MEASI
Institute *of* Management

Hospital Planning AND Administration (534CE8B)

COURSE MATERIAL

VISION & MISSION STATEMENTS OF THE INSTITUTE

VISION

- To emerge as the most preferred Business School with Global recognition by producing most competent ethical managers, entrepreneurs and researchers through quality education.

MISSION

- **Knowledge through quality teaching learning process:** To enable the students to meet the challenges of the fast challenging global business environment through quality teaching learning process.
- **Managerial Competencies with Industry institute interface:** To impart conceptual and practical skills for meeting managerial competencies required in competitive environment with the help of effective industry institute interface.
- **Continuous Improvement with the state of art infrastructure facilities:** To aid the students in achieving their full potential by enhancing their learning experience with the state of art infrastructure and facilities.
- **Values and Ethics:** To inculcate value based education through professional ethics, human values and societal responsibilities.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1 – Placement: To equip the students with requisite knowledge skills and right attitude necessary to get placed as efficient managers in corporate companies.

PEO 2 – Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving and decision-making skill.

PEO 3 - Research and Development: To make sustained efforts for holistic development of the students by encouraging them towards research and development.

PEO4 - Contribution to Society: To produce proficient professionals with strong integrity to contribute to society.

Program Outcome

PO1 - Problem Solving Skill: Apply knowledge of management theories and practices to solve business problems.

PO2 - Decision Making Skill: Foster analytical and critical thinking abilities for data-based decision making.

PO3 - Ethical Value: Ability to develop value based leadership ability.

PO4 - Communication Skill: Ability to understand, analyze and communicate global, economic, legal and ethical aspects of business.

PO5 - Individual and Leadership Skill: Ability to lead themselves and others in the achievement of organizational goals, contributing effectively to a team environment.

PO6 - Employability Skill: Foster and enhance employability skills through subject knowledge.

PO7 - Entrepreneurial Skill: Equipped with skills and competencies to become an entrepreneur.

PO8 - Contribution to community: Succeed in career endeavors and contribute significantly to the community.

Program Specific Objectives

PSO 1: Finance: The students should demonstrate proficiency in analyzing financial statements, evaluating investment opportunities and making financial decision to maximize shareholders' value.

PSO 2: Marketing: Students should be able to create a comprehensive marketing plan that integrates effective communication strategies, leading to customer success and the accomplishment of marketing objectives.

PSO 3: Logistics: Students will acquire knowledge of inventory management for domestic and global supply chains, thereby developing problem-solving skills in logistics to optimize supply chain efficiency.

PSO 4: Business Analytics: The students should able to analyze data, communicate insights, take data-driven decisions and solve business problems effectively.

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Subject Code	Subject Name	Category	L	T	P	O	Credits	Inst. Hours	Marks		
									CIA	External	Total
534E8B	**Hospital Planning and Administration**	Elective	Y	-	-	-	3	3	25	75	100

Course Objectives	
C1	To make the students understand the concept of hospital administration.
C2	To provide insights on the location layout of hospitals.
C3	To highlight on effective analysis of hospital utilization.
C4	To throw light on critical, administration and service zone.
C5	To understand different standards maintained in hospital.

UNIT	Details	No. of Hours	Course Objectives
I	Hospital: Classification – Changing role of hospitals – Role of hospital administration – Hospital system – Need for scientific planning and design of hospitals.	9	C1
II	**Planning:** Principles of Planning – Planning process – Size of the hospital – Size selection – Location Layout – Hospital architect – Selection of architect – Equipping a hospital –.	9	C2
III	**Technical analysis:** assessment the extent need for the hospital services – Demand and need – Factors influencing hospital utilization – Bed planning – Project cost – Land requirements – Space requirements – hospital drawings and documents.	9	C3
IV	**Hospital Design:** Building requirement – Entrance and ambulatory zone – diagnostic zone – Intermediate zone – Critical zone – Service zone – Administrative zone.	9	C4
V	**Facilities Planning:** Transport – Food Services – Communication – Information System – Minor facilities – others. **Standard in Hospital:** General Standards – Voluntary and mandatory Standards – Mechanical Standards – Electrical Standards – Standard for centralized medical gas system – Biomedical waste handling.	9	C5
	Total	**45**	

Course Outcomes		
Course Outcomes	On completion of this course, students will;	**Program Outcomes**

CO1	Be able to understand the concept of hospital administration.	P01,P04
CO2	Have insights on the location layout of hospitals.	P02,P06
CO3	Know the effective analysis of hospital utilization.	P02,P05
CO4	Have knowledge on critical administration & service zone.	P01,P08
CO5	Understands the different standards maintained in hospitals.	P07,P08
Reading List		
1.	https://www.pdfdrive.com/hospital-planning-and-administration-e25041502.html	
2.	https://www.researchgate.net/publication/259389319_hospital_administration	
3.	https://www.vpmthane.org/adc/Uploads/Hospital_Admin.pdf	
4.	http://202.91.76.90:81/fdScript/RootOfEBooks/E%20Book%20Collection%202021%20-%20A/MANAGEMENT/OBM752%20-%20Hospital%20Management%20(Ripped%20from%20Amazon%20Kindle%20eBooks%20by%20Sai%20Seena).pdf	
Reference Books		
1.	Miller, M. K., 2006. Planning, Design, And Construction of Health Care Facilities, 1st ed., Joint Commission Resources.	
2.	Paradkar, R. A., 2008. Hospital and Clinical Pharmacy, 1st ed., Pragati Books Pvt.Ltd.	
3.	Ruggiero, S. J., 2008. Staffing patterns in hospital pharmacy; four case studies, 2nd ed., Duquesne University Press.	
4.	Schneider, J. M., 2010. Introduction to Public Health, 3rd ed., Jones and Bartlett Publishers, Inc.	
5.	Shi, L. & Singh, A. D., 2009. Delivering Health Care in America, 4th ed., Jones &Bartlett Publishers.	
Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	

Create (K6)	Check knowledge in specific or offbeat situations, Discussions, Debating or Presentations

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	M			S				
CO 2		M				S		
CO 3		M			S			
CO 4	M							S
CO 5							M	S

S-Strong 3 M-Medium2 L-Low

UNIT I:

Hospital Classification and Administration

1. Introduction to Hospitals

Hospitals are complex healthcare institutions that provide preventive, diagnostic, therapeutic, and rehabilitative services. They serve as the backbone of any healthcare system and are essential for providing comprehensive medical care to the population.

2. Classification of Hospitals

Hospitals can be classified using various criteria. Each classification system helps understand different aspects of hospital functioning and organization.

2.1 Classification by Ownership

- **Government Hospitals:** Owned and managed by government authorities. Provide subsidized care to the general public. Examples: District hospitals, Medical college hospitals, Primary Health Centers (PHCs).
- **Private Hospitals:** Owned by private individuals, organizations, or corporate entities. Operate on profit basis. Usually provide superior

amenities and advanced equipment. Cater to individuals who can afford private healthcare.

- **NGO/Trust Hospitals:** Run by Non-Governmental Organizations or charitable trusts. Operate on not-for-profit basis. Focus on providing affordable healthcare to economically weaker sections. Examples: Mission hospitals, Missionary hospitals.
- **Armed Forces Hospitals:** Exclusively serve military personnel and their families. Maintain military standards and discipline.

2.2 Classification by Specialty

- **General Hospitals:** Provide services across all major specialties. Handle cases related to medicine, surgery, obstetrics, pediatrics, and other common conditions. Serve as first point of referral.
- **Specialty Hospitals:** Focus on specific areas of medicine. Examples: Eye hospitals, ENT hospitals, Psychiatric hospitals, Orthopaedic hospitals, Chest hospitals (TB and respiratory diseases).
- **Super-specialty Hospitals:** Provide highly specialized services in multiple disciplines. Equipped with advanced diagnostic and treatment facilities. Handle complex and rare conditions requiring subspecialty expertise.

