

# **MASTER OF BUILDING ENGINEERING 8: MANAGEMENT**

# SCHEME OF EXAMINATION

1 <sup>st</sup> YEAR - SEMESTER I												
Classification of Course	Code	Course	Hours/ Week	L	T	S	Credits	External Exam Type	Marks			Duration of (Theory) Exam
									Internal Assessment	External Examination	Total	
Core	BEM1.01	Construction Technology	4	2	0	2	4	Written-Exam	100	100	200	3 hrs.
	BEM1.02	Functional Performance of Buildings	4	2	0	2	4	Written-Exam	100	100	200	3 hrs.
	BEM1.03	Building Services	4	4	0	0	4	Internal Only	100	0	100	-
	BEM1.04	Project Planning and Scheduling	4	4	0	0	4	Written-Exam	100	100	200	3 hrs.
	BEM1.05	Project Planning and Scheduling Studio	6	0	0	6	6	Jury	100	100	200	-
	BEM1.06	Quantitative Methods and Operations Research	2	2	0	0	2	Internal Only	100	0	100	-
Audit Credit	BEM1.07	Research Methodology	2	2	0	0	NC	-	-	-	-	-
<b>TOTAL</b>			<b>26</b>				<b>24</b>		<b>600</b>	<b>400</b>	<b>1000</b>	

**List of Abbreviations**

L = Lecture; T = Tutorial/ Seminar/ Research/ Lab; S = Studio; NC = Non-Credit

1 <sup>st</sup> YEAR - SEMESTER II												
Classification of Course	Code	Course	Hours/ Week	L	T	S	Credits	External Exam Type	Marks			Duration of (Theory) Exam
									Internal Assessment	External Examination	Total	
Core	BEM2.01	Structural Systems & Design Process	4	2	0	2	4	Written-Exam	100	100	200	3 hrs
	BEM2.02	Project Cost & Contract Management	4	4	0	0	4	Written-Exam	100	100	200	3 hrs
	BEM2.03	Project Cost & Contract Management Studio	6	0	0	6	6	Jury	100	100	200	-
	BEM2.04	Project Seminar- I	4	0	0	4	4	Jury	100	100	200	-
Department Elective*	BEM2.05	Infrastructure Development & Management	2	2	0	0	2	Written-Exam	50	50	100	2 hrs.
	BEM2.06	Building Energy Modelling										
	BEM2.07	Fire & Life Safety										
Institute Elective	BEM2.08	Infrastructure Project Construction Management	2	2	0	0	2	Internal Only	100	0	100	-
<b>TOTAL</b>			<b>22</b>				<b>22</b>		<b>550</b>	<b>450</b>	<b>1000</b>	

**List of Abbreviations**

L = Lecture; T = Tutorial/ Seminar/ Research/ Lab; S = Studio; NC = Non-Credit

\*Pick any one

2 <sup>nd</sup> YEAR - SEMESTER III												
Classification of Course	Code	Course	Hours/ Week	L	T	S	Credits	External Exam Type	Marks			Duration of (Theory) Exam
									Internal Assessment	External Examination	Total	
Core	BEM3.01	Project Procurement Management	4	4	0	0	4	Written-Exam	100	100	200	3 hrs.
	BEM3.02	Project Procurement Management Studio	6	0	0	6	6	Jury	100	100	200	-
	BEM3.03	Project Finance Management	2	2	0	0	2	Internal Only	100	0	100	-
	BEM3.04	Project Seminar -II	4	0	0	4	4	Jury	100	100	200	-
Department Elective *	BEM3.05	Human Resource Management	4	4	0	0	4	Written-Exam	50	50	100	2 hrs.
	BEM3.06	Environmental Compliances & Management										
	BEM3.07	Real Estate Management							50	50	100	2 hrs.
	BEM3.08	Disaster Resilient Project Planning & Reconstruction										
Institute Elective	BEM3.09	Quality Management System	2	2	0	0	2	Internal Only	100	0	100	-
Audit Credit	BEM3.10	Training (Summer)	8 Weeks	0	0	0	NC	-	-	-	-	-
<b>TOTAL</b>			<b>22</b>				<b>22</b>		<b>600</b>	<b>400</b>	<b>1000</b>	

**List of Abbreviations**

L = Lecture; T = Tutorial/ Seminar/ Research/ Lab; S = Studio; NC = Non-Credit

\*Pick any two

2 <sup>nd</sup> YEAR - SEMESTER IV												
Classification of Course	Code	Course	Hours/ Week	L	T	S	Credits	External Exam Type	Marks			Duration of (Theory) Exam
									Internal Assessment	External Examination	Total	
Core	BEM4.01	Thesis	12	0	0	12	12	Jury	550	350	900	-
	BEM4.02	Quality Management System	2	2	0	0	2	Internal Only	100	0	100	-
<b>TOTAL</b>			<b>14</b>				<b>14</b>		<b>650</b>	<b>350</b>	<b>1000</b>	
<b>GRAND TOTAL OF ALL SEMESTERS</b>			<b>84</b>				<b>82</b>		<b>2400</b>	<b>1600</b>	<b>4000</b>	

**List of Abbreviations**

L = Lecture; T = Tutorial/ Seminar/ Research/ Lab; S = Studio; NC = Non-Credit

# SYLLABUS

## FIRST YEAR: SEMESTER I

### BEM1.01: Construction Technology

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	2	0	2	4	Written-Exam	100	100	200	3 hrs

#### Objectives

The aim of this course is to give a comprehensive coverage on all aspects of construction technologies related to building projects, the understanding of which are essential for the construction managers. The understanding should lead to selection of appropriate technology for various building and building related infrastructure projects through planning design and managerial interventions in a life cycle perspective.

#### Course content

- Geo-technical investigations, geo-informatics and interpretation of soil investigations;
- Soil / ground improvement techniques, deep excavations in various conditions;
- Foundation systems, effect in aggressive soil conditions, special foundation techniques;

Planning and design considerations of foundation and superstructure systems for Multi-storeyed, tall and super tall buildings;

- Construction of basements and water proofing techniques;
- Concrete Technology, Durability and mix design, production and placement of concrete, including mechanization, Ready Mixed Concrete; Special concrete (High performance concrete, self-compacting concrete, impervious concrete, architectural finishes and aesthetic concrete); Alternative aggregates;
- Quality Control in laboratory facilities and processes, experimental investigations; In-situ tests on concrete (including Non – Destructive Testing), Field laboratory tests;
- Formwork systems (including slip-form), temporary works and enabling works;
- Re-bar technologies and structural steel materials and jointing;

- Coatings, Construction chemicals, Admixtures, Water proofing chemicals, Painting systems; Water proofing and moisture / dampness prevention;
- Fabrication and erection of steel structures; Design and detailing of joints; Quality assurance in jointing, including welding and fabrication; Pre-engineered buildings;
- Repair technologies and materials for strengthening and retrofitting for existing / distressed buildings, heritage buildings;
- Pre-cast, pre-stressed concrete and composite constructions;
- Pre-fabricated and off-site technologies (including pre-engineered construction);
- Technologies for roads and pavements; Development of road infrastructure (including allied works such as drainage, culverts etc.)
- Construction equipment and machinery including maintenance issues;

