

**SATHYABAMA UNIVERSITY**

**Jeppiaar Nagar, Old Mammallapuram Road, Sholinganallur, Chennai – 119.  
Tamil Nadu, India.**

**FACULTY OF ARCHITECTURE**

**Degree of Master of Architecture**

**M. Arch (Building Management) - Approved by COA**

**SYLLABUS.**

**4 SEMESTER PATTERN.**

# REGULATIONS – 2010

## Degree of Master of Architecture (Building Management).

(Four Semesters Degree Programme)

### 1. Eligibility for Admission:

- 1.1 The candidate with a minimum of 50 % marks in aggregate in a Bachelor of Architecture degree course or equivalent courses recognized by the Council of Architecture shall be admitted to the to the first semester of the four semester M.Arch(Building Management) Degree Programme.
- 1.2 The candidate with a minimum of 50 % marks in aggregate in a Bachelor in Civil Engineering degree course or equivalent courses recognized by a competent authority

### 2 Structure of the Programme

- 2.1 Every Programme will have a curriculum with syllabi consisting theory and practical such as:
  - (i) General core courses like Mathematics,
  - (ii) Core course of Building Services / Management.
  - (iii) Elective course for specialization in related fields.
  - (iv) Workshop practice, Computer Practice, laboratory Work, Industrial Training, Seminar Presentation, Project Work, Educational Tours, Camps etc.
- 2.2 Each semester curriculum shall normally have a blend of lecture course not exceeding 7 and practical course not exceeding 4.
- 2.3 The medium of instruction, examinations and project report will be English.

### 3. Duration of the Programme

A student is ordinarily expected to complete the M.Arch (Building Management) degree Programme in 4 semesters **but in any case not more than 8 consecutive semesters from the time of commencement of the course.** The Head of the Department shall ensure that every teacher imparts instruction as per the number of hours specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

### 4. Requirements for Completion of a Semester

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

- 4.1 He/She secures not less than 90% of overall attendance in that semester.
- 4.2 Candidates who do not have the requisite attendance for the semester **will not be permitted to write the University Exams.**

## 5. Examinations

The examinations shall ordinarily be conducted between October and December during the odd semesters and between March and May in the even semesters. The maximum marks for each theory and practical course (including the project work and Viva Voce examination in the seventh Semester) shall be 100 with the following breakup.

### (i) Theory Courses

Internal Assessment	:	20 Marks
University Exams	:	80 Marks

## 6. Passing requirements:

- (i) A candidate who secures not less than 50% of total marks prescribed for the course (For all courses including Theory, Practicals and Project work) with a minimum of 40 marks out of 80 in the University Theory Examinations shall be declared to have passed in the Examination.
- (ii) If a candidate fails to secure a Pass in a particular course, it is mandatory that he/she shall reappear for the examination in that course during the next semester when examination is conducted in that course. However the Internal Assessment marks obtained by the candidate in the first attempt shall be retained and considered valid for all subsequent attempts.

## 7. Eligibility for the Award of Degree

A student shall be declared to be eligible for the award of the M.Arch (Building Management) degree, provided the student has successfully completed the course requirements and has passed all the prescribed examinations in all the 4 semesters within the maximum period specified in clause 2.

## 8. Award of Credits and Grades:

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, Letter Grades each carrying will be awarded as per the range of total marks (out of 100) obtained by the candidate as given below:

### RANGE OF MARKS FOR GRADES

Range of Marks	Grade	Grade Points (GP)
90-100	A++	10
80-89	A+	9
70-79	B++	8
60-69	B+	7
50-59	C	6
00-49	F	0
ABSENT	W	0

### CUMULATIVE GRADE POINT AVERAGE CALCULATION

The **CGPA** calculation on a **10 scale** basis is used to describe the overall performance of a student in all courses from first semester to the last semester. **F** and **W** grades will be excluded for calculating GPA and CGPA.

$$\text{CGPA} = \frac{\sum_i C_i \text{GP}_i}{\sum_i C_i}$$

where $C_i$	-	Credits for the subject
$\text{GP}_i$	-	Grade Point for the subject
$\sum_i$	-	Sum of all subjects successfully cleared during all the semesters

#### 9. Classification of the Degree Awarded

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the semesters in his/her first appearance within a maximum period of 4 consecutive semesters after commencement of study securing a **CGPA not less than 9.0** shall be declared to have passed the examination in **First Class – Exemplary**. **Further, the break of study will not be counted for the purpose of classification of degree.**
2. A candidate who qualifies for the award of the Degree having passed the examination in 4 consecutive semesters after commencement of study, securing a **CGPA not less than 7.5** shall be declared to have passed the examination in **First Class with Distinction**. **Further, the break of study will not be counted for the purpose of classification of degree.**
3. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the semesters in his/her first appearance within a maximum period of 4 consecutive semesters after commencement of study securing a **CGPA not less than 6.0** shall be declared to have passed the examination in **First Class**. **Further, the break of study will not be counted for the purpose of classification of degree.**
4. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 4 semesters within a maximum period of 8 consecutive semesters after his/her commencement of study securing a CGPA not less than 5.0 shall be declared to have passed the examination in Second Class.
5. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification of degree
6. A candidate can apply for revaluation of his/her semester examination answer paper in a theory course, within 1 week from the declaration of results, on payment of a prescribed fee along with prescribed application to the Controller of Examinations through the Head of Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

**Final Degree is awarded based on the following :**

<b>CGPA <math>\geq</math> 9.0</b>	-	<b>First Class - Exemplary</b>
<b>CGPA <math>\geq</math> 7.50 &lt; 9.0</b>	-	<b>First Class with Distinction</b>
<b>CGPA <math>\geq</math> 6.00 &lt; 7.50</b>	-	<b>First Class</b>
<b>CGPA <math>\geq</math> 5.00 &lt; 6.00</b>	-	<b>Second Class</b>

**Minimum requirements for award of P.G Degree, a student should have obtained a minimum of 5.0 CGPA.**

10. **Discipline**

Every student is required to observe disciplined and decorous behaviour both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of the University. If a student indulges in malpractice in any of the University theory / practical examination, he/she shall be liable for punitive action as prescribed by the University from time to time.