2.3 Classification by Level of Care

This classification represents the referral system and healthcare hierarchy:

Level	Institution Type	Services Provided
Primary	PHC, Sub-centers, Clinics	Preventive, Health education, Basic curative care

Level	Institution Type	Services Provided
Secondary	Community Health Center (CHC), District Hospital	Specialist services, Minor surgery, Obstetrics
Tertiary	Medical colleges, Teaching hospitals, Super-specialty centres	All specialties, Complex surgery, Research, Training

2.4 Classification by Bed Capacity

Category	Number of Beds	Typical Services
Small	Up to 100 beds	General outpatient, Limited in-patient, Basic facilities
Medium	100-500 beds	Full range of services, Multiple specialties
Large	500+ beds	Super-specialty, Teaching, Research facilities

2.5 Other Classification Systems

- **By Duration:** Acute care hospitals (short stay), Chronic care hospitals (long stay)
- **By Patient Admission:** Open hospitals (general public), Restricted hospitals (specific populations)

- **By Teaching Status:** Teaching hospitals (with medical schools), Non-teaching hospitals

3. Changing Role of Hospitals

Over the past century, the role and function of hospitals have evolved significantly in response to changing health needs, technological advances, and societal expectations.

3.1 Historical Evolution

1. **Custodial Care Era:** Hospitals primarily provided shelter and basic nursing care. Focus was on comfort rather than cure.
2. **Scientific Medicine Era:** Shift towards evidence-based treatment, development of diagnostic capabilities, and establishment of specialized units.
3. **Modern Comprehensive Era:** Integration of preventive, curative, and rehabilitative services with emphasis on community health.

3.2 Current Role and Functions

- **Preventive Services:** Immunization programs, Health education, Health screening camps, Disease prevention initiatives.
- **Diagnostic Services:** Laboratory testing, Imaging (X-ray, CT, MRI, Ultrasound), Pathology services, Specialized investigations.
- **Therapeutic Services:** Medical management, Surgical interventions, Emergency care, Critical care services.
- **Rehabilitative Services:** Physical therapy, Occupational therapy, Speech therapy, Vocational rehabilitation.
- **Palliative Care:** Pain management, Comfort care for terminal patients, Emotional and spiritual support.

- **Community Engagement:** Health education, Community outreach programs, Environmental health initiatives.

3.3 Contemporary Developments

- **Digital Health Integration:** Electronic Health Records (EHR), Telemedicine, Digital diagnostic platforms, Health information systems.
- **Patient-Centered Care:** Focus on patient satisfaction, Involvement in treatment decisions, personalized medicine approaches.
- **Quality and Safety:** Standardized protocols, Infection control measures, Patient safety programs, adverse event reporting.
- **Research and Innovation:** Clinical trials, Medical research, Development of new treatment modalities, Evidence generation.
- **Sustainability:** Green hospital initiatives, Resource optimization, Environmental responsibility, Social accountability.

4. Role of Hospital Administration

Hospital administration is the backbone of any healthcare institution. It involves planning, organizing, directing, and controlling various functions to ensure smooth and efficient hospital operations.

4.1 Key Administrative Functions

Strategic Planning and Policy

- Development of hospital mission, vision, and strategic goals
- Long-term planning and resource allocation
- Formulation of policies and standard operating procedures
- Compliance with regulatory requirements and guidelines

Financial Management

- Budget preparation and resource allocation
- Financial planning and cost control

- Audit and financial reporting
- Revenue generation and billing management
- Cost-benefit analysis of new projects

Human Resource Management

- Recruitment and selection of competent staff
- Staff development and training programs
- Performance management and appraisal
- Handling of employee relations and grievances
- Promotion of occupational health and safety

Quality Assurance and Accreditation

- Implementation of quality management systems
- Patient safety programs and error prevention
- Infection control and prevention
- Accreditation and certification (JCI, NABH)
- Regular monitoring and corrective actions

Infrastructure and Facility Management

- Building maintenance and repairs
- Equipment management and biomedical maintenance
- Utilities management (water, electricity, waste)
- Security and safety measures
- Environmental health management

Clinical Governance

- Ensuring evidence-based clinical practice
- Clinical audit and performance review
- Doctor-patient relations and grievance handling

- Research oversight and ethics

4.2 Organizational Structure

A typical hospital organization includes:

- Hospital Director/CEO: Overall responsibility and strategic leadership
- Medical Director: Oversight of clinical services and medical staff
- Administrator: Day-to-day operational management
- Heads of Departments: Specialty-based leadership
- Support Services: Finance, HR, Engineering, IT, Housekeeping

5. Hospital System

A hospital system refers to a coordinated network of healthcare institutions working together to provide comprehensive healthcare services to a defined population.

5.1 Components of Hospital System

- **Primary Health Centres (PHC):** First point of contact for health services, Preventive and basic curative care
- **Community Health Centres (CHC):** Secondary level care, Specialist consultation, Minor operative procedures
- **District Hospitals:** Tertiary level care, Major surgical services, Training facilities
- **Medical Colleges:** Teaching and research, Advanced specialty services, Human resource development
- **Super-specialty Centres:** Quaternary level care, Complex cases, Latest technology

5.2 Characteristics of Effective Hospital System

- **Integrated Services:** Seamless integration across different levels of care

- **Referral Networks:** Clear pathways for patient referral and counter-referral
- **Resource Sharing:** Efficient use of specialized equipment and expertise
- **Unified Information System:** Common health records and data management
- **Standardized Protocols:** Consistent clinical practices across institutions
- **Community Participation:** Engagement with local health needs and priorities

6. Need for Scientific Planning and Design of Hospitals

Scientific planning and systematic design of hospitals is essential to ensure optimal functionality, patient safety, quality care, and efficient resource utilization.

6.1 Reasons for Scientific Planning

- **Population Needs Assessment:** Data-driven understanding of disease burden and healthcare requirements
- **Resource Optimization:** Efficient allocation of financial, human, and material resources
- **Functional Efficiency:** Optimal workflow design reducing time waste and improving productivity
- **Patient Safety:** Prevention of errors, infection control, and emergency preparedness
- **Quality Care:** Adequate facilities and equipment for evidence-based practice
- **Cost-Effectiveness:** Minimum cost for maximum benefit
- **Flexibility and Adaptability:** Design allowing future expansion and technological upgrades
- **Sustainability:** Environmental responsibility and long-term viability

6.2 Components of Hospital Planning

Epidemiological Planning

- Analysis of disease patterns and health statistics
- Identification of priority health problems
- Determination of service requirements

Functional Planning

- Design of departments and functional areas
- Workflow analysis and optimization
- Specification of equipment and staffing

Spatial Planning

- Determination of land and building requirements
- Layout and zoning of different hospital areas
- Traffic flow and circulation design

Financial Planning

- Capital cost estimation
- Operating cost projection
- Financial sustainability analysis

6.3 Principles of Scientific Design

- **Evidence-Based Approach:** Use of research and best practices
- **Systems Thinking:** Understanding interconnections and holistic functioning
- **User-Centered Design:** Focus on patient and staff needs
- **Stakeholder Engagement:** Involvement of all relevant parties in planning
- **Iterative Process:** Continuous refinement based on feedback

- **Compliance with Standards:** Adherence to regulatory and best practice standards

UNIT-II

Hospital Planning

Introduction to Hospital Planning

Hospital planning is a critical and complex process that involves systematic assessment of healthcare needs, determination of appropriate services, and design of physical facilities to deliver those services efficiently. Proper planning ensures optimal utilization of resources, better patient care outcomes, and long-term sustainability of the institution.