- Materials and technologies for building envelope (including glass);
- Technologies and materials for fire protection of structures;
- Construction technologies for affordable housing; Appraisal and performance assessment of construction technologies; Innovations and emerging in technologies for smart infrastructure and buildings;
- Performance standards of building systems; Concrete versus steel technology suitability;
- Life cycle analysis of technologies; Sustainable Construction Technologies; Waste-based / recycled materials and technologies;

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff.  Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments, Studio work assessments	

## BEM1.02: Functional Performance of Buildings

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	2	0	2	4	Written-Exam	100	100	200	3 hrs

### Objectives

The objective of the course is to develop competence to determine the comprehensive performance of buildings with regards to its functional needs satisfaction. The environmental aspects considered for performance include thermal, illumination and aural behaviour. Course aims to impart requisite knowledge for taking effective managerial decisions to ensure desirable performance conforming to good practices and national / international

codes / standards. The objective of the course is also to rigorously train the students in using the IT applications and software packages related to functional performance of buildings like thermal and lighting analysis, passive fire and life safety requirements.

### Course content

- Thermal behaviour of buildings; Study of passive design measures; Role of Landscape

in thermal performance of buildings; Energy conservation consideration; Thermal simulation tools;

- Psychometrics and comfort; Indoor environmental quality;
- Natural and mechanical ventilation systems;
- Economic analysis of energy efficient systems; Life cycle energy assessment;

- Study of embodied energy; Carbon foot print / carbon neutral buildings;
- 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;
- Role of Building Automation and performance enhancement;
- Noise control requirements; Noise control measures; Concepts of aural comfort and sound quality considerations for spaces;
- Study of codes / standards for energy consumption in buildings; Energy auditing;

Green building approaches; Performance rating systems; Environmental impact studies of building projects;

- Functional analysis and design process; Functional performance satisfaction and reliability.

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff.  Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments, Studio work assessments	

### BEM1.03: Building Services

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	4	0	0	4	Internal Only	100	0	100	-

#### Objectives

Intent of the course is to provide exposure to students about various aspects of planning, design, execution and maintainability of mechanical, electrical, plumbing and fire safety services so as to effectively co-ordinate pre-construction and construction phase of

projects. In the context of large residential and institutional complexes, the course aims to cover the external infrastructural services, such as electrical, storm water drainage, sewerage etc., communication system and other civil infrastructure facilities.

#### Course Content

- Water and waste management services and systems; Water supply systems (sources, pumping, reservoirs, water treatment, tanks, pipe materials); Quality and quantity standards for water; Sewerage and Sewerage Treatment Plants; R.O. system for potable water; Storm water system;



Rain water harvesting; Plumbing system, fittings and fixtures; Hydro-pneumatic systems; Multi-stage pumping; Measures for effective water management; Net zero water approach;

- HVAC system types and components; Heating and cooling load determination; District cooling; Planning and design of ventilation;
- Electrical services system and components; Main sub-stations and sub-station equipment (for large developments); Power distribution systems (underground and overhead); Standby / captive power supply, metering; Renewable energy sources;
- Cogeneration systems; Steam supply;
- Vertical transportation system; Elevators; travellers; escalators;
- Access control CCTV system; Security and surveillance systems; Telecommunication and related information technology-based facilities;

- Study of schematic diagrams; Operation, maintenance and planning for retrofitting of services; Integrated building management system; Facilities management for building services; Performance specifications for

engineering services; Energy efficiency issues in engineering services; Overview of codes and standards applicable to MEP services;

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff.  Discussion of practical cases is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments	

## BEM1.04: Project Planning & Scheduling

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	4	0	0	4	Written-Exam	100	100	200	3 hrs

### Objective

The intent of the course is to disseminate about the application of Project Management and to familiarise with the information

technology-based tools, applications during the Project life cycle (i.e. inception phase to the Post-construction phase). The emphasis of module is on the planning processes at the

construction phase of a project. The concepts of project management are elaborated through inter-linked processes. The course is to introduce application software and their

usage in different phases of construction and rigorously impart training for using the project management software by on specific cases/projects. The course imparts basic understanding of computer networking and database management systems.

**Course Content**

- Introduction to Project Management; Principles and Practice of Project Management; Introduction to projects; Project nature, Construction project Peculiarities-Characteristics and features; Project appraisal, selection and evaluation; Life cycle stages of construction projects; Project Management definitions; Core components of project management; Review of project management processes (reference to IS 15883, PMBOK, PRINCE2);
- Project Organizations; Construction Project Organisations, Project organization structures and processes; Scope and services of PMCO, Role and responsibilities of a Project Manager, Client, Promoter, Consultants, Contractor; Organizational procedures.
- Time Management; Evolution of time management concepts; Need for time management; Challenges of project management (delays in pre-execution, construction phase); Methods and processes for time management as per IS 15883-II, PMBOK; Work Breakdown Structure;
- Project planning and scheduling; Deterministic and probabilistic scheduling; Activities and their durations; Activity

duration estimating techniques; Time Scheduling Techniques; Time constrained and resource constrained scheduling; Network techniques for project planning, scheduling and control (CPM, PERT, LOB); Risk based scheduling, tools and techniques;

- Resource Management and Resource-based Scheduling Techniques; Type of resources and their assessments; Activity Resource estimation; Resource levelling concepts and techniques
- Time Cost Analysis; Cost components of a construction project; Direct and indirect costs;
- Critical Chain Project Management, Delay Management; Earned Value Management (EVM); Cost-Time Relationships-Utility Curves, S-Curves; Time-Cost trade-off.
- Management processes (Scope, Cost, Risk, Communication and Time) during pre-construction phase; Building design process & design review, Project Feasibility & Detailed Project Report, risks in construction, quantitative determination of risk in project duration and cost;

- Risk management processes during planning, design and construction (including contract management) stage.
- Critical Chain Project Management; Path buffers and Project buffer; Project monitoring and control;
- Schedule monitoring and control; Delay management; Causes of delay; Classification of delays; Managing delays;
- Management Information Systems; Scope, significance, design criteria of MIS; Formats of MIS for construction stages;
- Information Technology in Construction; Application software used in construction project management for scheduling (such as BIM, MS Project and Primavera); Concept of computer networking, requirement, terminology and various networking configurations (LAN, WAN); Database management systems; Emerging areas of construction specific information technologies; Concept of ERP systems; Basic internet and web-based management technologies;

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b>	
Class tests, Presentation reviews, Individual Assignments, Studio work assessments	

## BEM1.05: Project Planning & Scheduling Studio

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
6	0	0	6	6	Jury	100	100	200	-

### Objective

The intent of the course is to augment the knowledge imparted through lectures by discussion of practical cases to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context. Live case studies are to be undertaken and various aspects of the course are 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 the actual real-life cases are undertaken to enable hands on experience. The course aims to define the Project Management context with reference to building and related infrastructure project with topics on project phases, characteristics of the project life cycle, project stakeholders and project organisation their roles, responsibilities, scope and services of team members.

