing real estate industry in the current business environment and to classify the various statutory and legal regulations applicable to real estate market.
- CO2** : Outline the roles, responsibilities, rights and liabilities of different real estate stakeholders.
- CO3** : Get exposure to the various documentation procedures for different real estate transactions, appraisals, agreements and valuation of properties.
- CO4** : Apply quantitative methodology used in different transactions using the current rates of properties, registration charges and appropriate fees applicable in different states. Delineate project development process, compare the different sources of real estate funds and classify the risks associated therein.
- CO5** : Formulate a real estate project by assessing its feasibility and evolving strategies for effective management.

TEXT / REFERENCE BOOKS

1. Geltner, Miller, Clayton and Eichholtz, Commercial real estate analysis and investments, On-course Learning, 2013
2. John Ratcliffe and Michael Stubbs, Urban planning and real estate (Natural and Built Environment Series), Routledge, 2009
3. Mike E. Miles, Gayle L. Berens, and Mark A. Weiss, Real Estate Development: Principles and Process, Urban Land Institute, 2000
4. Stephen P. Peca, Real Estate Development and Investment: A Comprehensive Approach, Wiley, 2009

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA5203	REAL ESTATE AND MARKETING MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To provide a comprehensive understanding about real estate practice, financial markets, legal aspects and marketing management.
- To formulate and appraise capital investments for developers for different types of projects and to be able to prepare DPRs.
- To acquire competence in managing real estate and infrastructure assets and interpretation of valuation methods.

UNIT 1	PRINCIPLES AND PRACTICES OF REAL ESTATE MANAGEMENT	9 Hrs
Real and personal property, Characteristics of real estate; Affordable housing; Laws affecting property development, Real estate contracts; Leases; Fair housing and ethical practices; Property management, Environmental issues and real estate transactions; Financial services, markets and institutions- - structure and role; Banking institutions and non-bank financial companies, development & housing finance institutions, Micro finance, Financial regulatory bodies.		
UNIT 2	BUSINESS DEVELOPMENT AND MARKETING MANAGEMENT	12 Hrs
Business development process; Real estate/property markets, forecasting and business cycles, Analytical tools for selection of new business; Market Analysis and Demand Forecasting, Technical analysis including Value Engineering, Economic Analysis, (EIA), Project risk analysis & cash flow analysis, estimation from contractors view and clients View, PPP projects and life cycle perspective from developers aim; DPR from various stakeholders perspective. Project Appraisal; SCBA. Project marketing concepts, Twin-track approach towards project marketing, Project marketing mix.		
UNIT 3	REAL ESTATE DEVELOPMENT PRACTICE	9 Hrs
Development control regulations; Zoning; Rent control Act; Building byelaws; Permissions; Changing land use; Real estate types; Location selection; relevant ownership flats/apartments act; Planning for single, mixed use, planned use, specialized Special Economic Zones (SEZ) projects; Choosing vendors, contract terms; Facilities mix management; Integrating environmental issues in development.		
UNIT 4	VALUATION AND ASSET MANAGEMENT OF PROPERTIES	9 Hrs
Value, valuation and importance of Value, Appraisal/valuation cycle, Valuation principles and factors, Major Approaches to Valuation-Market approach, Cost approach and Income approach, Valuation techniques/methods Valuation for Contemporary Issues viz., Energy and Environment, Contemporary issues in valuation. Asset management strategy and objectives; Overview of asset management standards: British Standard Institution (BSI), Publicly Available Specification (PAS) 55.ISO 55000;: Asset management policy, Deterioration modelling; Maintenance - objectives models and maintenance requirements determination; Life cycle costing; Economic life of asset; Replacement analysis; Decision tools for asset management; Prioritization and optimization; System reliability.		
UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
Individual assignments on valuation, EIA, cash flow, project formulation, DPR and case study analysis.		

Max. 45 Hours**COURSE OUTCOMES**

CO1	Summarize the scope of the existing real estate industry in the current business environment and to classify the various statutory and legal regulations applicable to real estate market.
CO2	Outline the roles, responsibilities, rights and liabilities of different real estate stakeholders.
CO3	Get exposure to the various documentation procedures for different real estate transactions, appraisals and valuation of properties.
CO4	Apply quantitative methodology used in different transactions.
CO5	Delineate project development process, compare the different sources of real estate funds and classify the risks.
CO6	Formulate a real estate project by assessing its feasibility and evolving strategies for effective management.