10. **Revision of Regulations and Curriculum**

The University may from time to time revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

**SUBJECTS OF STUDY AND SCHEDULE OF EXAMINATIONS****FIRST SEMESTER**

Sub. code	Sub. Name	Hours			Credits	Sessional marks	Univ. Exam Marks	Total Marks	Min. for pass in Univ. Exam	Min. for pass in Subject	Exam Duration
		L	T	P							
SAR X 5001	<b>Theory</b> Project Management I	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X 5002	Building Services & Integration I	2	1	-	3	20	80	100	40	50	3 Hrs
SMTX 5004	Quantitative Techniques	3	-	-	3	20	80	100	40	50	3 Hrs
SAR X 5003	Advanced Building Materials & Construction Techniques	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X 5004	Contract Management	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X 6501	<b>Practical</b> <b>Project I</b> (Project Mgmt & Bldg Services )	-	-	15	8	200	-	200	-	100	-
	<b>Total</b>	11	4	15	23	300	400	700			

**SECOND SEMESTER**

Sub. code	Sub. Name	Hours			Credits	Sessional marks	Univ. Exam Marks	Total Marks	Min. for pass in Univ. Exam	Min. for pass in Subject	Exam Duration
		L	T	P							
SAR X 5005	<b>Theory</b> Project Management II	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X 5006	Building Services & Integration II	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X 5007	Resource Management I	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X 5008	Quality Management	2	1	-	3	20	80	100	40	50	3 Hrs
	Elective 1	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X 6502	<b>Practical</b> <b>Project II</b> (Quality Mgmt & Bldg Services)	-	-	16	8	200	-	200	-	100	-
	<b>Total</b>	10	4	16	22	300	400	700			

**THIRD SEMESTER**

Sub. code	Sub. Name	Hours			Credits	Sessional marks	Univ. Exam Marks	Total Marks	Min. for pass in Univ. Exam	Min. for pass in Subject	Exam Duration
		L	T	P							
SAR X5009	<b>Theory</b> Resource Management II	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X5010	Building Energy Analysis and Management	2	1	-	3	20	80	100	40	50	3 Hrs
	Elective 2	2	-	-	2	20	80	100	40	50	3 Hrs
	Elective 3	2	-	-	2	20	80	100	40	50	3 Hrs
	Elective 4	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X6503	<b>Practical</b> Dissertation	-	-	18	9	200	-	200	-	100	-
	Total	10	2	18	21	300	400	700			

**FOURTH SEMESTER**

Sub. code	Sub. Name	Hours			Credits	Sessional marks	Univ. Exam Marks	Total Marks	Min. for pass in Univ. Exam	Min. for pass in Subject	Exam Duration
		L	T	P							
SAR X5011	<b>Theory</b> Financial Management	2	1	-	3	20	80	100	40	50	3 Hrs
SAR X5012	Facilities Management	2	1	-	3	20	80	100	40	50	3 Hrs
SAR XPROJ	<b>Practical</b> Thesis	-	-	24	12	200	-	200	-	100	-
	Total	4	2	24	18	300	160	400			

**LIST OF ELECTIVE SUBJECTS**

Sub. code	Sub. Name	Hours			Credits	Sessional marks	Univ. Exam Marks	Total Marks	Min. for pass in Univ. Exam	Min. for pass in Subject	Exam Duration
		L	T	P							
SAR X5013	Maintenance and Rehabilitation Of Structures	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5014	Risk Management	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5015	Real Estate Management	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5016	Safety Management	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5017	Business strategies & Corporate Planning	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5018	Functional Efficiency of Buildings	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5019	Advanced Acoustics	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5020	Lighting Planning and Design	2	-	-	2	20	80	100	40	50	3 Hrs
SAR X5021	Research methodologies in architecture	2	-	-	2	20	80	100	40	50	3 Hrs

**DETAILED SYLLABUS****SEMESTER I**

SAR X 5001	PROJECT MANAGEMENT I	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48**

**UNIT I (12 Hours)**  
**PROJECT MANAGEMENT FRAMEWORK**

Introduction - Project management, Project management versus Traditional management Different forms of Project Management – Project Phases – Project Life Cycle – Project Management Process

**UNIT II (12 Hours)**  
**PROJECT PLANNING AND ORGANIZING**

Project Plan Development – Project Master Plan – Programming – Scheduling – Project Organization – Scope and Work Definition – Scope Definition, Planning & Control

**UNIT III (12 Hours)**  
**NETWORK TECHNIQUES**

Activity Definition, Sequencing, Duration estimating – Schedule Development, Control – Relevance of construction schedules -The critical path method - Calculations for critical path scheduling – Activity float and schedules - Resource oriented scheduling – Scheduling with resource constraints - Use of Advanced Scheduling Techniques-Scheduling with uncertain durations

**UNIT IV (12 Hours)**  
**PROJECT CONTROL**

Cost Estimating Process – Inputs, Tools & Techniques – Control Process – Internal & External Project Control – Cost Accounting System – Project Management Information System – Communication Planning – Information Distribution – Performance Reporting