### Course Content

Introduction to Project Management; Familiarisation with Building Projects through studies of project drawing & documents, and extracting inferences for group projects on:

- 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.

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 co-ordination,

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.

TEACHING LEARNING PROCESS	AIM
Presentations	Studio exercises will be in the form of group work/and or individual assignments Each group shall have its own unique real life ongoing project for study. Groups are encouraged to have diverse projects so that peculiarities in specific projects are explored by entire class
<b>ASSESSMENT</b>	
Presentation reviews: All group members are encouraged to deliver presentations. Students shall strive to gain maximum understanding from their project on various aspects by discussing the doubts/nitty-gritties they find during their project appraisals with the jury members Quality of presentation shall also carry weightage in the assessment process. Emphasis shall be on the learnings from the projects rather than documenting the existing drawings/data	
Individual Assignments: Individual contributions in the group work shall be taken into consideration while assessing the group work	
Studio work assessments: Each group shall be assessed by a jury of expert's basis presentations made by them on below given topics	

## BEM1.06: Quantitative Methods & Operations Research

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Internal Only	100	0	100	-

### Objective

The prerequisite for the application of project management principles is the fair understanding of quantitative methods. Therefore, input to the project management, relevant quantitative techniques are introduced to strengthen the quantitative

decision-making capability. The quantitative techniques learnt are further augmented by dissemination of various system analysis and operation research techniques, which would be used to determine the best course of action of a decision problem under the restriction of limited resources

### Course Content

- Quantitative techniques in management; Collection, analysis and presentation of data; Sampling techniques; Factor Analysis; Probability theories; Variance analysis; Regression analysis; Forecasting

techniques; Fuzzy set models; Control charts as monitoring tools;

- Quantitative approaches to optimise decision problems; Decision theories; Queuing theory; Linear programming; Inventory models; Replacement models; Goal programming; Game theory models; Simulation models; Transportation; Assignment problems; Genetic algorithm

<b>TEACHING LEARNING PROCESS</b>	<b>AIM</b>
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>ASSESSMENT</b> Class tests, Individual Assignments	

### BEM1.07: Research Methodology

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	Non-Credit	-	-	-	-	

#### Objective

The course is aimed to create an appropriate capability for the students to conduct academic research, the students are imparted knowledge of research methodology. The aim is also to equip students with skills to articulate the findings of their research in the form of seminar and thesis reports as well as research papers.

#### Course Content

- Research area identification; Research aim and objective definition; Hypothesis of research topic;
- Literature sourcing and search; Literature study; Referencing; Developing journal papers

- Formulation of methodology; Quantitative and Qualitative research; Field study planning;
- Data Collection; Planning sample surveys, Sample size determination, Survey data collection, Data types and structures, Population description, Ranking & Scoring; Field application and simulation models;
- Data Analysis and Results; Approach to analysis of survey data; Validity and Reliability analysis; Analysis and presentation of research results;
- Inferences and Validation, and derivation of conclusions; Compilation and drawing inferences; Research study validation through case studies; Discussion of findings of research; Conclusion of study and formulation of recommendations.

<b>TEACHING LEARNING PROCESS</b>	<b>AIM</b>
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Discussion of specific cases in the class to comprehend practice.

## FIRST YEAR: SEMESTER II

### BEM2.01: Structural Systems & Design Process

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	2	0	2	4	Written-Exam	100	100	200	3hrs

#### Objective

The objective of the course is to introduce the structural system concepts and design processes methodology in relation to architectural and services systems peculiarities of building projects. These concepts will help in the selection of the appropriate structural systems and the broader understanding of the design process and structural detailing aspects which are essential for the design management and construction management responsibilities. Planning, design emphasis would consider life cycle cost economics and sustainability issues.

#### Course Content

- Principles of structural analysis, design and detailing, static and dynamic loading concepts, concept of prescriptive versus performance-based design;
- Study of structural requirements of buildings, Basis of Design;
- Various structural systems for low-rise (including confined masonry), multi-

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff.  Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments, Studio work assessments	

- storeyed, tall and super tall buildings and their planning and design considerations including cost economics;
- Seismological studies, Landslide vulnerability; Earthquake and wind resistant design and detailing of buildings including codal provisions; Seismic-resistant architecture design; Technologies

- for seismic risk reduction; Technologies for hills and Himalayan region;
- Durability of structures, service life of structure;
- Structural fire safety;
- Special structure systems including large span structures, blast resistance;

- Computer aided structural analysis and design process;
- Constructability review and construction method statement;
- Assessment of distressed structures and forensics;
- Sustainable structure system design;
- Performance based design of structures;
- Analysis of special buildings (including tall and super tall);
- Co-ordination between structural systems and architectural and building services system

## BEM2.02: Project Cost and Contract Management

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	4	0	0	4	Written-Exam	100	100	200	3hrs

### Objective

The intent of the course is to disseminate knowledge about the application of project management processes during the pre-construction phase of a project life cycle. The competence is also aimed to be developed for efficient and effective decision making in each of the project management areas. The course is structured to research and develop understanding about the technology, material science components specifications for emerging building materials and technologies. Students are imparted awareness about legal issues vis-à-vis project specific responsibilities. The scope is limited to contracts for works.

### Course Content

- Cost management processes; Cost determination, management and control; Risk in cost; Life Cycle Cost analysis; Time-cost assessment; Estimation types, parametric and elemental methods of

estimation, preliminary cost estimations, cost indices, analysis of rates, analysis of material, labour and equipment component, rationale of contingencies, detailed estimation, schedule of rates, preparation of bills of quantities and justification documentation; Value engineering; Valuation for building projects, basic elements of land & building methods for Valuation methods including Income Capitalization Method, market analysis;

- Principles of change of scope and change management; Value management; cost estimation, contract management, billing; Change control, scope change control, cost control processes; Performance reporting and risk response; Project closing, administrative closure and contracts close out;
- Contract Management, Indian Contract Act, Study of 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 & evaluation negotiations, award of work, prequalification methods (rating/evaluation and enlisting of construction agencies), bid review & evaluation, methods of subcontracting; Contract close-out; Defect liability and performance guarantee; Undertaking works at Contractor's risk and cost;

- Impact of Master planning, building regulation, bylaws of local authorities, laws related to land development, Land acquisition, lease & easement rights, property acts, Urban Land Ceiling and Regulation Act, permits and clearance related to environment impact, urban form, fire regulation, completion certificate;

- 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; Premium determination and risk reduction;
- Disputes in construction contracts, alternative dispute resolution and dispute review mechanisms, Dispute Resolution Board proceedings, Arbitration and Conciliation Act 1996, Arbitration proceedings, arbitration award, termination proceedings, powers of arbitrator, setting aside of awards and enforcement of awards, appeal and revision and court proceedings, managerial approach to dispute minimisation;
- Study of emerging building materials, study of their composition, physical properties,

chemical properties, characteristics, durability, performance requirements, inspection and testing procedures, construction specifications and working details, study of performance, codes and standards; Nano material science;

- Construction Specifications, types of specifications (prescriptive and performance based), item nomenclature, formulation of specifications for special items;

- Site Management, organization of site operations, temporary structures, site management procedures and documentation; Health safety and environmental management; Safety procedures and management responsibilities; Principles, systems and Practices of safety Management, occupational health and hygiene in construction; Project Environmental management.