TEXTS/ REFERENCE BOOKS

1. Madura, J. (2008). *Financial markets and institutions*. Ohio: Thomson Publications.
2. Levinson, M. (2001). *Guide to financial markets*. London: Economist Profile Books.
3. Ishkin, F., Eakins, S. (2009). *Financial markets and institutions*. New Delhi.: Pearson Education,
4. Verma, J. (1997). *Venture capital financing in India*. New Delhi.: Response Books.
5. Kotler, P. and Armstrong, G. (2008). *Principles of marketing*. New Delhi.: Prentice-Hall of India.
6. Kotler, P. and Keller, K. (2009). *Marketing Management*. New Delhi: Prentice- Hall of India.
7. Porter, M. (1992). *Competitive strategy*. New York: Free Press.

End semester examination question paper pattern
(To be distributed uniformly among all the units)

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks****Exam Duration: 3 Hrs****: 08 x 05 = 40 Marks**

SAR 5610	RESEARCH METHODOLOGIES IN BUILT ENVIRONMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To comprehend the need, role and importance of research in Architecture.
- To understand and synthesize process of research.

UNIT 1 INTRODUCTION**10 Hrs.**

Basic research issues and concepts- Orientation to research process- Types of research: historical, qualitative, co-relational, experimental, simulation and modelling, logical argumentation, case study and mixed methods- illustration using research samples.

UNIT 2 RESEARCH PROCESS**14 Hrs.**

Elements of research process: finding a topic- Writing an introduction- Stating a purpose of study identifying key research questions and hypotheses- Reviewing literature using theory, defining, delimiting and stating the significance of the study, advanced methods and procedures for data collection and analysis- illustration using research samples.

UNIT 3 RESEARCHING AND DATA COLLECTION**14 Hrs.**

Library and archives- Internet: new information and the role of internet, finding and evaluating sources of misuse- Test for reliability ethics - Methods of data collection- From primary sources: observation and recording, interviews structured and unstructured, questionnaire, open ended and close ended questions and the advantages, sampling- Problems encountered in collecting data from secondary sources.

UNIT 4 REPORT WRITING & CASE STUDIES**10 Hrs.**

Writing & publishing the research work in journals - Research writing in general- Components:referencing- Writing the bibliography- Developing the outline – presentation etc. - Case studies - illustrating how good research can be used from project inception to completion- Review of research publications.

Max. 48 Hours**COURSE OUTCOMES:**

On completion of the course the student will be able to

- CO1:** Distinguish different types of research in architecture
- CO2:** Demonstrate an understanding of the process of research and the elements of the research process.
- CO3:** Ability to review and critically analyze the literature to establish current knowledge of a topic, compare and contrast the various findings, arguments, theories, and methodologies, and problems or gaps in the literature.
- CO4:** Comprehend the different data collection techniques and their application in a context
- CO5:** Understanding the basics of research paper writing and publishing.
- CO6:** Develop and write a preliminary research proposal.

TEXT / REFERENCE BOOKS

1. Wayne C Booth, Joseph M Williams, Gregory G Colomb, The Craft of Research, 2nd Edition, Chicago guides to writing, editing and publishing, 1995
2. Iain Borden, Kaaterina Ruedi, The Dissertation: An Architecture Student's Handbook, Architectural Press, 2000
3. Ranjith Kumar, Research Methodology- A step by step guide for beginners, Sage Publications, 2005
4. John W Creswell, Research design: Qualitative, Quantitative and Mixed method approaches, Sage Publications, 2002
5. Linda N. Groat, David Wang, Architectural Research methods, Wiley, 2nd edition, 2013

End semester examination question paper pattern
(To be distributed uniformly among all the units)

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA5104	RESEARCH METHODOLOGIES IN BUILT ENVIRONMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To comprehend the need, role and importance of research in Architecture.
- To understand and synthesize the process of research.
- To give an insight to report writing and publishing research work in journals.

UNIT 1	INTRODUCTION	9 Hrs
Introduction to research - Orientation to research process- Types of research: Quantitative, Qualitative, Mixed methods -Strategies for Architectural research: historical, qualitative, co-relational, experimental, simulation and modelling, logical argumentation, case study and combined methods- illustration using research samples.		

UNIT 2	RESEARCH PROCESSES	10 Hrs
Research process- Formulating a research problem- conceptualizing research Design-Stating a purpose of study identifying key research questions and hypotheses- Reviewing literature using theory, defining, delimiting and stating the significance of the study, - illustration using research samples.		