**References**

1. Chitkara, K.K. " Construction Project Management Planning ", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenngam, " Project planning, Scheduling and Control in Construction: An Encyclopedia of Terms and Applications ", Wiley, New York, 1995
3. Chris Hendrickson and Tung Au, " Project Management for Construction - Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000
4. Willis., E.M., " Scheduling Construction projects ", John Wiley and Sons 1986
5. Halpin,D.W., " Financial and cost concepts for construction Management ", John Wiley and Sons, New York, 1985.
6. P.K. Joy "Total Project Management – The Indian Context" Macmillan India Limited 1998

**UNIVERSITY EXAM QUESTION PAPER PATTERN**  
**(To be distributed uniformly among all the units)**

**Max. Marks: 80****Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.  
 (8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)  
 (with problem oriented questions from Third & Fourth unit)



SAR X 5002	BUILDING SERVICES & INTEGRATION I	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48**

**UNIT I**

**(12 Hours)**

**WATER SUPPLY AND SEWAGE SYSTEMS**

**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 II**

**(12 Hours)**

**HVAC**

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 III**

**(12 Hours)**

**VERTICAL TRANSPORTATION:**

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 IV**

**(12 Hours)**

**SERVICE INTEGRATION**

Integration of services – water pump monitoring & control - Control of Computerized HVAC Systems - Direct Digital Control - chillers, pumps, BTU monitoring & control – IBMS system and its components – centralized control equipments – sub- station and field controllers – field sensors.

**References**

1. Frederick s. Merritt ,Jonathan t. Ricketts -Building design And construction Handbook
2. Fred hall And Roger greeno- Building Services Handbook Fourth edition
3. Handbook of Air Conditioning and Refrigeration <sup>2nd</sup> Ed, McGraw\_Hill
4. Krieder, JF - Handbook of Heating Ventilation and Air Conditioning [CRC Press 2001].

**UNIVERSITY EXAM QUESTION PAPER PATTERN**

**(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SMT X 5004	L	T	P	Credits	TOTAL
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	<b>QUANTITATIVE TECHNIQUES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>100</b>
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**Contact Hours: 48**

**UNIT I**

**(12 Hours)**

**PROBABILITY CONCEPTS & STANDARD DISTRIBUTION**

Probability - Conditional Probability - Bayes Theorem - Random variables - Moments - Moment Generating Function- Binomial – Poisson- Normal Distributions(Mean, Variance applications only)

**UNIT II**

**(12 Hours)**

**TESTING OF HYPOTHESIS AND DESIGN OF EXPERIMENTS**

Sampling Distribution - Test based on Normal,  $t$ , Chi-square and F-distributions. Completely Randomized Design - Randomized Block Design - Latin Square Design - ANOVA.

**UNIT III**

**(12 Hours)**

**OPERATIONS RESEARCH**

Introduction to OR - Linear Programming - Graphical and Simplex methods- Big M method - Two Phase method. Duality in LPP. Transportation and Assignment problems.

**UNIT IV**

**(12 Hours)**

**PRODUCTION MANAGEMENT**

Inventory control, EOQ, Quantity Discounts, Safety stock-Replacement Theory – Simulation Models-Quality Control.

**TEXT / REFERENCE BOOKS**

1. Freund.J.E and Miller.I, Probability and Statistics for Engineers, Prentice Hall India Ltd. 1994
2. Gupta.S.C ,Statistics. Himalaya Publisher, 1984
3. Taha.H.A., Operations Research - An Introduction, Prentice Hall of India Ltd. 1997
4. Panneerselvam, Operation Research, PHI,2002.
5. Gupta PK & Hira DS, Operations Research, S.Chand Publishers,2008

**UNIVERSITY EXAM QUESTION PAPER PATTERN  
(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X 5003	ADVANCED BUILDING MATERIALS AND CONSTRUCTION TECHNIQUES	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48****UNIT I****(12 Hours)****ADVANCED STRUCTURAL SYSTEMS**

Properties, Application, specification and standards(Indian and International)  
Shell structure, Domes, Space frames, shell barrel vault, folded plate, Tensile structure ad Pneumatic structure. Working Details and Case studies.

**UNIT II****(12 Hours)****GREEN BUILDING MATERIALS AND TECHNOLOGY**

Introduction, green building product and materials, product selection criteria.  
Concrete, Eco block, Insulated concrete forms(ISF), hydra form, prefabs/Structural insulating panels, Cellulose insulation, adobe, rammed earth, earth sheltered and recycled materials. Working Details and Case studies.

**UNIT III****(12 Hours)****BIO MATERIALS**

Properties, Application, specification and standards(Indian and International)  
Bio materials from Industrial waste, mining waste, mineral waste, agricultural waste. Working Details and Case studies.

**UNIT IV****(12 Hours)****NEW EMERGING MATERIALS**

Properties, Application, specification and standards(Indian and International)  
Teflon, special glasses, aluminum composite panel etc  
Nano technology applications in construction. Working Details and Case studies.

**References**

1. William P. Spence, Construction Materials, Methods, and Techniques
2. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery
3. Ross Spiegel, Dru Meadows , Green Building Materials: A Guide to Product Selection and Specification
4. Louise Jones, Environmentally Responsible Design: Green and Sustainable Design for Interior Designers
5. Sylvia Leydecker, Nano Materials: in Architecture, Interior Architecture and Design

**Web Site**

- [www.greenbuildingsmaterials.com](http://www.greenbuildingsmaterials.com)
- [www.lewisbamboo.com](http://www.lewisbamboo.com)
- [www.amazon.com/biomaterials](http://www.amazon.com/biomaterials)
- [www.answer.com/greenmaterials](http://www.answer.com/greenmaterials)
- [www.greenbuildingsolutions.org](http://www.greenbuildingsolutions.org)
- [www.nanotechweb.org](http://www.nanotechweb.org)

**UNIVERSITY EXAM QUESTION PAPER PATTERN**  
**(To be distributed uniformly among all the units)**

**Max. Marks: 80****Exam Duration: 3 hrs.****Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)  
(with minimum of 40% drafting questions)

SAR X 5004	CONTRACT MANAGEMENT	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48**

**UNIT I (12 Hours)**  
**CONTRACTS AND CONTRACT DOCUMENTS**

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 II (12 Hours)**  
**TENDERS**

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 III (12 Hours)**  
**DISPUTES AND ARBITRATION**

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 and revision and court proceedings.