1. Principles of Hospital Planning

The following fundamental principles guide effective hospital planning and ensure that the resulting institution meets the needs of the community it serves.

1.1 Principle of Accessibility

- The hospital should be located in a place easily accessible to the population served
- Proximity to major transportation networks (roads, railways, airports)
- Adequate parking and public transport facilities
- Safe and convenient access for patients with disabilities
- Central location within the service area to minimize travel time

1.2 Principle of Functionality

- Logical arrangement and workflow of different departments
- Minimal movement of patients, staff, and supplies

- Clear separation between clean and contaminated areas
- Efficient communication and information flow
- Easy access to emergency and critical care services

1.3 Principle of Safety

- Structural integrity and earthquake-resistant design
- Fire safety measures: sprinklers, alarms, emergency exits
- Infection control through proper isolation and ventilation
- Electrical safety and grounding systems
- Proper handling and storage of hazardous materials
- Safe and hygienic water supply and sewerage systems

1.4 Principle of Efficiency

- Optimal space utilization without wastage
- Reduced operating costs through smart design
- Operational efficiency in staffing and workflow
- Energy-efficient systems and sustainable practices
- Reduced waiting times and quick service delivery

1.5 Principle of Flexibility

- Design allowing for future expansion and modifications
- Adaptability to changing healthcare needs
- Capacity for technology upgrades
- Ability to add new departments without major restructuring
- Modular approach to departmental design

1.6 Principle of Economy

- Cost-effective construction materials and methods
- Minimum capital cost without compromising quality

- Lower operational and maintenance costs
- Resource sharing and consolidation
- Sustainability to ensure long-term viability

1.7 Additional Principles

- **Aesthetic Principle:** Pleasant environment promoting healing and staff morale
- **Sustainability Principle:** Environmental responsibility and green building practices
- **Community Engagement:** Responsiveness to local healthcare needs and expectations

2. Hospital Planning Process

Hospital planning is a systematic, phased approach that progresses from conceptualization to implementation. The process requires coordination between healthcare professionals, architects, engineers, administrators, and community representatives.

2.1 Phase 1: Situational Analysis and Needs Assessment

Objective: Understand the healthcare needs of the target population

- Demographic analysis: Population size, age structure, density, growth rate
- Epidemiological assessment: Disease patterns, mortality and morbidity data, health risks
- Socioeconomic analysis: Income levels, employment, educational status, affordability
- Existing healthcare infrastructure: Current facilities, capacity, gaps
- Community consultation: Views, expectations, and priorities of stakeholders

2.2 Phase 2: Conceptual Planning

Objective: Define the vision, mission, and strategic goals for the hospital

- Mission statement: Purpose and core values of the hospital
- Vision statement: Long-term aspirations and desired future state
- Goal setting: Broad objectives aligned with community needs
- Service strategy: Types of services to be offered (preventive, curative, rehabilitative)
- Stakeholder engagement: Consultation with government, community, professionals

2.3 Phase 3: Functional Master Planning

Objective: Determine operational requirements and spatial organization

- Service line definition: Detailed specification of all departments and services
- Bed capacity determination: Number and type of beds (general, ICU, HDU, isolation)
- Staffing requirements: Number and type of personnel needed
- Equipment specifications: Medical, surgical, and diagnostic equipment needed
- Space requirements: Area calculations for each department
- Workflow analysis: Patient and staff movement patterns
- Zoning: Organization of functional areas (diagnostic, therapeutic, administrative, support)

2.4 Phase 4: Design Development

Objective: Translate functional requirements into architectural and engineering designs

- Architectural design: Building layouts, floor plans, elevations, sections
- Structural design: Foundation, frame, and load-bearing systems
- MEP design: Mechanical (HVAC), Electrical, and Plumbing systems
- Medical gas systems: Oxygen, nitrous oxide, vacuum, compressed air distribution
- Safety systems: Fire protection, emergency lighting, evacuation routes
- Specification documents: Material, finishes, and quality standards

2.5 Phase 5: Documentation and Approval

Objective: Prepare detailed drawings, specifications, and obtain necessary approvals

- Preparation of detailed construction drawings
- Technical specifications for all systems
- Cost estimation and financial planning
- Regulatory compliance and approvals from authorities
- Environmental clearance if required
- Procurement and bidding documents

2.6 Phase 6: Implementation

Objective: Construct and equip the hospital according to approved plans

- Site preparation and foundation work
- Building construction and quality control
- Installation of MEP and medical gas systems
- Equipment procurement and installation
- Staff recruitment and training
- Establishment of standard operating procedures
- Testing and commissioning of all systems

2.7 Phase 7: Operational Management and Monitoring

Objective: Ensure smooth operations and continuous improvement

- Hospital opening and patient admission
- Performance monitoring and evaluation
- Patient and staff satisfaction assessment
- Quality assurance and accreditation
- Maintenance and equipment management
- Continuous improvement and feedback loops

3. Size of Hospital and Size Selection

3.1 Factors Determining Hospital Size

- **Population to be served:** Total population in the service area
- **Demographic structure:** Age distribution affects healthcare needs
- **Disease burden:** Prevalence of diseases in the population
- **Socioeconomic factors:** Income and ability to afford healthcare
- **Existing healthcare infrastructure:** Other hospitals and clinics in the area
- **Geographic area:** Rural vs. urban settings have different requirements
- **Economic viability:** Financial capacity to establish and run the hospital

3.2 WHO Guidelines for Hospital Bed Planning

The World Health Organization provides guidelines for estimating required hospital beds:

Level of Care	WHO Recommendation	Context
Primary Level	Limited/No beds	Mainly outpatient services
Secondary Level	0.5-1 bed per 1000 population	District and community hospitals
Tertiary Level	1-2 beds per 1000 population	Medical colleges, referral centers
Total (All levels)	1-2 beds per 1000 population	Overall healthcare system

3.3 Bed Capacity Calculation

Formula: Number of beds = (Annual admissions × Average length of stay) / 365 × 100 / Target occupancy rate

- **Annual admissions:** Expected number of patients per year
- **Average length of stay (ALOS):** Typically 3-5 days for general hospitals
- **Target occupancy rate:** Usually 75-85% for optimal functioning
- Example: For 10,000 annual admissions, 4-day ALOS, 80% occupancy: (10,000 × 4) / 365 × 100 / 80 = 137 beds

3.4 Distribution of Bed Capacity

- General wards: 50-60% of total beds
- Specialized wards (ICU, HDU): 10-15%
- Isolation/Quarantine: 5-10%
- Obstetric/Pediatric: Based on service demand

- Reserved/Emergency beds: 5-10% for surge capacity

4. Location and Layout

4.1 Site Selection Criteria

- **Central Location:** Accessible to majority of service population
- **Connectivity:** Good road network, public transport, proximity to highways
- **Land Area:** Adequate space (20-25 sq.m per bed) for buildings, parking, future expansion
- **Topography:** Level or gently sloping ground, avoiding flood-prone areas
- **Utilities Availability:** Water supply, electricity, sewerage connections
- **Environmental Factors:** Away from pollution, noise, industrial areas
- **Cost Feasibility:** Land acquisition cost and valuation
- **Regulatory Compliance:** Zoning laws, building codes, environmental regulations

4.2 Hospital Layout Principles

- **Zoning Approach:** Clear separation of diagnostic, therapeutic, administrative, and service zones
- **Traffic Segregation:** Separate routes for patients, staff, visitors, and supplies
- **Vertical Organization:** Multi-story construction to optimize land use
- **Compact Design:** Minimal walking distances between departments
- **Flexibility:** Modular design allowing easy reconfiguration
- **Natural Light:** Windows and skylights to reduce artificial lighting needs