UNIT 3	DATA COLLECTION AND ANALYSIS	10 Hrs
Methods of data collection- Primary and secondary: observation and recording, interviews structured and unstructured, questionnaire, open ended and close ended questions and the advantages, sampling- Problems encountered in collecting data from secondary sources- Basics of processing and analysis of data: classification and tabulation of data, Overview of types of quantitative analysis: Multiple regression, Multiple discriminant analysis, Multivariate analysis of variance, Inferential analysis – Methods of qualitative analysis.		

UNIT 4	REPORT WRITING & CASE STUDIES	10 Hrs
Writing & publishing the research work in journals- Research Metrics: Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score, Metrics: h-index, g index, i10 index, altmetrics - Research writing in general- Components: referencing- Writing the bibliography- Developing the outline – presentation etc.-. Databases: Indexing databases, Citation databases: Web of Science, Scopus, etc. Research ethics: intellectual honesty and research integrity, Scientific misconduct: falsification, fabrication, and plagiarism.		

UNIT 5	COMPREHENSIVE ASSIGNMENTS	6 Hrs
Write a review on selected papers or books individually and submit a report on the same. To submit an abstract of a paper on an interesting topic with references in APA style.		

Max.45 Hours**COURSE OUTCOMES:**

CO1	Distinguish different types of research in architecture
CO2	Demonstrate an understanding of the process of research and the elements of the research process.
CO3	Ability to review and critically analyze the literature to establish current knowledge of a topic, compare and contrast the various findings, arguments, theories, and methodologies, and problems or gaps in the literature.
CO4	Comprehend the different data collection techniques and their application in a context.
CO5	Understanding the basics of research paper writing and publishing.
CO6	Develop and write a preliminary research proposal.

TEXT / REFERENCE BOOKS

1. Creswell, J. W. (2002). Research design: Qualitative, Quantitative and Mixed method approaches. Sage Publications.
2. Iain Borden, K. (2000). The Dissertation: An Architecture Student's Handbook. Architectural Press.
3. Kumar, R. (2005). Research Methodology- A step by step guide for beginners. Sage Publications.
4. Linda N. Groat, D. W. (2013). Architectural Research methods. Wiley.
5. Wayne C Booth, J. M. (1995). The Craft of Research. Chicago: Chicago guides to writing, editing and publishing.

SAR 5612	BUSINESS STRATEGIES & CORPORATE PLANNING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- Touse analytical tools and techniques for studying construction case studies in the context of the business environment.
- To identify key elements of a good strategic plan, determine long term goals, policies and objectives and to translate and communicate the same.
- To understand the value of purpose in ensuring a high performance organization that achieves results through creative Strategic Planning.

UNIT 1 BUSINESS AS A SOCIAL SYSTEM/ECONOMIC SYSTEM**12 Hrs.**

Objective of Business - Business Environment – Socio economic sector, technology Sector, government Sector - The industry environment – customer sector/ supplier sector/ competitor sector - The International environment – Opportunities for International activities - Threats from International activities.

UNIT 2 BUSINESS POLICY IN VARIOUS ECONOMIC SYSTEMS**12 Hrs.**

Business ethics - Social responsibility of Business / Indian businessmen, social audit - Capitalist economy: economic system of socialism and mixed economic system.

UNIT 3 BUSINESS POLICY AND CORPORATE STRATEGY**12 Hrs.**

How to make policy corporate strategy – Policies, strategies and tactics, policies and procedures - Functions and importance, strategy alternatives, considering strategy variations, strategic choice and implementation.

Policy Formulation: objectives, direction, consideration of change - Business Policy concepts, characteristics and importance - Different types of policies: classification, strategies, programmes, procedures and rules - M.B.O./ M.B.E. major and minor policies - Supporting composite and contingency policies: parameter of policy - Development of Business Policy - Swot Analysis - Elements of Business Policy - Implementation of Policy.

UNIT 4 MAJOR BUSINESS POLICIES**12 Hrs.**

Man Power planning - Product Policies, marketing policies, production and purchase policies - Financial policies, capital procurement and distribution - Administration and control of policy - Communication system - Policy implementation - Rules and procedures - GPI policy - Appended implied and imposed policy - Oral and written policies control and review.

Max. 48 Hours**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO1** : Define Business in a social and economic system and assess the external and internal environments.
CO2 : Articulate the importance of corporate social responsibility and to measure its impact on business and society.
CO3 : Learn to make strategic decisions and translate a strategic plan into policies, objectives, tactics and procedures.
CO4 : Classify policies at different levels and organize the various steps in effective policy making.
CO5 : Develop a mission and vision statement for a construction business and implement an appropriate strategy.