**UNIT IV (12 Hours)**  
**LEGAL REQUIREMENTS**

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – 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

**References**

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982
2. Tamilnadu PWD Code, 1986
3. Jimmie Hinze, Construction Contracts, 2nd Edition, McGraw-Hill, 2001
4. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw-Hill, 2000
5. Kwaku a. Tenah. & Jose M Guevara., Fundamentals of construction Management and organization, Prentice Hall, Virginia.

**UNIVERSITY EXAM QUESTION PAPER PATTERN**  
**(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

<b>SAR X 6501</b>	<b>Project I</b> (Project Mgmt & Bldg Services )	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>TOTAL</b>
		-	-	15	8	200

**Contact Hours: 120**

The project aims to provide an opportunity for students to learn the process of applying project management techniques and efficient planning of building services in high rise 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, installation, commissioning and operation of new or existing buildings of all types. In the course of the project, students may be required to conduct measurements and undertake surveys. When required, students are expected to interact with the relevant parties or persons such as Architects, engineers, operation and maintenance staff or building occupants in a professional and ethical manner.

**SEMESTER II**

<b>SAR X 5005</b>	<b>PROJECT MANAGEMENT II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>TOTAL</b>
		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>100</b>

**Contact Hours: 48****Unit I****(12 Hours)****Project Portfolio Management**

Defining and Implementing Project -Portfolio Management - Bridging the Gap between Operations - Management and Projects Management - The Important Role of Project Portfolio -Management -Project Selection and Risk - Risk Management Is an Essential Part of Project -Portfolio Management

**Unit II****(12 Hours)****Project Communication and Documentation**

The Project Management Configuration Plan-A Documentation and Communication "Road Map" - Methods of Communicating -General Guidelines for Effective Communication -Conducting High-Quality Meetings -Communication Skills and the Project Manager -Key Project Documentation - Project Manager's Checklist.

**Unit III****(12 Hours)****An Approach to Comprehensive Planning for Complex Projects**

Project Definition –Objectives-Strategy-Technology and Design-External Factors, Finance, and Duration-Political, Environmental, and Economic Factors -Attitudes-Implementation-Organization-Contract Strategy-People Issues-Planning and Control-Strategic Issues for Enterprises Working on multiple Projects with thrust on high -rise constructions

**Unit IV****(12 Hours)****Project Closure**

Learning From Past Experience -Releasing People and Equipment -Recognizing and Rewarding People - Some Guidelines for Future Projects -Questions for Getting Started

**References**

1. Chitkara, K.K. " Construction Project Management Planning ", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenngam, " Project planning, Scheduling and Control in Construction: An Encyclopedia of Terms and Applications ", Wiley, New York, 1995
3. Chris Hendrickson and Tung Au, " Project Management for Construction - Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000
4. Willis., E.M., " Scheduling Construction projects ", John Wiley and Sons 1986
5. Halpin,D.W., " Financial and cost concepts for construction Management ", John Wiley and Sons, New York, 1985.
6. P.K. Joy "Total Project Management – The Indian Context" Macmillan India Limited 1998

**UNIVERSITY EXAM QUESTION PAPER PATTERN  
(To be distributed uniformly among all the units)**

**Max. Marks: 80****Exam Duration: 3 hrs.****Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

<b>SAR X 5006</b>	<b>BUILDING SERVICES &amp; INTEGRATION II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>TOTAL</b>
		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>100</b>

**Contact Hours: 48****UNIT I****(12 Hours)****ELECTRICAL SERVICES**

Electrical power – DC / Ac system, electrical load and emergency power – electrical conductors and race ways – electrical distribution in buildings – Substations – substation equipments – 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 - How to Select the Recommended Illuminance - Zonal Cavity Method of Calculating Illumination - Lamp Characteristics and Selection Guide - How Light Affects Color

**UNIT II****(12 Hours)****FIRE SAFETY**

Fire detection & Fire alarm systems – fire protections systems – study of codes and standards -

Telecommunications Structured Cabling Systems - Blown Optical Fiber Technology (BOFT) - SPRINKLER SYSTEMS - Automatic Sprinklers - System Design – Standpipes- Water Supplies for Sprinkler and Standpipe Systems - Central Station Supervisory Systems

**UNIT III****(12 Hours)****INFRASTRUCTURE SERVICES**

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.

**UNIT IV****(12 Hours)****SERVICE INTEGRATION**

Integration of services – Electrical – power monitoring – 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.

**References**

1. Frederick s. Merritt ,Jonathan t. Ricketts -Building design And construction Handbook
2. Fred hall And Roger greeno- Building Services Handbook Fourth edition
3. Barrie Rigby ,Design of Electrical Services for Buildings, 4th Edition
4. W. E. Steward ,T. A. Stubbs - Modern Wiring Practice Design and Installation Revised edition

**UNIVERSITY EXAM QUESTION PAPER PATTERN****(To be distributed uniformly among all the units)****Max. Marks: 80****Exam Duration: 3 hrs.****Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X 5007	RESOURCE MANAGEMENT I	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48**

**UNIT I (12 Hours)**

**CONSTRUCTION EQUIPMENT MANAGEMENT**

Identification – Planning - Equipment management in projects - Maintenance management – Replacement - Cost control of equipment-Depreciation Analysis - Safety Management

**UNIT II (12 Hours)**

**CONSTRUCTION MATERIAL MANAGEMENT**

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 (MMS) - Materials Management Systems

**UNIT III (12 Hours)**

**CONSTRUCTION EQUIPMENT & MATERIALS HANDLING EQUIPMENT**

Fundamentals of earthwork operations - Earth moving operations - Types of Earthwork Equipment - Tractors, Motor, Graders, Scrapers, Front end waders, Earth Movers.

Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting-Equipment for compaction-Erection Equipment-Types of pumps used in construction.

Equipment for Dewatering and Grouting-Foundation and Pile Driving Equipment Forklifts and Related Equipment -Portable Material Bins-Conveyors -Hauling Equipment

**UNIT IV (12 Hours)**

**MATERIAL AND EQUIPMENT PROCUREMENT**

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 - construction equipment - buying / leasing / hiring option - owner's tools and plants - equipment performance and selection - operation of equipment - maintenance - organize maintenance team -training - scheme for maintenance - monitoring and effectiveness of management - log book.

**References**

1. Peurifoy, R.L., Ledbetter, W.B.and Schexnayder, C., " 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. Deodhar, S.V. " Construction Equipment and Job Planning ", Khanna Publishers, New Delhi, 1988.
4. Dr. Mahesh Varma, " Construction Equipment and its Planning and Application ", Metro-politan Book Company, New Delhi-, 1983.
5. Journals such as Civil Engineering and Construction Review (CE&CR), New building materials and construction world (NBM & CW).
6. 'Materials of Construction' by Ghose, Tata- McGraw Hill Publication.
7. Handbook of Materials management - Gopalkrishnan, Prentice Hall Publication.
8. Materials Management - Dean Ammer.
9. CECR's (Construction Engineering Construction Reviews) manuals on machinery.
10. Management of Construction equipment - Frank Harris and Ronal Cafer (Macmillan Publication)

**UNIVERSITY EXAM QUESTION PAPER PATTERN**

**(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)



SAR X 5008	QUALITY MANAGEMENT	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48**

**UNIT I**

**(12 Hours)**

**QUALITY MANAGEMENT SYSTEMS**

Introduction – quality management systems – concepts and meaning – importance of quality management in construction projects – role of QMS in project management.

**UNIT II**

**(12 Hours)**

**QUALITY CONTROL**

Quality control operations – concepts – norms, techniques and procedures – quality and time – quality during building's life – quality control in concrete – services – maintenance .

**UNIT III**

**(12 Hours)**

**QUALITY ASSURANCE AND TRAINING**

MIS – information needs at different levels of project organization – organizational functions – types of information.

Training QMS – objective – requirement – programmes – workers and operators – typical training programmes.

**UNIT IV**

**(12 Hours)**

**QUALITY AUDIT AND TQM**

Quality Audit – organization – interface – quality circles.

TQM – Introduction – 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.

**References**

1. Igenhaum A.V., Total quality control, McGraw Hill , New York.
2. Kwaku a. Tenah. & Jose M Guevara., Fundamentals of construction Management and organization, Prentice Hall, Virginia.
3. Ferguson Ian & Mitchell Eric., Quality on site, B.T. Batsford Ltd., London.
4. Crosby Philip B., Quality is Free., McGraw Hill , New York.

**UNIVERSITY EXAM QUESTION PAPER PATTERN**

**(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

<b>SAR X 6502</b>	<b>Project II</b> (Quality Mgmt & Bldg Services )	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>TOTAL</b>
		-	-	<b>16</b>	<b>8</b>	<b>200</b>

**Contact Hours: 120**

The project aims to provide an opportunity for students to learn the process of applying Quality management techniques and efficient planning of building services in high rise 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 and building services respectively.

The focus shall be on an actual problem, in respect of design, installation, commissioning and operation of new or existing buildings of all types. In the course of the project, students may be required to conduct measurements and undertake surveys. When required, students are expected to interact with the relevant parties or persons such as Architects, engineers, operation and maintenance staff or building occupants in a professional and ethical manner.

**SEMESTER III**

<b>SAR X5009</b>	<b>RESOURCE MANAGEMENT II</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>TOTAL</b>
		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>100</b>

**Contact Hours: 48****UNIT I****(12 Hours)****HUMAN RESOURCE DEVELOPMENT**

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

**UNIT II****(12 Hours)****MANAGING PERSONNEL AND RELATIONS**

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 III****(12 Hours)****INDUSTRIAL RELATIONS AND LABOUR LAWS**

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 IV****(12 Hours)****SITE ORGANISATION**

Types of site organization – functional, divisional and matrix organization – organization chart – execution and monitoring

Mobilization of materials and equipment on site and management

Work completion and finalization - completion of work and closing of site – preparation of final bill – reconciliation of materials – plant and equipment utilization statement – list of defects – demobilization of resources – settlement of claim – extension of time – guidelines for site management.

**References**

1. Carleton Counter II and Jill Justice Coutler, The` Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989.
2. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1992.
3. Josy. J. Familiaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1987.
4. Pringle Charles, Management Longenecker Emerricle Publishing Company, 1981.
5. R.S. Dwivedi, Human Relations and Organisational Behaviour, BH – 1987.
6. Austen A D & Neale R H, Manging construction projects, Dialogue publication, 1985.