4.3 Functional Zones

- **Entrance Zone:** Reception, registration, information desk, ambulance bay
- **Diagnostic Zone:** Radiology, laboratory, pathology, imaging centres

- **Therapeutic Zone:** Operation theatres, OPD, emergency department
- **Inpatient Zone:** Wards, ICU, HDU, isolation rooms
- **Administrative Zone:** Director's office, accounts, HR, medical records
- **Service Zone:** Kitchen, laundry, waste disposal, maintenance

5. Hospital Architect and Architect Selection

5.1 Role of Hospital Architect

- Translate functional requirements into built form
- Design patient-centered facilities that support clinical workflows
- Ensure compliance with building codes and healthcare standards
- Integrate advanced technology and sustainable design principles
- Balance functionality, aesthetics, and economy
- Coordinate with engineers, healthcare professionals, and stakeholders
- Manage project timelines and budget constraints
- Oversee construction quality and compliance

5.2 Qualifications of Hospital Architect

- Professional architecture degree and licensed/registered architect
- Specialized knowledge in healthcare facility design
- Understanding of healthcare workflows and operations
- Experience with building codes, safety standards, and regulations
- Knowledge of infection control and sterilization requirements
- Proficiency in 3D modelling and CAD software
- Project management and team coordination skills
- Knowledge of sustainable and green building practices

5.3 Architect Selection Process

1. **Define Requirements:** Prepare brief outlining hospital size, services, budget, timeline

2. **Issue RFQ/RFP:** Send Request for Quotation or Proposal to multiple firms
3. **Evaluate Credentials:** Review firm's experience, portfolio, qualifications, references
4. **Design Competition:** Request concept designs from shortlisted firms
5. **Presentations:** Evaluate and compare designs through presentations
6. **Negotiate:** Finalize scope, fees, timeline with selected architect
7. **Prepare Agreement:** Execute formal contract with clear deliverables and milestones

6. Equipping a Hospital

6.1 Equipment Planning Process

- Define services and specialties planned in the hospital
- Determine patient volume and case complexity
- List equipment requirements for each department
- Prioritize equipment based on criticality and urgency
- Estimate costs for purchase, installation, and maintenance
- Plan phased procurement to manage cash flow
- Ensure vendor support and training capabilities
- Plan warehouse and storage arrangements

6.2 Categories of Hospital Equipment

Medical Equipment

- Patient monitoring systems (ECG, BP, SpO2, etc.)
- Ventilators and respiratory support systems
- Infusion pumps and fluid management systems
- Anesthesia machines and delivery systems
- Defibrillators and cardiac support equipment

Diagnostic Equipment

- X-ray machines and radiographic equipment
- Ultrasound machines
- CT scanners
- MRI machines
- Laboratory analyzers (haematology, biochemistry, microbiology)
- ECG machines

Surgical Equipment

- Operating theatre tables and lights
- Surgical instruments and sets
- Diathermy machines
- Surgical suction and irrigation systems
- Laparoscopic equipment for minimally invasive surgery

Support Equipment

- Sterilization equipment (autoclaves, dry heat sterilizers)
- Wash machines and medical gas supply systems
- Patient transport equipment (stretchers, wheelchairs)
- Beds and mattresses
- Furniture for various departments

6.3 Equipment Procurement Guidelines

- **Quality Standards:** Ensure equipment meets international standards and certifications
- **Warranty and Service:** Comprehensive warranty and reliable after-sales service
- **Cost-Benefit Analysis:** Balance capital cost with durability and operational cost

- **Training Support:** Vendor must provide staff training on operation and maintenance
- **Spare Parts:** Availability of spare parts and consumables
- **Compatibility:** Equipment should be compatible with existing systems
- **Sustainability:** Energy-efficient equipment with environmental considerations

6.4 Equipment Management

- Create equipment register with specifications and purchase date
- Schedule preventive maintenance at regular intervals
- Train operators and biomedical staff on proper use and care
- Maintain service records and service contracts
- Monitor equipment performance and patient safety
- Plan for equipment replacement and upgrades
- Conduct periodic biomedical audits and inspections

UNIT III:

Technical Analysis

Introduction to Technical Analysis

Technical analysis is the scientific and systematic approach to assess healthcare needs, determine service requirements, calculate spatial needs, and estimate project costs. It bridges the gap between planning principles and actual implementation, providing data-driven evidence for all hospital development decisions.

1. Assessment of Healthcare Service Needs

This is the fundamental step in technical analysis, where the extent and nature of healthcare services required by the population are systematically determined.

1.1 Methods of Needs Assessment

Demographic Analysis

- Total population size in the service area
- Age distribution: percentage of children, adults, elderly
- Gender composition: male-female ratio
- Population density and growth rate
- Occupational pattern and migration trends

Epidemiological Assessment

- Disease patterns and prevalence in the community
- Mortality data: leading causes of death
- Morbidity data: disease incidence and prevalence
- Communicable disease burden (TB, malaria, dengue, etc.)
- Non-communicable disease burden (diabetes, hypertension, cancer, etc.)
- Maternal and child health indicators

- Nutritional status and micronutrient deficiencies
- Occupational health hazards

Socioeconomic Assessment

- Income levels and poverty indicators
- Employment patterns
- Educational status
- Housing and sanitation conditions
- Ability to pay for healthcare services
- Insurance coverage and health schemes

Healthcare Infrastructure Assessment

- Existing hospitals and clinics in the area
- Bed capacity and occupancy rates
- Services currently available
- Gaps in service provision
- Quality of existing services
- Adequacy of personnel and equipment

1.2 Data Sources for Needs Assessment

- Census data for demographic information
- National Health Surveys and Demographic Health Surveys
- Disease surveillance systems
- Hospital statistics and records
- Community health center reports
- Key informant interviews
- Focus group discussions
- Community surveys and questionnaires

2. Demand and Need

2.1 Definition and Distinction

Healthcare Need

Definition: The quantity and quality of healthcare services required based on epidemiological evidence and professional assessment of the population's health status.

- Objective determination based on disease burden
- Professional/expert judgment
- Often greater than what is actually demanded
- Example: Everyone with diabetes needs specialist care, but not all seek it

Healthcare Demand

Definition: The quantity and quality of healthcare services actually sought or requested by the population based on perceived health needs and ability to pay.

- Subjective - what people think they need
- Based on awareness, cultural beliefs, and affordability
- May be less than actual need due to ignorance or poverty
- Example: Many people with untreated hypertension are unaware of their condition

Aspect	Need	Demand
Basis	Epidemiological evidence	Patient perception and behaviour
Who Determines	Health professionals/experts	Patients/community

Aspect	Need	Demand
Magnitude	Usually fixed	Variable, influenced by services offered
Planning Focus	What services should be provided	How many beds/services are utilized

2.2 Bridging the Gap between Need and Demand

- Health education and awareness programs
- Improving accessibility and affordability
- Community engagement and trust building
- Subsidies or free services for vulnerable populations
- Outreach programs and screening camps

3. Factors Influencing Hospital Utilization

3.1 Demographic Factors

- **Age Structure:** Elderly population uses more hospital services
- **Gender:** Women use more outpatient services; males use more emergency services
- **Population Density:** Urban areas show higher hospital utilization

3.2 Epidemiological Factors

- **Disease Burden:** High prevalence of serious diseases increases hospital visits
- **Injury and Emergency Cases:** Accidents and trauma affect emergency department usage

- **Seasonal Variations:** Monsoon season increases water-borne diseases; winter affects respiratory conditions