TEXT / REFERENCE BOOKS

1. Lawrence R Jauch and William F Glueck, Business policy and strategic management, McGraw Hill, 1988
2. SatishMamoria, C.B Rao, P. Subba, Business planning and Policy, Himalaya Publishing house, 2001
3. Budhiraja SB and Athreya MB, Cases in Strategic Management, Tata McGraw Hill, 1996
4. Michael A. Hitt, R. Duane Ireland, Robert E. Hoskisson, Strategic Management - competitiveness and Globalization, Thomson/South-Western, 2003.

**End semester examination question paper pattern
(To be distributed uniformly among all the units)**

Max. Marks: 100**PART A : 2 questions from each unit, each carrying 4 marks.****PART B : 2 questions from each unit with an internal choice, each carrying 15 marks****Exam Duration: 3 Hrs.****: 08 x 05 = 40 Marks****: 04 x 15 = 60 Marks**

SARA7401	BUSINESS STRATEGIES & CORPORATE PLANNING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To appreciate the strategic moves of firms in the context of the business environment toward achievement of the organizational mission strategic management process
- To identify key elements of a good strategic plan, determine long term goals, policies and objectives and to translate and communicate the same.
- To understand the value of purpose in ensuring a high performance organization that achieves results through creative Strategic Planning.

UNIT 1	BUSINESS AS A SOCIAL SYSTEM/ECONOMIC SYSTEM	12 Hrs
Objective of Business - Business Environment – Mission and Goals, Objective setting, Policies, Socio economic sector, technology Sector, government Sector - the industry environment – customer sector/ supplier sector/ competitor sector – Analysis of the internal , external, natural , international environment – opportunities for international activities - threats from International activities. Environmental Forecasting Techniques. Business ethics - Social responsibility of Business, social audit - Capitalist economy: economic system of socialism and mixed economic system.		
UNIT 2	MAJOR BUSINESS POLICIES	9 Hrs
Different types of policies: classification - capital procurement and distribution - Administration and control of policy - Communication system - Policy implementation - Rules and procedures - GPI policy -Appended implied and imposed policy - Oral and written policies control and review. Major and minor policies - Supporting composite and contingency policies: parameter of policy - Development of Business Policy.		
UNIT 3	FORMULATION OF STRATEGY	9 Hrs
Formulation of strategy: linkage between structure, leadership and culture, different approaches to strategy Formulation- Grand Strategy Alternatives- Stability, Growth, Retrenchment ,new business models and strategies for new internet models. Strategic issues: managing technology and Innovation, Strategic Issues for non-profit Organization.		
UNIT 4	BUSINESS POLICY AND CORPORATE STRATEGY	9 Hrs
Evaluation and Choice of Strategy , steps in implementation of Strategy- structure, Policies and directions, resources commitment, leadership, motivation, power and politics, M.B.O./ M.B.E. - McKinsey's 7 model; premise control, implementation control, strategic surveillance, special alert control, monitoring, performance. Strategy Evaluation tools and techniques- BCG model, GE 9 cell model and others.		
UNIT 5	CONSTRUCTIVE ASSIGNMENTS	6 Hrs
Assignments on analysis of Business policy and strategies of major construction consulting companies		
		Max. 45 Hours

COURSE OUTCOMES

CO1	Define Business in a social and economic system and assess the external and internal environments.
CO2	Articulate the importance of corporate social responsibility and to measure its impact on business and society.
CO3	Learn to make strategic decisions and translate a strategic plan into policies, objectives, tactics and procedures.
CO4	Classify policies at different levels and organize the various steps in effective policy making.
CO5	Formulate strategy and evaluate them with tools and techniques.
CO6	Develop a mission and vision statement for a construction business and implement an appropriate strategy.

TEXT / REFERENCE BOOKS

1. Lawrence R Jauch and William F Glueck. (1988) *Business policy and strategic management*. California: McGraw-Hill Inc.US
2. SatishMamoria, C.B Rao, P. Subba (2001) *Business planning and Policy* . Mumbai: Himalaya Publishing house.
3. Budhiraja SB and Athreya MB. (1996) *Cases in Strategic Management*. New Delhi : Tata McGraw Hill.
4. Michael A. Hitt, R. Duane Ireland, Robert E. Hoskisson (2003) *Strategic Management - Competitiveness and Globalization*. OH, United States: Thomson\ South-Western.
5. Carpenter, M., Sanders W. and Salwan, P. (2012). *Strategic management- A dynamic perspective* New Delhi: Pearson.
6. Pearce, J., Robinson, R.(1996). *Strategic management- Strategy formulation & implementation*. New Delhi : AITBS Publishers and Distributors.