**UNIVERSITY EXAM QUESTION PAPER PATTERN****(To be distributed uniformly among all the units)****Max. Marks: 80****Exam Duration: 3 hrs.****Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X5010	BUILDING ENERGY ANALYSIS AND MANAGEMENT	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48**

**UNIT I (12 Hours)**  
**INTRODUCTION**

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 II (12 Hours)**  
**ENERGY AND BUILDING SERVICES**

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 III (12 Hours)**  
**INTEGRATED BUILDING SYSTEMS**

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 IV (12 Hours)**  
**BUILDING INFORMATION MODELING (BIM)**

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-.integrate people, systems, business structures and practices for maximizes efficiency through all phases of design, fabrication, construction and life cycle of the structure.

**References**

1. Rural Energy Management S Kaushik, T Verma Deep and Deep Publs.
2. Energy Management W R Murphy; G Mckay B.S. Publications
3. Renewable Energy and Energy Management S C Patra; B C Kurse; R Katak International Book Co.
4. Operations and Maintenance Manual for Energy Management.

**UNIVERSITY EXAM QUESTION PAPER PATTERN**  
**(To be distributed uniformly among all the units)**

**Max. Marks: 80****Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)  
(First & Second unit, 20% problem, 80% theory)

<b>SAR X6503</b>	<b>Dissertation</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>TOTAL</b>
		-	-	18	9	200

**Contact Hours: 150**

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 20 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.

**SEMESTER IV**

SAR X5011	FINANCIAL MANAGEMENT	L	T	P	Credits	TOTAL
		2	1	0	3	100

**Contact Hours: 48****UNIT I****(12 Hours)****PRINCIPLES OF FINANCIAL MANAGEMENT**

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 II****(12 Hours)****BUDGETING**

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 III****(12 Hours)****PROJECT FINANCE**

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.

**UNIT IV****(12 Hours)****CONSTRUCTION CLAIMS MANAGEMENT**

Construction claims - classification of claims - claim forms - disputes and arbitration - contractual remedies - court cases - management of escalation - price escalation provisions - general methodology - critical analysis.

**References**

1. Kuchhal. S.C., Financial Management, Chaitanya Publishing House, Allahabad.
2. Hillabrandt P.M., Economic Theory and construction industry, Macmillan, London.
3. Tompkins.B.G., Project cost control for managers, Jaico.
4. Kwaku a. Tenah. & Jose M Guevara., Fundamentals of construction Management and organization, Prentice Hall, Virginia.

**UNIVERSITY EXAM QUESTION PAPER PATTERN**  
**(To be distributed uniformly among all the units)**

**Max. Marks: 80****Exam Duration: 3 hrs.****Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

<b>SAR X5012</b>	<b>FACILITIES MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credits</b>	<b>TOTAL</b>
		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>100</b>

**Contact Hours: 48****Unit I****(12 Hours)****FUNDAMENTALS OF FACILITIES MANAGEMENT**

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 II****(12 Hours)****FACILITIES DESIGN AND SPACE PLANNING**

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 III****(12 Hours)****FACILITY PLANNING AND DECISION SUPPORT SYSTEM**

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

**Unit IV****(12 Hours)****FACILITY MANAGEMENT DURING CONSTRUCTION PHASE AND HANDOVER**

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.

**References**

1. David G. Cotts, Kathy O. Roper, The Facility Management Handbook
2. Bernard Lewis and Richard Payant, Facility Manager's Maintenance Handbook
3. Keith Alexander, Brian Atkin, Jan Bröchner, and Tore Haugen, Facilities Management: Innovation and Performance
4. Eric Teicholz, Facility Design and Management Handbook
5. Frank Booty, Facilities Management Handbook, Fourth Edition

**UNIVERSITY EXAM QUESTION PAPER PATTERN**  
**(To be distributed uniformly among all the units)**

**Max. Marks: 80****Exam Duration: 3 hrs.****Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR XPROJ	THESIS	L	T	P	Credits	TOTAL
		-	-	24	12	200

**Contact Hours: 210**

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.



**LIST OF ELECTIVES**

SAR X5013	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32****UNIT I****(8 Hours)****INFLUENCE ON SERVICEABILITY AND DURABILITY**

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 II****(8 Hours)****MAINTENANCE AND REPAIR STRATEGIES**

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

**UNIT III****(8 Hours)****MATERIALS AND TECHNIQUES FOR REPAIR**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro 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.

**UNIT IV****(8 Hours)****EXAMPLES OF REPAIR TO STRUCTURES**

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure. Engineered demolition techniques for Dilapidated structures - case studies

**References**

1. Denison Campbell, Alien and Harold Roper, " Concrete Structures ", Materials, Maintenance and Repair, Longman Scientific and Technical UK.
2. R.T.Alien and S.C.Edwards, " Repair of Concrete Structures ", Blahie and Sons, UK,.
3. M.S.Shetty, "Concrete Technology- Theory and Practice ", S.Chand and Company, New Delhi.

**UNIVERSITY EXAM QUESTION PAPER PATTERN****(To be distributed uniformly among all the units)****Max. Marks: 80****Exam Duration: 3 hrs.****Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.**(8 X 4 = 32 marks)****Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X5014	RISK MANAGEMENT	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32**

**UNIT I (8 Hours)**

**INTRODUCTION**

Definitions of risk - Elements of risk management - causes of risk.

**UNIT II (8 Hours)**

**RISK MANAGEMENT**

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 III (8 Hours)**

**IDENTIFICATION OF RISK**

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.

**UNIT IV (8 Hours)**

**RISK RESPONSE AND COMMUNICATION**

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.

**References**

1. PMP Project Management Professional Study Guide, Joseph Phillips, McGraw-Hill.
2. Bruce Barkley, Project Risk Management (Project Management).
3. John R. Schuyler, Risk and Decision Analysis in Projects (Cases in project and program management series).
4. Chris Chapman and Stephen Ward, Project Risk Management: Processes, Techniques and Insights.
5. Dale F. Cooper, Stephen Grey, Geoffrey Raymond, and Phil Walker, Project Risk Management Guidelines: Managing Risk in Large Projects and Complex Procurements.
6. William G. Ramroth, Risk Management for Design Professionals.
7. James B. Atkins and Grant A. Simpson, Managing Project Risk: Best Practices for Architects and Related Professionals.