TEACHING LEARNING PROCESS	AIM
Lectures	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented ‘process assets’ of professionals and views expressed in literature
Presentations	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b>	
Class tests, Presentation reviews, Individual Assignments. Studio work assessments	

### BEM2.03: Project Cost and Contract Management Studio

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
6	0	0	6	6	Jury	100	100	200	-

#### Objective

The intent of the course is to augment the knowledge imparted through lectures by discussion of practical cases to determine practice, critically analyse application of

knowledge in professional context, experience simulated application procedure in a limited context. Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with

project technical staff and other stakeholders.

#### Course Content

- Specifications; Understand execution



process of building works; Frame scope of work for specification of item; Write specifications;

- Cost Management; Plinth Area Estimate; Arrive at volumes/areas/heights of the building projects; Calculations of Plinth Area; Detailed listing of work packages; Specification deviation statement; Calculation of cost index; Additional item rate calculations; Item nomenclature for civil and MEP works; Quantity surveying of projects; Analysis of rates;
- Contact Management; Conventional and emerging contracts types like CPWD, MES, FIDIC, AIA, NEC, JCT etc.; International contract types, and comparative analysis; Contract estimations; Bidding models and bidding strategies; Qualification of bidders; Suitability of contracts for various types of project; Roles and the responsibilities of stakeholders; Critical Appraisal of the Conditions of Contract; Comparison of the contract conditions; Determination of Special Conditions of Contract for projects; Tendering and contractual procedures; Indian Contract Act 1872; Contract

Administration; Delay protocol; Change order analysis; professional ethics;

- Value engineering in projects; Analysis of Function; Life Cycle Costing techniques; Value Engineering on Architectural Planning, Selection of Materials (green) for finishes, Selections of MEP System out of various alternatives;

- Risk and Scope Management; Claim management, resolving disputes, and compensation; Dispute and Resolution Techniques; Arbitration and Conciliation Act 1996; Arbitration Case Studies;
- Cost Benefit Analysis of Project (Review of Project feasibility).

TEACHING LEARNING PROCESS	AIM
<b>Presentations</b>	Studio exercises will be in the form of group work/and or individual assignments Each group shall have its own unique real life ongoing project for study. Groups are encouraged to have diverse projects so that peculiarities in specific projects are explored by entire class
<b>ASSESSMENT</b>	
Presentation reviews: All group members are encouraged to deliver presentations. Students shall strive to gain maximum understanding from their project on various aspects by discussing the doubts/nitty-gritties they find during their project appraisals with the jury members Quality of presentation shall also carry weightage in the assessment process. Emphasis shall be on the learnings from the projects rather than documenting the existing drawings/data	
Individual Assignments: Individual contributions in the group work shall be taken into consideration while assessing the group work	
Studio work assessments: Each group shall be assessed by a jury of experts basis presentations made by them on below given topics	

### BEM2.04: Project Seminar-I

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	0	0	4	4	Jury	100	100	200	-

### Objective

The Project Seminar provides an opportunity for the academic research. This knowledge is furthered by carrying pout Project Seminars aimed to provide students an opportunity 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 through an extensive literature study and data collection from the field. Project Seminars should help students in undertaking academic research independently.

to test their outcome proposals through various methods, including questionnaire surveys and case studies. It is encouraged that students identify topics for the seminar work which can be further developed into another Project Seminar research in the next semester for more in-depth research. Alternatively, This Project Seminar can be an independent research topic. Students must create an innovative insight on the specific issues.

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.

- Project Seminar work includes processes such as: Research area identification; hypothesis of research topic; literature sourcing and search; aim and objective definition; formulation of methodology;

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

### Course Content

- The state of art report prepared on the chosen topic and develop hypothesis to be tested through the research methodology designed for the purpose. A comprehensive seminar report is prepared with the identification of areas for further research and development. Students are required

<b>TEACHING LEARNING PROCESS</b>	<b>AIM</b>
<b>Research Seminars</b>	Undertaking research in specific topics, presenting literature studies, presenting analysis and making proposals for recommendations for application
<b>ASSESSMENT</b>	
Periodic review of academic research undertaken as Seminars	

## BEM2.05: Infrastructure Development and Management

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Written-Exam	50	50	100	2 hrs

### Objective

The intent of the course is to introduce students to basic concepts related to infrastructure

development with an aim for developing expertise in effective management of infrastructure challenges across the country. The focus is on

imparting knowledge and skills required for planning, management, and effective delivery of large-scale infrastructure projects.

### Course Content

- Overview of infrastructure sector; Introduction to infrastructure business; Study of various types of infrastructure; Evolution and growth of infrastructure; Models on infrastructure development; Government’s initiatives in infrastructure; Initiatives in 5-year plans;
- Infrastructure Policy & Regulation; Land procurement; Project clearances; Appraisal of techno-legal and regulatory aspects of infrastructure;
- Infrastructure Project Feasibility - Appraisal and Due Diligence; Life Cycle perspective of infrastructure; Social benefits of infrastructure development; Integrated impact assessment; Infrastructure project finance;
- Infrastructure procurement and Project Implementation approach - SPVs & PPPs;

Bidding systems; concession agreements, selection procedures of concessionaires; issues in financial closure, stakeholder management

- Infrastructure Project Finance Management; Financial Models; Infrastructure Project

planning and management; Strategic planning; Risk analysis techniques; Typical DPR Structures; Study case examples on different infrastructure types

- Environmental Impact Assessment; Case studies of infrastructure projects.

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented ‘process assets’ of professionals and views expressed in literature
<b>Case-studies</b>	Discussion of practical cases during is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b>	
Class tests, Presentation reviews, Term paper / Individual Assignments, Studio work assessments	

### BEM2.06: Building Energy Modelling

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Written-Exam	50	50	100	2 hrs

#### Objective

The course is aimed at providing fundamental knowledge of building sciences for the development of high-performance buildings utilizing energy modelling and simulation technology as an energy performance

analysis. The purpose is to equip students with skills and techniques to calculate the energy consumption of heating, cooling, lighting, and other equipment by hand to understand the energy & thermal behaviour of buildings, then compare and analyse these calculations with

others calculated using energy modelling and simulation programs.

#### Course Content

- Introduction to energy efficient buildings;

Building physics; Latent, specific heat gains in the building; Psychometric analysis; Weather analysis;

- Energy use in buildings; Energy Supply in Buildings: Heating, Ventilating, and Air-Conditioning (HVAC) Systems; Heating and cooling loads;
- Daylighting and artificial lighting analysis;
- Energy Performance Analysis: Energy

Codes, Guidelines, and Standards; Constructing energy simulation models: Thermal modelling, Models for ventilation,

Steady state and dynamic heat flow analysis; Evaluating models: Measurements, Comparisons and verifications.