3.3 Socioeconomic Factors

- **Income Level:** Higher income correlates with more hospital usage
- **Education:** Better educated people seek earlier and more adequate care
- **Insurance Coverage:** Availability of health insurance increases hospital utilization
- **Employment Type:** Formal sector workers have better healthcare access

3.4 Healthcare System Factors

- **Accessibility:** Distance, transportation, and travel time affect utilization
- **Availability of Services:** Presence of specialized services attracts more patients
- **Quality of Care:** Good reputation and quality outcomes increase usage
- **Cost of Services:** Affordability directly affects utilization rates
- **Bed Availability:** Limited beds reduce inpatient admissions
- **Staff Competency:** Availability of trained personnel enhances service delivery

3.5 Cultural and Behavioural Factors

- Health Beliefs: Traditional vs. modern medicine preferences
- Health Awareness: Knowledge about diseases and prevention
- Patient Behaviour: Preventive vs. curative approach
- Gender Roles: May affect healthcare-seeking behaviour

4. Bed Planning

4.1 Comprehensive Bed Planning Framework

- Define hospital services and specialties
- Assess current and projected patient demand
- Determine optimal bed capacity
- Distribute beds across departments
- Plan functional organization of beds

4.2 Bed Calculation Methods

Method 1: Population-Based

Formula: Number of beds = Population × Beds per 1000 population

- WHO recommendation: 1-2 beds per 1000 population
- Example: For 5 lakh population: 5,00,000 × 1.5 / 1000 = 750 beds

Method 2: Workload-Based

Formula: Number of beds = (Expected annual admissions × Average length of stay) / 365 / Occupancy rate

- Expected admissions: Based on outpatient attendance ratio
- Average length of stay: Typically 4-5 days for general, 2-3 days for acute
- Occupancy rate: Target 75-85% for efficient operations
- Example: 20,000 admissions, 4 days ALOS, 80% occupancy: (20,000 × 4)/(365 × 0.80) = 274 beds

Method 3: Specialty-Based

Plan individual department bed requirements based on:

- Specialty-specific admission rates
- Average length of stay for each specialty
- Historical data from similar hospitals

- Operational policies and guidelines

4.3 Distribution of Beds by Type

Ward Type	% of Total	ALOS	Purpose
General Wards	50-60%	4-5 days	Common cases
ICU/HDU	10-15%	2-4 days	Critical care
Isolation	5-10%	Variable	Infections
Obstetrics	5-10%	2-3 days	Maternity
Pediatric	5-10%	3-5 days	Children

4.4 Occupancy Rate

Formula: Occupancy rate = (Total patient-days in year / Available bed-days in year) × 100

- Optimal range: 75-85% for efficient functioning
- Below 75%: Indicates excess capacity or low demand
- Above 85%: May indicate overutilization and long waiting lists
- Example: 50,000 patient-days / (200 beds × 365 days) = 68.5% (below optimal)

5. Project Cost Estimation

5.1 Components of Project Cost

Capital Cost (One-Time)

- **Land Cost:** Acquisition of property
- **Construction Cost:** Building, civil works, finishing
- **Equipment Cost:** Medical, surgical, diagnostic equipment
- **Infrastructure:** Electrical, HVAC, plumbing, medical gas systems
- **Furniture & Fixtures:** Beds, chairs, tables, cabinets
- **Professional Fees:** Architect, engineer, consultant fees

Operational Cost (Recurring)

- Personnel costs: Salaries and benefits
- Utilities: Electricity, water, fuel
- Maintenance: Building, equipment repairs
- Consumables: Medical supplies, drugs, linen
- Services: Waste management, transport, catering
- Insurance and contingencies

5.2 Cost Estimation Methods

Method 1: Per Bed Cost

Formula: Total capital cost = Number of beds × Cost per bed

- India costs (varies by location and specifications):
- Small hospital: Rs. 10-20 lakhs per bed
- Medium hospital: Rs. 15-30 lakhs per bed
- Large hospital: Rs. 20-50 lakhs per bed

- Super-specialty: Rs. 40-100+ lakhs per bed

Method 2: Per Square Meter

Formula: Total cost = Building area (sq.m) × Cost per sq.m

- Typical rates: Rs. 5,000-15,000 per sq.m (varies by region)
- Example: 10,000 sq.m × Rs. 10,000 = Rs. 10 crore

Method 3: Detailed Estimation

Item-wise breakdown:

- Prepare quantity survey for all materials
- Apply unit rates for each item
- Add contingencies and overhead
- Include inflation projections

5.3 Cost-Benefit Analysis

- Compare benefits (lives saved, health improved) against costs
- Calculate Return on Investment (ROI) period
- Assess financial viability and break-even point
- Identify funding sources (government, private, donor, loan)

6. Land Requirements

6.1 Land Area Calculation

Formula: Total land area = Building area + Circulation + Parking + Future expansion

- General guideline: 20-25 sq.m of land per bed
- Example: 200 beds × 22.5 sq.m = 4,500 sq.m minimum land area

6.2 Land Composition

Component	% of Total Area	Details
Building Footprint	40-50%	Main structure
Parking	15-25%	Patient & staff
Circulation	10-15%	Roads, pathways
Green Space	5-10%	Garden, landscaping
Future Expansion	10-20%	Reserve land

7. Space Requirements

7.1 Building Area Calculation

Formula: Total building area = (Number of beds × Space per bed) + Departmental areas + Circulation + Mechanical

- General guideline: 6-8 sq.m per bed (total building area)
- Super-specialty: 10-15 sq.m per bed
- Example: 200 beds × 7 sq.m = 1,400 sq.m core area + 50% for circulation and services = 2,100 sq.m

7.2 Departmental Space Allocation

Department	Space (sq.m)	% of Total	Inclusions
Inpatient Wards	3-4 per bed	30-35%	Beds, nursing area
OPD	1.5-2	8-10%	Consultation rooms
Operation Theatre	60-80 per OT	8-12%	OT + Recovery
Laboratory	150-200	5-7%	Collection, testing
Radiology	200-300	5-8%	Imaging, control
Admin	200-300	5-8%	Offices, records
Support Services	500-1000	10-15%	Kitchen, laundry

8. Hospital Drawings and Documents

8.1 Architectural Drawings

- **Site Plan:** Shows location of building, parking, approach roads, utilities, green spaces
- **Floor Plans:** Detailed layout of each floor showing all departments, rooms, corridors, stairs, elevators

- **Elevations:** Front, rear, and side views showing building facade and heights
- **Sections:** Vertical cuts showing internal relationships and vertical circulation
- **Details:** Enlarged drawings of specific areas (wall junctions, doors, windows, stairs)

8.2 Engineering Drawings

- **Structural Drawings:** Foundation plans, RCC frame, floor slabs, columns
- **Electrical Drawings:** Power layout, lighting plan, emergency systems, backup generator
- **Mechanical Drawings:** HVAC layout, chiller rooms, ventilation systems
- **Plumbing Drawings:** Water supply, drainage, sewage system layout
- **Medical Gas System:** Oxygen, nitrous oxide, vacuum, compressed air distribution
- **Fire Safety:** Sprinkler system, fire alarm, emergency lighting, exit routes

8.3 Technical Specifications

- Material specifications for all building components
- Quality standards and testing requirements
- Equipment specifications and performance standards
- Installation and commissioning procedures
- Compliance with building codes and healthcare standards

8.4 Administrative Documents

- **Project Report:** Executive summary, justification, objectives

- **Feasibility Study:** Technical, financial, and social feasibility analysis
- **DPR (Detailed Project Report):** Comprehensive project documentation
- **Cost Estimate:** Itemized cost breakdown
- **Bill of Quantities (BOQ):** Detailed quantity and cost of all items
- **Tender Documents:** Instructions to bidders, evaluation criteria
- **Approval Letters:** From environmental, structural, electrical authorities

8.5 Operational Documents

- Standard Operating Procedures (SOPs): Clinical and administrative protocols
- Safety Manual: Emergency procedures, disaster management
- Equipment Manuals: Operation, maintenance, troubleshooting
- Staff Handbook: Policies, duties, responsibilities
- Maintenance Schedule: Preventive maintenance timelines

UNIT IV: Hospital Design

Introduction to Hospital Design

Hospital design is the art and science of creating functional, efficient, safe, and patient-centered healthcare facilities. It encompasses architectural planning, engineering systems, and operational workflows to create an environment that supports quality patient care while optimizing staff efficiency. Hospital design follows a zoning approach that segregates different functions into distinct zones.