**UNIVERSITY EXAM QUESTION PAPER PATTERN  
(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X5015	REAL ESTATE MANAGEMENT	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32**

**UNIT I**

**(8 Hours)**

**REAL ESTATE MARKET**

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 II**

**(8 Hours)**

**PARTICIPANTS AND STAKE HOLDERS**

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

**UNIT III**

**(8 Hours)**

**REAL ESTATE DEVELOPMENT**

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 IV**

**(8 Hours)**

**DOCUMENTATION**

Interests 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.

**References**

1. David M.M Geltner, Commercial real estate analysis and investments, South western educational & Professional.
2. John Ratcliffe, Urban planning and real estate, Taylor & Francis, Inc.
3. Mike E. Miles, Gayle Berens, and Mark Eppli , Real Estate Development: Principles and Process
4. Stephen P. Peca, Real Estate Development and Investment: A Comprehensive Approach

**UNIVERSITY EXAM QUESTION PAPER PATTERN**

**(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X5016	SAFETY MANAGEMENT	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32**

**UNIT I (8 Hours)**

**CONSTRUCTION ACCIDENTS**

Accidents and their causes-Human factors in construction safety-cost of construction injuries-Occupational and Safety hazard assessment-Legal implications

**UNIT II (8 Hours)**

**SAFETY PROGRAMMES**

Problem areas in construction safety-Elements of an Effective in safety programme -Job site Safety assessment safety meetings-safety incentives

**UNIT III (8 Hours)**

**CONTRACTUAL OBLIGATIONS**

Safety in construction contracts-Substance Abuse-Safety record keeping

**UNIT IV (8 Hours)**

**DESIGNING FOR SAFETY**

Safety culture-Safe workers-Safety and first line supervisors-Safety and Middle Managers-Top Management Practices, Company Activities and Safety-Safety Personnel-Sub contractual obligation-Project Coordination and Safety Procedures-Workers Compensation

**References**

1. Jimmy W.Hinze, "Construction Safety ", Prentice Hall Inc.
2. Richard J. Coble , Jimmie Hinze and Theo C. Haupt, " Construction Safety and Health Management ", Prentice Hall Inc..
3. Raymond Elliot Levitt and Nancy Morse Samelson, Construction Safety Management
4. Charles D. Reese, Occupational Health and Safety Management: A Practical Approach, Second Edition.
5. Tamilnadu Factory Act.

**UNIVERSITY EXAM QUESTION PAPER PATTERN  
(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X5017	BUSINESS STRATEGIES & CORPORATE PLANNING	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32**

**UNIT I (8 Hours)**

**BUSINESS AS A SOCIAL SYSTEM/ECONOMIC SYSTEM**

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 II (8 Hours)**

**BUSINESS POLICY IN VARIOUS ECONOMIC SYSTEMS**

Business ethics, Social responsibility of Business / Indian Businessmen, Social Audit, Capitalist Economy: Economic System of Socialism and mixed Economic system.

**UNIT III (8 Hours)**

**BUSINESS POLICY AND CORPORATE STRATEGY**

How to make policy corporate strategy: Policies: Strategies and Tactics: Policies and procedures - Functions and importance, strategy alternatives, considering strategy variations, Strategic choice, implementation.

**POLICY FORMULATION AND IMPLEMENTATION**

Policy Formulation: Objectives, Direction: Consideration of change: Business Policy concepts. Business Policy – Characteristics 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 IV (8 Hours)**

**MAJOR BUSINESS POLICIES**

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

**References**

1. Lawrance, Jauch and William Blucck Business Policy and Strategic Mgt., - McGraw Hill Intl
2. Mamoria and Mamoria – Business planning and Policy, Himalaya Publishing house
3. Budhiraja SB and Athreya MB, Cases in Strategic Management, Tata McGraw Hill
4. Christensen CR, Business Policy: Text and cases, Illinois, Richdar Irwin
5. Hitt, Strategic Management, competitiveness and Globalization, Thomson
6. David Fred, Strategic Management, Prentice Hall of India
7. R. Srinivasan, Strategic Management the Indian context, Prentice Hall of India

**UNIVERSITY EXAM QUESTION PAPER PATTERN**

**(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

SAR X5018	FUNCTIONAL EFFICIENCY OF BUILDINGS	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32**

**UNIT I (8 Hours)**  
**THERMAL BEHAVIOUR OF BUILDINGS**

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 II (8 Hours)**  
**PLANNING FOR VENTILATION**

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 III (8 Hours)**  
**DAYLIGHTING**

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

**UNIT IV (8 Hours)**  
**BUILDING AUTOMATION**

Introduction to building automation systems – components of BAS – HVAC – Lighting – electrical systems- water supply and sanitary systems – acoustics – fire safety – security -communication and office automation system – Concept of Intelligent buildings.

**References**

1. Otto Koenigsberger & others – Manual of Tropical Housing and Building, Longmans, London .
2. Martin Evans – Housing, Climate and Comfort. Architectural Press, London .
3. Climate Responsive Architecture – A design hand book for energy efficient buildings by Arvind Krishnan, Nick Baker, Simos Yannas, SV Szokolay.
4. Climatic Data Handbook – Eashwar Chand, Tata McGraw Hill.
5. Handbook of Functional Requirements of Buildings – Bureau of Indian Standards No.SP.41(SAT).
6. Concepts in Thermal Comfort – David Egan, Prentice Hall.
7. Climate considerations in building and Urban design – Baruch Givoni, John Wiley & Sons, New York.
8. Climatic Factors and Urban Space Design – Tirani L.
9. Intelligent Buildings – Ed.Brian Atkin, Kogan Page Limited, London.
10. The Intelligent Workplace – Carnegie Mellon University.