TEACHING LEARNING PROCESS	AIM
Lectures	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
Case-studies	Discussion of specific cases in the class to comprehend practice.

## BEM2.07: Fire and Life Safety

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Written-Exam	50	50	100	2 hrs

### Objective

The course aims to provide advanced exposure to students about various aspects of fire safety science and engineering for building projects. Students should be able to determine and analyse the implication of fire safety beyond codes and standards.

### Details

- Heat Transfer and Thermo-fluids; Heat and Mass Transfer; Fluid Mechanics and Thermodynamics; Enclosure fires principles; Rate of heat release; T-square fires;
- Fire Dynamics; Fire Initiation, Flaming

and smouldering fires; Development, Suppression and Release of Toxic Products of Combustion; Enclosure fire development growth, flashover and decay;

- Structural Fire Engineering; Material Behaviour (steel, concrete, masonry, laminates, fabrics etc.); Fire Loads; Fire Structural Performance in Buildings; Compartmentation; Case studies of fire distressed buildings;
- Life Safety for Occupants; Human behaviour during fire; Mobility during egress; Occupant load; RSET and ASET determination; Egress time and capacity analysis; Exit, Exit Access, Exit Discharge building component requirements; Travel

distance, Common path of travel, Dead-end travel requirements; Staircase and refuge area capacity; Egress design in buildings;

- Compartmentation and passive fire safety; Fire and smoke performance of compartment barriers (including requirements of doors etc.);
- Smoke prevention and control; Smoke extraction system and smoke management; Pressure differential system and smoke extraction for egress; Effect of ventilation on tall buildings; Study of codes and standards; Fire Lifts;
- Building envelope fire performance; Effect of leaping flames;

- Active Fire Safety; Fire detection and alarm systems; Conventional and addressable alarm systems; Water based fire suppression systems (wet riser and down comers); Sprinklers, deluge and water curtains; Mist systems; Clean agent systems (CO2 flooding, Inert gas, Foaming agent, FM 200, NOVEC);
- Low Voltage Systems integration with fire system;
- Study of Codes and Standards;
- Fire safety evaluation / audit; IT tools for life and fire safety; Fire Safety Economics; Quantitative Fire Risk Assessment; Risk Perception; Deterministic and Probabilistic

approaches in calculating fire risk and quantify the impacts from fire;

- Computer modelling in fire engineering; Analysis Techniques; Simulation.

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Term paper / Individual Assignments, Studio work assessments	

## BEM2.08: Infrastructure Project Construction Management

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Internal Only	100	0	100	-

### Objective

The intent of the course is to introduce students to basic concepts related to infrastructure development with an aim for developing expertise in effective management of infrastructure challenges across the country. The focus is on imparting knowledge and skills required for planning, management, and effective delivery of large-scale infrastructure projects.

### Course Content

- Overview of infrastructure sector; Introduction to infrastructure business; Study of various types of infrastructure;
- Infrastructure Project Feasibility - Appraisal and Due Diligence; Life Cycle perspective of infrastructure; Project Implementation approach - SPVs & PPPs; Bidding systems;
- Infrastructure Project Management; Project planning and management; Strategic

planning; Risk analysis techniques; Typical DPR Structures;

- Time management; Cost management; Quality management; Scope management; Risk management; Integration management.

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Discussion of practical cases during is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Term paper / Individual Assignments, Studio work assessments	

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## SECOND YEAR: SEMESTER III

### BEM3.01: Project Procurement Management

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	4	0	0	4	Written-Exam	100	100	200	3 hrs.

#### Objective:

The intent is to disseminate knowledge about Procurement Management Processes with emphasis on consulting services. The procurement could also include design stage services. During the “Bid and Award Phase” of the project life cycle in different project types in terms of organizational settings, contractual arrangements and building typologies. In addition, the course covers the monitoring and control processes. The course includes procurement of equipment supplies.

The objective is also to define the job specification for a project management organisation and give guidance on the project manager’s role in various life cycle phases of a project with an aim to study various professional and national / international professional practices and codes to relate to the Indian context of profession. The course also includes application of quality management system in various situations on projects, including project procurement.

#### Course Content

- Project procurement management process; Study of procurement guidelines of international institutions (e.g. World Bank, ADB); Design & construction (EPC and other forms) of contracts; Preparation of contract documents (RFP, RFQ); Pre-qualification of contractors; Evaluation of technical and financial bid proposals; Negotiation and award; Overview of dispute resolution mechanisms (Alternate dispute resolution, DRBs; Arbitration procedures; issues related to contract administration, etc.)
- Contracts for procurement of professional services; Selection of professionals for professional services (Design, Project Management services); Fee structures and contractual conditions; Joint ventures of professional teams (including equity in construction organizations in EPC / design build contracts); Norms for engagements of international Consultants; Performance guarantees; Bank guarantees and other fiscal aspects;
- Project delivery systems (including PPP / Swiss Challenge, DBB, DB, EPC);

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented ‘process assets’ of professionals and views expressed in literature
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments, Studio work assessments	

- Procurement procedures for various supplies, equipment, machineries; Warrantees and tax issues; Inspections, testing and release of payments; Fiscal aspects of supplies;
- Material Management; Scope, Objective and function of material management; Material classification; Supply Chain Management; Procurement strategies and purchase procedures; Inventory control and management;
- Post construction management; Facilities management; Maintenance management; Asset management; Organisation structures and contractual aspects of maintenance management; Financial management of maintenance activities;
- Responsibilities of project management organisation; Procurement of Project Management services; Standard PMC consultancy agreement forms, fee structure; Code of professional practice; Issues of inter-disciplinary interaction and coordination and professional ethics.

### BEM3.02: Project Procurement Management Studio

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
6	0	0	6	6	Jury	100	100	200	-

#### Objective

The intent of the course is to augment the knowledge imparted through lectures by discussion of practical cases to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context. Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff and other stakeholders.