1. Building Requirements for Hospitals

Hospitals must meet stringent building requirements to ensure safety, functionality, and compliance with healthcare standards. These requirements encompass structural, safety, and operational aspects.

1.1 Structural Requirements

- **Seismic Design:** Hospital buildings must be earthquake-resistant as per local seismic codes
- **Foundation:** Adequate depth and design to support multi-story structure with equipment loads
- **Structural Integrity:** RCC or steel frame construction with proper load distribution
- **Floor Specifications:** Non-slip, durable, easy to clean surfaces; sufficient loading capacity
- **Ceiling Heights:** Minimum 3.5m for wards, 4m for operation theatres, allowing for MEP systems
- **Load Capacity:** Floors must support heavy medical equipment (CT scanner: 2-3 tons, MRI: 10+ tons)

1.2 Fire Safety Requirements

- Fire Rating: Walls and doors must have 2-4 hour fire resistance rating
- Emergency Exits: Multiple stairways; minimum one staircase per 2500 sq.m
- Fire Detection: Smoke detectors, fire alarms, and automatic alert systems
- Sprinkler Systems: Automatic water sprinkler in all areas
- Emergency Lighting: Battery-backed lighting on exit routes
- Fire Extinguishers: Different types (dry powder, CO2, water) at strategic locations
- Evacuation Plan: Clear signage and practiced evacuation procedures

1.3 Infection Control Requirements

- Surface Specifications: Washable, non-porous, easy to disinfect materials
- Ventilation: Proper air changes per hour (ACH) - 12-15 for OT, 6-8 for wards
- Isolation Facilities: Separate rooms with negative pressure for infectious diseases
- Water Supply: Clean water system with separate hot water supply
- Sewage System: Proper waste water treatment and disposal
- Hand washing: Adequate wash basins with running water and soap dispensers
- Biomedical Waste: Designated areas for segregation and treatment

1.4 Electrical Safety Requirements

- Backup Power: Diesel generator and UPS for uninterrupted power supply
- Grounding: Proper earthing systems to prevent electrical hazards
- Distribution: Separate circuits for critical loads (ICU, OT) and regular loads

- Lighting: Sufficient illumination levels in all areas (100 lux minimum, 500 lux for OT)
- Equipment Protection: Surge protectors and stabilizers for sensitive equipment

1.5 Safety and Accessibility Requirements

- Disability Access: Ramps, elevators, accessible washrooms for disabled patients
- Corridor Width: Minimum 2m for patient movement, 2.5m for stretcher passage
- Handrails: On all corridors and stairs for patient safety
- Door Specifications: Wide doors (1.2m minimum) for stretcher passage
- Signage: Clear directional signs, emergency symbols, color-coded zones
- Flooring: Non-slip surfaces to prevent falls

2. Entrance and Ambulatory Zone

The entrance and ambulatory zone is the first point of contact for patients and visitors. It sets the tone for the hospital experience and must be welcoming, well-organized, and efficient.

2.1 Main Entrance Design

- Location: Prominently placed, easily visible from main road
- Covered Area: Weather protection; minimum 15m × 10m vestibule
- Signage: Large, clear signage in local language and English
- Landscape: Attractive landscaping, water features, seating areas
- Accessibility: Wheelchair ramps, handrails, accessible doors
- Security: Entry gates, visitor passes, security personnel

2.2 Reception Area

- Location: Immediately after entrance, visible and accessible

- Counters: 3-4 reception counters for 200-bed hospital; comfortable standing height
- Seating: 20-30 seats for waiting visitors
- Information Board: Directory of departments, doctor schedules, charges
- Staff: Trained receptionists, multilingual support
- System: Electronic token/appointment management system
- Facilities: Public toilet, drinking water, phone booth

2.3 Triage and Waiting Area

- Triage: Screening station for patient vital signs and urgency assessment
- Waiting: Adequate, comfortable seating; adequate ventilation
- Capacity: 40-60 seats for typical ambulatory service
- Entertainment: Television, reading material, children's play area
- Digital Displays: Patient information, queue management, fees display

2.4 Outpatient Department (OPD)

- Consultation Rooms: 15-20 rooms for 200-bed general hospital
- Room Size: Minimum 20 sq.m including examination table and doctor's desk
- Fixtures: Examination table, sink, cupboard, comfortable seating
- Privacy: Sound-proof walls, door locking system
- Specialty Clinics: Separate areas for cardiology, pediatrics, gynaecology, etc.
- Nursing Station: Central area for nurse supervision and supplies
- Records Area: Secure storage of patient medical records

2.5 Emergency Department (ED)

- Entrance: Separate entrance with ambulance access, ample space
- Triage: Quick assessment area with vital sign monitoring

- Resuscitation Bays: 2-3 bays with full life support equipment
- Treatment Cubicles: 4-6 cubicles for minor injuries and stabilization
- Observation Ward: 6-8 beds for post-stabilization observation
- Waiting Area: Separate for relatives; TV, seating
- Support Services: X-ray, ECG, laboratory facilities nearby
- Staff Area: Lounge, lockers, washroom for ED personnel

2.6 Parking and Drop-Off Facilities

- Parking Spaces: 1 space per 3-4 beds; separate areas for visitors and staff
- Surface: Paved, well-lit, organized with clear markings
- Disabled Parking: Accessible spaces near entrance with ramp
- Ambulance Bay: 30m × 15m drop-off area with shelter
- Security: Parking attendant, CCTV surveillance

3. Diagnostic Zone

The diagnostic zone houses specialized services for investigation and disease detection. It requires specialized infrastructure, skilled personnel, and strict quality control.

3.1 Radiology Department

- Location: Separate zone away from ward areas; lead-lined walls for safety
- X-ray Room: 30-40 sq.m with lead shielding, control room, dressing room
- Ultrasound: 15-20 sq.m; darkened room, comfortable positioning
- CT Scanner: 40-50 sq.m; special flooring to support 2-3 ton equipment
- MRI: 50-60 sq.m; RF-shielded room, no ferrous material inside
- Consultation Room: For radiologist to review and report
- Filing and Archive: PACS (Picture Archiving and Communication System)

3.2 Clinical Laboratory

- Collection Area: Comfortable seating (8-10 chairs), hand wash, privacy partitions
- Processing Area: Refrigerated centrifuge, sample preparation
- Testing Area: Separate sections for haematology, biochemistry, microbiology
- Quality Control: Calibration area, reference material storage
- Biosafety Cabinet: For handling infectious samples
- Office: Report generation and result communication

3.3 Pathology Department

- Specimen Reception: Labelled, logged with bar coding
- Tissue Processing: Formalin fume hood, tissue processor
- Histology Lab: Embedding, cutting, staining microscopes
- Examination Room: Pathologist office with microscope
- Waste Management: Sharps container, biohazard disposal

3.4 Other Diagnostic Services

- ECG Room: Comfortable couch, privacy, quiet environment
- EEG: Dark, sound-proof room; electrode preparation area
- Endoscopy: Procedure room with camera, suction, light source
- Pulmonary Function: Spirometry equipment in controlled environment

4. Intermediate Zone (Inpatient Wards)

The intermediate zone houses stable patients requiring continued hospitalization for treatment and nursing care. It comprises general wards, specialty wards, and intermediate care facilities.