**UNIVERSITY EXAM QUESTION PAPER PATTERN**  
**(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

(First unit,80% theory & 20% problem, Second & Third Unit 60% theory & 40% problem)

SAR X5019	ADVANCED ACOUSTICS	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32**

**UNIT I**

**(8 Hours)**

**PRINCIPLES OF ARCHITECTURAL ACOUSTICS**

**Basic theory** – sound generation, hearing process, characteristics of sound, frequency & decibel ranges of audible sounds, inverse square law, loudness perception

**Room acoustics** – directivity contours for speech, reflection, refraction, diffusion, diffraction, small rooms, and sound reflectors, patterns of reverberant decay, articulation index, sound defects & preventive measures

**UNIT II**

**(8 Hours)**

**SOUND CONTROL**

**Indoor noise** – Absorption (sound absorbing treatment, sound absorption & noise reduction coefficient, prefabricated & suspended sound absorbing panels, reverberation time, facings, variable sound absorbers), redirection, insulation, transmission, isolation, impact noise, flanking of sound, leak, noise reduction methods, acoustic consideration in open plan offices, broadcasting studio, worship places.

**Outdoor noise** – Open air theatre, outdoor barriers for outdoor noise, orientation & self protecting forms of buildings

**UNIT III**

**(8 Hours)**

**AUDITORIUMS**

**Introduction** - Ancient theatres, basic theatre stages, performance types

**Design principles** - side wall , rear wall & ceiling treatment, basic sightlines, seating, stage house & backstage planning, orchestra pit & shell design, balconies & boxes, incorporating building codes, sound reinforcing systems

home theatres, digital media auditorium & auditorium for the future

**UNIT IV**

**(8 Hours)**

**MECHANICAL SYSTEM NOISE & VIBRATION**

**Pumps & motors** - Vibrations from mechanical equipment, 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

**References**

1. M. David Egan, Architectural Acoustics
2. William J. Cavanaugh, Gregory C. Tocci, Joseph A. Wilkes, Architectural Acoustics: Principles and Practice
3. Tor Erik Vigran , Building acoustics

**UNIVERSITY EXAM QUESTION PAPER PATTERN  
(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

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SAR X5020	LIGHTING PLANNING AND DESIGN	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32**

**UNIT I (8 Hours)**

**INTRODUCTION TO LIGHTING**

Photometric quantities, standards and measurements, colorimetric quantities and systems. Production and processing of photometric data.

Human and environmental factors, Visual and human factors, visual performance and its assessment. Lighting and comfort, glare. Importance of lighting in relation to health, safety and well-being. Non-visual effects of light. Lighting quality.

**UNIT II (8 Hours)**

**DAYLIGHTING**

Benefits of Daylighting, Daylighting availability, sky models, design techniques and calculations, daylight-linked control systems.

**UNIT III (8 Hours)**

**LIGHTING EQUIPMENT AND SYSTEMS**

Incandescent lamps, discharge lamps, fluorescent lamps, luminaries and control gear. Conventional and electronic ballasts. Lamp and ballast as a system. Lighting control systems. LEDs, Fibre optics, new light sources and emerging lighting systems.

**UNIT IV (8 Hours)**

**LIGHTING DESIGN**

Design objectives and criteria. Choices of lighting system, lamp and luminaries, Lighting calculations Integration of electric light and daylight, Energy conservation. Balance of performance, comfort and energy consumption Maintenance of lighting systems. Cost analysis. Lighting economics. Lighting energy codes and standards.

**References**

1. Coaton J.R. and Marsden - A.M. Lamps and Lighting, 4<sup>th</sup> Edition Arnold.
2. Advanced Lighting Controls:Energy Savings, Productivity, Technology and Applications Edited by Craig DiLouie
3. Gary Steffy – Architectural Lighting Design

**UNIVERSITY EXAM QUESTION PAPER PATTERN  
(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)

( Second & Fourth Unit 80% theory & 20% problem)



SARX 5021	RESEARCH METHODOLOGIES IN ARCHITECTURE	L	T	P	Credits	TOTAL
		2	-	-	2	100

**Contact Hours: 32  
(8 Hours)**

**UNIT I  
INTRODUCTION**

Basic research issues and concepts- orientation to research process- types of research: historical, qualitative, co-relational, experimental, simulation and modeling, logical argumentation, case study and mixed methods- illustration using research samples

**UNIT II  
RESEARCH PROCESS**

**(8 Hours)**

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 III  
RESEARCHING AND DATA COLLECTION**

**(8 Hours)**

Library and archives- Internet: New information and the role of internet; finding and evaluating sources- 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 IV  
REPORT WRITING & CASE STUDIES**

**(8 Hours)**

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

**References**

1. Wayne C Booth; Joseph M Williams; Gregory G. Colomb; The Craft of Research, 2nd Edition; Chicago guides to writing, editing and publishing;
2. Iain Borden and 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 Methods Approaches; Sage Publications; 2002

**UNIVERSITY EXAM QUESTION PAPER PATTERN  
(To be distributed uniformly among all the units)**

**Max. Marks: 80**

**Exam Duration: 3 hrs.**

**Part A:** 8 questions, 2 questions from each of the FOUR units of 4 mark each without choice.

(8 X 4 = 32 marks)

**Part B:** 4 questions from each of the FOUR units with internal choice of 12 marks each (4 X 12 = 48)