#### Course Content

- Contract Management; Familiarisation with National and International Contract Forms; Study and documentation contract forms in International bidding; Identifying key differences between various contract

TEACHING LEARNING PROCESS	AIM
<b>Presentations</b>	Studio exercises will be in the form of group work/and or individual assignments Each group shall have its own unique real-life ongoing project for study. Groups are encouraged to have diverse projects so that peculiarities in specific projects are explored by entire class
<b>ASSESSMENT</b>	
Presentation reviews: All group members are encouraged to deliver presentations. Students shall strive to gain maximum understanding from their project on various aspects by discussing the doubts/nitty-gritties they find during their project appraisals with the jury members Quality of presentation shall also carry weightage in the assessment process. Emphasis shall be on the learnings from the projects rather than documenting the existing drawings/data	
Individual Assignments: Individual contributions in the group work shall be taken into consideration while assessing the group work	
Studio work assessments: Each group shall be assessed by a jury of expert's basis presentations made by them on below given topics	



- forms; Risks in Contract Management for Project Manager;
- Bidding Documents/ NIT; Developing notice inviting tender; Selecting bidding methodology; Developing bidding documents for projects;
- RFP/RFQ for Professional Services; Conceptualization and deciding requirements of Services desired for a project; Developing Quotation for Professional Consulting Services; Preparing a request for proposal / request for quote for professional consulting services
- Preparation of equipment, plant and machinery plan; Develop detailed specifications based of project needs; Develop procurement documents for equipment, plant and machinery; RFP/RFQ and selection of suppliers;
- Construction Logic for pre-construction phase of projects; Identifying detailed activities, milestones based on Work Breakdown Structure;
- Code of Professional Practice and Ethics in Project Management; Models for procurement of Project Management service
- Quality Assurance Plans and Quality Control; Understanding evolution and significance of quality assurance plans and quality control mechanisms; Developing on the importance of Cost of Quality and Risks of Rework; Preparation of quality assurance plans for organizations and quality control checklists for various items of works; Developing control mechanisms for ensuring quality management within organizations and project sites.

### BEM3.03: Project Finance Management

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Internal Only	100	0	100	-

#### Objective

The objective of the course is to familiarise the fundamentals of financial management concepts and their applications in the various phases of the project cycle of construction projects. The course aims to provide a basic knowledge to carry out the financial feasibility of projects, evaluation of project investment decisions.

#### Course Content

- Finance Management; Time value of money;

Taxation; Depreciation, amortization and inflation; Capital budgeting techniques; Management of working capital; Cash flow forecasting and cash flow management of projects; Understanding and analysis of financial ratio; NPV, ROR, and IRR; time value of money; basis of comparisons; discounted cash-flow; Cost-benefit analysis; replacement analysis; break-even analysis; financial statement analysis; balance sheet; income statement; project-loss statements; profit after taxation

- Financial investment alternative models; comparative analysis; assessing financial health of projects; concept of capital budgeting and working capital management for projects, risks; risks and uncertainties in capital budgeting; budgetary controls; performance budgeting;
- National economic status and impact on construction; Financial accounting and budgeting; Forms of business organisation (including joint ventures, consortiums) International finance; Role of financial

institutions; Project financing norms and procedures of International financial institutions; Financial management of international projects;

- Financial Planning; preparation of financial feasibility report; project investment decisions; financial risk analysis;
- Practical problems; case studies, and application to projects.

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff. Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments, Studio work assessments	

### BEM3.04: Project Seminar-II

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
4	0	0	4	4	Jury	100	100	200	-

#### Objective

Carrying from the objectives of Project Seminar-I, the objective of Project Seminar-II is to further research on the chosen topics which could be in continuation with the earlier Project Seminar or different. Students are expected to come out with more specific findings and recommendations and better innovative solutions. This should lead to better performance in the Thesis to be undertaken in the fourth semester.

#### Course Content

- The state of art report prepared on the chosen topic and develop hypothesis to be tested through the research methodology designed for the purpose. A comprehensive seminar report is prepared with the identification of areas for further research and development. 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 seminar work which can be further developed into

a thesis work as well. Students must create an innovative insight on the specific issues.

- The state of art report prepared on the chosen topic and develop hypothesis to be tested through the research methodology designed for the purpose. A comprehensive seminar report is prepared with the identification of areas for further research and development. 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 seminar

work which can be further developed into another Project Seminar research in the next semester in Thesis for more in-depth research. Alternatively, This Project Seminar can be an independent research topic. Students must create an innovative insight on the specific issues.

- Project Seminar 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; 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 seminar work is presented and discussed by the student

periodically in the classroom environment and progress monitored continuously. The seminar work develops the comprehension and presentation skills of the students. The students are provided guidance from the faculty to channelize their thoughts.

<b>TEACHING LEARNING PROCESS</b>	<b>AIM</b>
<b>Research Seminars</b>	Undertaking research in specific topics, presenting literature studies, presenting analysis and making proposals for recommendations for application
<b>ASSESSMENT</b> Periodic review of academic research undertaken as Seminars	

### BEM3.05: Human Resource Management

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Written-Exam	50	50	100	2 hrs.

#### Objective

The course aims to develop competence to manage human resource and enhance its potential in the interest of individual of the organisation. A student is exposed to aspects concerning human performance and its capabilities that are inherent in a professional cognizant of his / her responsibilities towards organisation and the society. The course should help in developing the necessary skills and sensitivity towards working in teams and organizations.

<b>TEACHING LEARNING PROCESS</b>	<b>AIM</b>
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Term paper / Individual Assignments, Studio work assessments	

**Course Content**

- Concepts of organisational and individual behaviour; Perception and attitudes; Communication process and information management;
- Motivation concepts and processes;
- Group behaviour and teams; Leadership;

Conflict management

- Stress management.
- Nature of organisations; Organisational development; Principles of organisation structure;
- Human resource policies & practices; Selection, training and assessment;

Performance Appraisal; Training need assessment and dissemination of training; Post-training performance assessment.

- Philosophies of values, morals and ethics; Societal responsibilities and good citizenry. Good practices and managerial responsibilities.

**BEM3.06: Environmental Compliances and Management**

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Written-Exam	50	50	100	2 hrs.

**Objective**

The course aims to develop competence to understand the environmental compliances and management systems for buildings and infrastructure projects. A student is exposed to policies, standards, procedures, and various formats relating to environmental compliance requirements practically applicable for projects, and develops competence in their application. The course should help in developing the necessary skills and sensitivity towards sustainability of built-environment.

studies in India under CDM; COPs / United Nations Climate Change Conferences;

- Sustainable Development; Concept & elements of sustainable development; Carrying capacity concept and indicators of carrying capacity demonstrated examples; Ecological footprint concept, carbon footprint & sustainability, measures for footprint reduction, learning to use online calculators;
- Air & Noise Pollution Management; Air pollutants- indoor, outdoor; sources; nature; National Ambient Air Quality Standards & for Noise; Air pollution prediction modelling- concept, basic equation, fugitive dust modelling, line modelling, plume modelling, samples-GLC contour maps; Mitigating air pollution

in construction projects; Mitigating noise pollution in construction projects; Construction and demolition pollution control practices;

- Renewable Energy & Green belt designing; Alternate sources of power generation, renewable energy; Solar power- methods of generation, applicability, calculations; Green belt design concepts - choosing location, width and plants according to bio-indication, pollution tolerance and agro climatic zones;
- Water and waste water management; Assessment of water consumption and waste water generation for different types of buildings; Permissions for water withdrawal for infrastructure projects from Central Ground Water Authority/

**Course Content**

- International agreements agendas and protocols; Earth Summit at Rio, 1992 and subsequent developments, Agenda 21; UNFCCC; Copenhagen Accord; Montreal Protocol; Kyoto protocol- CDM, J.I.; Case