4.1 General Ward Design

- Location: Mid-floors preferred; accessible to diagnostic and therapeutic zones
- Ward Size: 20-25 beds per ward; range from 2-6 bed units
- Bed Area: 3-4 sq.m per bed including space around bed
- Room Types: Single (private), 2-bed, 4-bed, 6-bed configurations
- Bed Design: Adjustable height, side rails, comfortable mattress
- Windows: Ample natural light, opening for fresh air; therapeutic view
- Privacy: Curtains between beds; private toilet for privacy wards
- Storage: Locker for patient belongings, shelf space

4.2 Nursing Station

- Location: Central, visible to all beds; easy access
- Area: 30-40 sq.m for 20-25 bed ward
- Counter: Documentation area, medication cart
- Storage: Medicine cabinet (locked), supply shelf
- Technology: Computer for medical records, call bell system
- Monitoring: Cardiac monitors, vital sign display

4.3 Utility Rooms

- Pantry: 15-20 sq.m; tea, coffee, light food preparation
- Linen Store: Clean linen storage; bed changes daily
- Soiled Linen: Separate collection for contaminated materials
- Equipment Store: Spare oxygen cylinders, suction equipment
- Waste Bin: Segregated waste disposal area
- Cleaning Materials: Disinfectants, mops, brooms

4.4 Specialty Wards

- Pediatric Ward: Colourful, friendly environment; toys, play area; safe furnishings
- Obstetric Ward: Delivery rooms with obstetric equipment; pre and postnatal care
- Isolation Ward: Separate entry, negative pressure ventilation, special disinfection
- Orthopaedic Ward: Beds with traction mechanism; physiotherapy area
- Psychiatric Ward: Secure rooms, padded walls if needed; safe environment

5. Critical Zone

The critical zone houses the most acute and emergency care facilities including ICU, HDU, and operation theatres. These require the highest level of environmental control, safety, and specialist supervision.

5.1 Intensive Care Unit (ICU)

- Location: Separate building or floor; close to operating theatres and labs
- Bed Capacity: 1 ICU bed per 25-30 hospital beds (typically 5-8 for 200-bed hospital)
- Room Design: Open plan with individual alcoves; each 20-25 sq.m
- ICU Bed: Manual or motorized; complete monitoring capabilities
- Monitoring Equipment: Multi-parameter monitors, ECG, BP, SpO2, temperature
- Life Support: Ventilators, defibrillators, suction, oxygen, emergency drugs
- Nursing Station: Central, elevated, visible to all beds
- Physician Area: Small office for ICU physician

- Visitor Room: Separate, limited access; communication area with family
- Amenities: Viewing window, minimal noise, optimized lighting

5.2 High Dependency Unit (HDU)

- Purpose: Between ICU and general ward; patients needing frequent monitoring
- Capacity: 3-5 beds; typically adjacent to ICU
- Nursing Staff: Lower patient-to-nurse ratio (1:3 vs 1:1 in ICU)
- Equipment: Basic monitoring, oxygen, suction but not full ICU support
- Bed Area: 15-18 sq.m per bed

5.3 Operating Theatres

- Number: 1 OT per 50-75 beds (3-4 OT for 200-bed hospital)
- Location: Central location; accessible from all areas; separate entry
- OT Suite Components: Entrance, reception, pre-op area, OT rooms, recovery, storage
- OT Room Size: 60-80 sq.m; 4.5m ceiling height
- Flooring: Non-slip, conductive for electrical safety
- Lighting: Operating light (minimum 160,000 lux at surgical site)
- Ventilation: 12-15 ACH, positive pressure, HEPA filtered
- Surgical Equipment: OT table (motorized), suction, cautery, laparoscopy tower
- Medical Gas: Oxygen, N2O, compressed air, vacuum outlets
- Wall Finish: Smooth, durable, washable, non-porous
- Infection Control: Separate changing area, hand wash sinks, sterilization

5.4 Pre-operative Area

- Capacity: 6-8 beds for 4 OT rooms
- Functions: Patient preparation, anesthesia assessment, pre-med

- Facilities: IV stand, oxygen, suction, monitor
- Staff: Nurses, anesthesia technician

5.5 Recovery Room (Post-operative)

- Location: Adjacent to OT; immediate access
- Capacity: 2-3 beds per OT
- Duration: 1-2 hours post-op stay before ward transfer
- Monitoring: Continuous monitoring, oxygen, suction, emergency equipment
- Staff: Trained recovery nurses

6. Service Zone

The service zone includes all supporting facilities that keep the hospital functioning efficiently. It handles food, laundry, waste, supplies, and maintenance.

6.1 Kitchen and Food Services

- Location: Ground floor, separate from patient areas; away from waste
- Area: 100-150 sq.m for 200-bed hospital
- Zones: Receiving, dry storage, cold storage, preparation, cooking, plating
- Equipment: Large cookers, pressure cookers, griller, convection oven
- Hygiene: Hand wash sinks, separate toilet, food handling standards
- Distribution: Trolleys towards; special diet meal carts
- Cafeteria: Separate area for staff and visitors

6.2 Laundry Services

- Location: Separate building or isolated area; away from patient zones
- Sections: Receiving (soiled), washing, drying, pressing, storage (clean)
- Equipment: Industrial washers, dryers, pressers
- Capacity: Process 50-100 kg daily linen for 200-bed hospital
- Segregation: Separate handling of contaminated vs. regular linen

6.3 Sterilization Services

- Location: Near OT; separate building preferred
- Equipment: Autoclaves (steam sterilizers), dry heat sterilizers, ETO sterilizers
- Process: Decontamination, cleaning, packaging, sterilization, storage
- Quality Control: Biological indicators, documentation
- Storage: Temperature and humidity controlled

6.4 Biomedical Waste Management

- Segregation: At point of generation into 5 colour codes
- Temporary Storage: Segregated bins; away from patient areas
- Treatment: Incineration, autoclaving, chemical disinfection
- Final Disposal: Landfill or certified waste management
- Safety: Personal protective equipment, documentation, staff training

6.5 Stores and Supply Management

- Central Store: Medicines, equipment, stationery
- Cold Chain: Refrigeration for vaccines, biological
- Organization: Proper shelving, labelling, inventory system
- Security: Locked storage for controlled substances
- Record Keeping: Stock registers, expiry date monitoring

7. Administrative Zone

The administrative zone provides the management infrastructure for hospital operations. It includes offices, conference rooms, records storage, and support functions.