Board; Waste water treatment systems (definitions, processes, advantages and disadvantages)- A. conventional STPs, CETPs, B. various anaerobic treatment processes, and various aerobic treatment processes, C. non-conventional treatment processes, BOD, COD, water quality limits as per Schedule VI and classification of water as per CPCB; Water harvesting- rain water harvesting calculations, runoff coefficients, designing pits, trenches, recharge through abandoned well/ bore;

- Solid Waste Management; Solid waste generation assessment; Composition of solid waste and segregation; Solid waste handling & disposal; Recycling of solid waste- technologies & innovations; Conventional & modern solid waste treatment systems; Area required and methods of composting, vermi-composting; landfill location and features; Biogas plants;
- Statutory Acts, regulations & Notifications; Environment (Protection) Act 1986; Environment (Protection) Rule, 1986, as amended to date; NOC's and Authorities which grant NOCs; The Water (Prevention and control of Pollution) Act, 1974 as amended to date; The Air (Prevention and control of Pollution) Act, 1981 as amended to date; The Noise Pollution (Regulation and Control) Rules, 2000 as amended to date; General Standards for discharge of environmental pollutants; Restriction

in construction due to archaeological acts, airport authority; The Hazardous Wastes (Management, Handling and Transboundary Movement) rules, 2008, as amended to date; The bio medical waste (management & handling) rules, 1998, as amended to date; The municipal solid wastes (management and handling) rules, 2000, as amended to date; E-waste (management and handling) rules, 2012; The Batteries (management and handling) rules, 2001; Wetland Rule 2010; Coastal Regulation Zone (CRZ) Rules 2011, as amended to date; Clearance under Aravalli Notification; Clearance from Ridge Management Board; Clearance from National Board of Wildlife; Clearance from National Tiger Conservation Authority; Clearance from Taj Trapezium Zone (Prevent and Control) Authority; National Resettlement & Rehabilitation Policy; Corporate Social Responsibility under Companies Act 2013;

- Environmental Impact assessment- methods, procedures, legal framework of EIA; EIA Notification 2006, as amended to

date; Steps of environmental clearance (EC); Authorities jurisdictions to grant EC and their scope; Applicability of forest clearance; Formats- Form 1, 1 A; Understanding TOR; Understanding EIA; Generic structure of EIA; Baseline data generation- parameters and methods/ sources for climate, micro meteorology, air, water, noise, soil, drainage, topography, flora, fauna, socio economics, demography, industries, natural phenomenon;

- Case studies of EIA as relevant to construction projects; Case study and filling of Form 1 & 1A; Sources of information; Calculation for water consumption, waste water generation, water recycling, power consumption/ electrical loads, solid waste generation, rain water harvesting, map preparation; Impacts of new construction projects and mitigations measures to be followed; Consolidated Presentation of project;
- Environment Management System - ISO 14001; Scope and Implementation.

TEACHING LEARNING PROCESS	AIM
Lectures	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
Case-studies	Discussion of specific cases in the class to comprehend practice.

## BEM3.07: Real Estate Management

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Written-Exam	50	50	100	2 hrs.

### Objective

Intent of the course is to impart detailed knowledge of all aspects related to management of Real Estate projects to train the students as Real Estate Project Managers. Students are expected to comprehend interests of various stakeholders and build understanding to discharge appropriate functions.

### Course Content

- Real Estate Scope; Classification of real estate activities and peculiarities; Role, scope, working characteristics and principal functions of real estate participants and stakeholders;
- 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; Appraisal of Real Estate development projects; Real Estate financing; REIT
- Urban economics: Land as a factor of production, land rent, land use problems, location decisions
- Introduction to building economics; The

Economic context: Materials, Labour, Capital; Economic aspects of design decisions; The Initial Cost of Building Projects; Construction Cost; Financing Construction Projects.; The Future Performance of Buildings: Cost-In-Use; Life Cycle Cost; Benefits and Value of Buildings; Measures of Economic Performance; Techniques of Economic performance analysis for building projects;

- Functions of Real Estate development; Project formulation; Feasibility studies; Developing Costing and financing; Planning, scheduling and monitoring of real estate projects; Marketing/advertising; Risk management; Documentation in real

estate processes;

- Facilities and asset management; Role and responsibilities of property managers;
- Transaction management; Transfer of titles and title records; Real Estate appraisal and valuation;
- Real estate consultants and their activities; Types of agreements between the consultants and principal; Knowledge base for assessment and forecasting the Real Estate market; Real Estate investment, sources and related issues; Code of ethics for Real Estate participants; Environmental issues related to Real Estate transactions; Closing the Real Estate transactions.

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b>	
Class tests, Presentation reviews, Term paper / Individual Assignments, Studio work assessments	

## BEM3.08: Disaster Resilient Project Planning and Reconstruction

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Written-Exam	50	50	100	2 hrs.

### Objective

Intent of the course is to impart knowledge of identifying improved disaster resilience opportunities using project management opportunities. Students are expected to comprehend role of project management in attaining successful disaster planning and recovery and reconstruction.

recovery projects

- Governance and organisation of disaster planning and recovery; multiple stakeholder management and coordination; professionalism and ethics of disaster planning and reconstruction; disaster planning and reconstruction policies and

standards; innovative and participatory approach to disaster management

- Community safety and disaster resilience; predicting disasters, and appropriate response management
- Risk management in disaster planning and reconstruction; identification of risk.

### Course Content

- Role of Project Management in disaster planning and reconstruction projects;
- Methods, tools, processes, practices and knowledge areas used in managing disaster recovery and reconstruction;
- Case studies of management of large-scale disaster projects; experiences and lessons learnt; factors affecting success/failure of disaster planning and management; measurement of performance of disaster

TEACHING LEARNING PROCESS	AIM
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Term paper / Individual Assignments, Studio work assessments	

## BEM3.09: Quality Management System

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Internal Only	100	-	100	-

### Objective

The intent of the course is to give an insight into the concepts of Quality Management System and further develop applications relevant to planning, design & construction of buildings. The specific emphasis is to relate quality principles to design development, project management and construction activities.

### Course Content

- Quality concepts; Evolution of modern concept of Quality management process approach; Quality assurance & control.
- Concept and philosophy of TQM; Quality circle, Quality cost; Practical aspects of quality control of building projects. Good practices and managerial responsibilities; Human resource management for TQM; TQM system evaluation (NBQ Awards criteria)
- Introduction to concept of quality in building design, construction, project management; standard definition of quality; Deming’s principles; Concepts by Juran, Ishikawa, Crosby, Taguchi etc.; Organisation for quality management
- Product quality approach versus systems

quality approach, Problems of rework, wastage and compromise in product quality approach, Problems of inspections/ test-oriented approach in service quality.

- ISO 9000 Quality system standards (family discussion); applicability of ISO 9000 series standards world-wide, Elements of quality systems standards elements; Aspects of quality control & assurance of major building items; Contractual implications of quality systems.
- Quality Tools; SWOT analysis, Ishikawa

Diagram, Pareto Analysis, Statistical Quality Control, Brainstorming, Delphi Technique; Quality cost; Quality system and Total Quality Management philosophy as applied to building sector.

- Quality Function Deployment; Just in Time technique
- ISO 14000 series - Environmental Management System standards; ISO 14000 standards as applied to building projects; Environment impact assessment for environmental quality.

TEACHING LEARNING PROCESS	AIM
Lectures	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented ‘process assets’ of professionals and views expressed in literature
Case-studies	Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff and other stakeholders.  Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
Presentations	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments, Studio work assessments	

### BEM3.10: Audit Credit Training (8 weeks during summer vacations)

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
8 weeks	-	-	-	Non-Credit	-	-	-	-	-



## Course Content

- Practical Training of 8 weeks is to be carried out during the Summer Vacation after the

Second Semester. During Practical Training students are required to study various aspects, as discussed during preceding

semester course and submit a report on the following aspects:

A	General Information
	Name of student
	Placement of Training
	Duration of training
B	Nature of organizational enterprise ( <i>explain type of design, construction, PM activities the organizations involved</i> )
C	Organization structure and position of Trainee
D	Chronological list of responsibilities assigned to the Trainee
E	List of the Works done during training ( <i>enclose typical work outputs</i> )
F	Experiences and inferences drawn during Training
a.	Typical project work stages followed
b.	Time management process adopted
c.	Cost management process adopted
d.	Quality management process adopted
e.	Scope management process adopted
f.	HR management process adopted
g.	Communication systems, practices and management processes adopted
h.	Procurement management policies and processes adopted
i.	Health, safety, environment management processes adopted
j.	Risk management processes adopted
	Type of consultancy (architecture, PM, construction contract followed) ( <i>enclose typical documents</i> )
	Special features of the project / work ( <i>enclose documents to explain and highlight peculiarities</i> )
m.	Any other information

## SECOND YEAR: SEMESTER IV

### BEM4.01: Thesis

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
12	0	0	12	12	Jury	550	350	900	-

#### Objective

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 own choice.

#### Course Content

The subject for special study may be conceptual or practical but pertaining to Building Engineering and Management. This should however, offer scope to adopt a fresh approach in formulating a concept or developing a methodology effective and useful. Each student will prepare the Thesis under the guidance of a principal advisor with regular reviews by the faculty of the department. The Thesis will be presented in the accepted form of a thesis report duly supported by copious References, sketches, graphs, statistical data, details of survey if any, detailed account of experimental / analytical procedures adopted. Each student is required to defend his Thesis at a Viva Voce Examination by jury.

<ol style="list-style-type: none"> <li>1. Building Engineering</li> <li>2. Construction technology</li> <li>3. Structural systems</li> <li>4. Energy efficient building materials &amp; techniques</li> <li>5. Construction project management</li> <li>6. Time management</li> <li>7. Cost management</li> <li>8. Quality management</li> <li>9. Safety management</li> <li>10. Contract Administration</li> </ol>	<ol style="list-style-type: none"> <li>11. Design management</li> <li>12. Construction financial management</li> <li>13. Human resource management</li> <li>14. Quantitative techniques</li> <li>15. Energy management</li> <li>16. Building services</li> <li>17. Building management systems</li> <li>18. Infrastructure services</li> <li>19. Management information systems</li> <li>20. Project planning and feasibility</li> <li>21. Disaster management</li> </ol>
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TEACHING LEARNING PROCESS	AIM
Research Studies	Undertaking research in specific topics, presenting literature studies, presenting analysis and making proposals for recommendations for application
<b>ASSESSMENT</b> Periodic review of academic research	

## BEM4.02: Quality Management System

Hrs / Week	Lecture	Tutorial	Studio	Credits	External Exam Type	Marks			Duration of (Theory) Exam
						Internal Assessment	External Examination	Total	
2	2	0	0	2	Internal Only	100	0	100	-

### Objective:

The intent of the course is to give an insight into the concepts of Quality Management System and develop applications relevant to planning, design, construction and management of buildings projects. Quality management concepts, tools & techniques, codes and standards are studied to explore their appropriate application in practice. The emphasis is to relate quality principles to design development, project management and construction activities.

### Course Content

- Quality concepts and stakeholder concerns for building and construction; Evolution of modern concept of Quality management process approach; Quality assurance & control; Quality management system and ISO 9000 : 2000 requirements; Quality system standards for construction elements; Inspections & tests; Quality management tools; Environmental Management System Standards and their application in construction; EMS - QMS relationships; Concept and philosophy of TQM; Quality circle, Quality cost; Practical

aspects of quality control of building projects. Good practices and managerial responsibilities;

- Introduction to concept of quality in building design, construction, project management; standard definition of quality; Deming's principles; Concepts by Juran, Ishikawa, Crosby, Taguchi etc.; Special features of construction vs. manufacturing sector; Organisation for quality management;
- Design of tolerances; Quality standards and grading;
- Quality of building facilities and stakeholder's concerns, quality responsibilities and commitment of Architect, consultant, project managers and contractors;
- Product quality inspections 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;
- Evolution of modern concepts of quality management; quality system and quality control approaches; advantages of quality

systems approach; quality systems concepts for building design, construction and management activities; Quality systems standards of BS 5750/ QS 9000 series and their evolution;

- ISO 9000 Quality system standards (family discussion); applicability of ISO 9000 series standards world-wide, India and Indian Building sector; Elements of quality systems standards elements; Aspects of quality control & assurance of major building items like RCC, brickwork, woodwork, steelwork, flooring, finishing, internal water supply, sanitary electrical services, external services like roads, sewers et.; quality of maintenance works, checklists; Contractual implications of quality systems;
- Quality Tools; SWOT analysis, Ishikawa Diagram, Pareto Analysis, Statistical Quality Control, Brainstorming, Delphi Technique; Quality cost; Quality system and Total Quality Management philosophy as applied to building sector; Human resource management for TQM; Business Process Re-engineering; Benchmarking; Partnering; Quality Circles; Quality Function Deployment; Just in Time technique;

Six-Sigma; Analysis and design tools for management, including, Quality Function Deployment, Brain storming, Parametric Modelling);

- Process re-engineering; Constructability review;
- Quality management system performance evaluation (NBQ and other quality wards criteria);
- Integration of ISO 14000 series - Environmental Management System standards, ISO 18000 Occupation Health and Safety Assessment Series –standards as applied to building projects.

<b>TEACHING LEARNING PROCESS</b>	<b>AIM</b>
<b>Lectures</b>	For dissemination of theoretical concepts, development of knowledge, imparting inputs on consolidated repository experience, sharing documented 'process assets' of professionals and views expressed in literature
<b>Case-studies</b>	Live case studies are undertaken and various aspects of the course are taken up in the Studios. Emphasis is given to interaction with project technical staff and other stakeholders.  Discussion of practical cases during Studios is to determine practice, critically analyse application of knowledge in professional context, experience simulated application procedure in a limited context
<b>Presentations</b>	Study of individual topics of assignment from literature and field, present ideas, validate the same with objective discussion and articulate
<b>ASSESSMENT</b> Class tests, Presentation reviews, Individual Assignments, Studio work assessments	