7.1 Administrative Offices

- Director's Office: 20-25 sq.m; window, meeting table, professional setup
- Medical Director: 15-20 sq.m; accessible to clinical staff
- Administrative Officer: 12-15 sq.m
- HR Department: 20 sq.m; records and recruitment functions
- Accounts Department: 25-30 sq.m; secure storage of financial records
- IT Department: 15-20 sq.m; secure server room, backup systems

7.2 Medical Records and Information

- Location: Central, accessible to all departments
- Area: 40-60 sq.m with secure filing
- Storage: Organized shelving, indexed records
- Digitization: EHR system, scanning station
- Privacy: HIPAA compliance, restricted access
- Retrieval: Efficient system for chart requests

7.3 Conference and Training Facilities

- Conference Room: 40-50 sq.m; AV equipment, seating for 30-40
- Seminar Room: 20-25 sq.m; flexible seating
- Library: 50-75 sq.m; reference materials, computers
- Training Centre: Demonstration equipment, simulation models

7.4 Staff Support Facilities

- Staff Lounge: 50 sq.m; comfortable seating, TV, refreshment
- Changing Rooms: Separate for male and female; lockers
- Bathrooms: Adequate toilet and bathing facilities
- Canteen: Tea, coffee, food service
- Medical Room: First aid, occupational health services
- Counselling: Psychological support for stressed staff

7.5 Other Support Areas

- Mortuary: 20-25 sq.m; cold storage, relative viewing room
- Chaplaincy: 15 sq.m; spiritual and emotional counselling
- Security Office: Control room, monitoring station
- Maintenance Workshop: Tools, spare parts storage
- Power House: Generator, transformer, water tank

UNIT V: Facilities Planning and Standards

Introduction

Facilities planning and standards are essential components of hospital management and design. They ensure that hospitals operate efficiently, safely, and in compliance with regulatory requirements. This unit covers the planning of various support services and the standards that govern hospital operations.

PART 1: FACILITIES PLANNING

1. Transport Facilities

Transport is critical for patient care, staff movement, and supply management. It encompasses patient transport, staff mobility, and material handling.

1.1 Patient Transport

- **Horizontal Transport:** Wheelchairs and stretchers for patient movement within wards and departments
- **Vertical Transport:** Elevators sized for stretcher passage (minimum 2m × 1.2m); capacity 800-1000 kg
- **Quantity:** Minimum 2-3 elevators for hospital; 1 patient elevator per 150-200 beds
- **Design:** Adequate lighting, emergency alarm, handrails, no sharp corners
- **ICU Transport:** Wide corridors (2.5m minimum), mechanical lifts for ceiling-mounted patient movement systems
- **Emergency:** Mechanical or stair-climbing devices for evacuation

1.2 Parking and Vehicle Management

- Parking Capacity: 1 space per 3-4 beds; separate areas for staff, visitors, doctors
- Layout: Multi-level parking preferred; organized marking, directional signs
- Disabled Parking: 2-3% of spaces near entrance with ramps
- Security: Entry barriers, CCTV, parking attendant, adequate lighting
- Ambulance Garage: Covered area for maintenance and washing
- Traffic Flow: One-way circulation where possible; clear marking

1.3 Internal Material Transport

- Dumbwaiters: For small items, medicines, samples between floors
- Separate Elevators: For staff, materials, and waste - not mixing with patients
- Trolley Routes: Wide corridors for meal, linen, and waste trolleys
- Pneumatic Tube System: For laboratory samples, documents in large hospitals

- Handling Equipment: Mechanical lifts to reduce staff injury

2. Food Services

Food services are crucial for patient nutrition, recovery, and satisfaction. It includes meal planning, preparation, delivery, and management.

2.1 Kitchen Design and Planning

- Location: Ground floor, separate from patient areas, away from waste facilities
- Area: 100-150 sq.m for 200-bed hospital
- Layout: Linear or L-shaped for efficient workflow
- Capacity: Meals for all patients plus staff; estimated 300-400 meals/day for 200-bed hospital

2.2 Kitchen Zones

- **Receiving Zone:** Food inspection, measurement, storage arrangement
- **Dry Storage:** Rice, flour, spices; temperature 15-20°C, low humidity
- **Cold Storage:** Refrigerator (-5 to 5°C) and freezer (-18°C); organized shelving
- **Preparation Area:** Vegetable chopping, peeling; work tables, drainage
- **Cooking Zone:** Large cookers, pressure cookers, griller, convection oven
- **Plating Area:** Portion control, tray assembly, quality check
- **Dishwashing:** Industrial dishwasher, drying, storage

2.3 Nutritional Management

- Diet Planning: Based on medical conditions - diabetic, cardiac, renal, soft, liquid diets
- Calorie Calculation: Adjusted for patient age, weight, activity level
- Menu Variety: 5-7 day rotating menu to prevent monotony
- Special Diets: Vegetarian, vegan, religious dietary requirements

- Dietician Consultation: For therapeutic diets and counselling

2.4 Food Safety and Hygiene

- Storage: Temperature control, proper containers, expiry date monitoring
- Handling: Staff training, hand washing, no cross-contamination
- Cooking: Proper temperature, time, and cooking methods
- Transportation: Hot meals kept in insulated containers; maximum 2 hours delivery
- Quality Check: Visual inspection before serving
- Pest Control: Regular inspection, pesticide application, sealed containers

3. Communication Systems

Effective communication is vital for hospital operations, patient safety, and coordinating multiple departments.

3.1 Internal Communication

- **Telephone System:** Internal extensions, trunk lines, emergency button
- **Intercom:** Department to department communication; nursing station to patient rooms
- **Call Bell System:** Wireless or wired buttons in patient rooms; alerts nursing station
- **Public Address (PA):** Hospital-wide announcements, overhead paging
- **Internal Messaging:** SMS alerts for critical alerts and emergencies
- **Email System:** Departmental updates, memos, scheduling

3.2 External Communication

- Trunk Lines: Multiple phone lines for incoming calls
- Ambulance Communication: Two-way radio, coordination with emergency
- Referral Communication: Secure fax, email for medical records
- Media and Public: Public relations office, website, helpline

4. Information Systems

Modern hospital information systems are essential for data management, patient safety, billing, and clinical decision-making.

4.1 Hospital Information System (HIS)

- Function: Central database for all hospital operations
- Components: OPD, IPD, billing, pharmacy, lab, radiology modules
- Benefits: Real-time data, reduced errors, improved efficiency
- Security: User authentication, data encryption, backup systems

4.2 Electronic Health Record (EHR)

- Content: Patient demographics, medical history, diagnoses, medications, lab results
- Accessibility: Authorized personnel across departments
- Interoperability: Ability to share data between systems
- Advantages: Reduce duplicate tests, improve care coordination, patient portals

4.3 Specialized Systems

- Laboratory Information System (LIS): Sample tracking, test results, quality control
- Picture Archiving and Communication System (PACS): Storage and retrieval of medical images
- Pharmacy Management: Drug inventory, dispensing, interaction checking
- Financial System: Billing, accounts receivable, payroll
- Human Resources: Staff management, scheduling, training records

4.4 Data Security and Privacy

- HIPAA Compliance: Patient privacy protection regulations

- Encryption: Data transmission and storage security
- Access Control: Role-based permissions, audit trails
- Backup Systems: Redundancy, disaster recovery plans
- Regular Audits: Security assessments, vulnerability testing

5. Minor Facilities

5.1 Mortuary and Autopsy Services

- Morgue: 20-25 sq.m; refrigerated storage units (2-4 bodies)
- Temperature: 2-4°C for body preservation
- Viewing Room: For family identification; separate access, dignified setting
- Autopsy Room: For post-mortem examination; dissection table, drainage system
- Documentation: Death certificates, consent forms

5.2 Chaplaincy and Counselling

- Chaplain Office: 15-20 sq.m; prayer room for patients
- Functions: Spiritual support, grief counselling, religious services
- Multi-faith Approach: Accommodation for different religions
- Psychological Support: Counseling for patients with emotional stress

5.3 Library and Information Centre

- Space: 50-75 sq.m; quiet study area
- Resources: Medical journals, textbooks, online databases
- Computers: Internet access, literature search facilities
- Librarian: Information management, research support

5.4 Training and Conference Facilities

- Conference Room: 40-50 sq.m; AV equipment, seating 30-40
- Seminar Rooms: Multiple small rooms for group training
- Simulation Lab: Manikins for nursing and emergency training

- Regular Programs: Staff continuing education, patient education

5.5 Other Facilities

- Security Office: Control room, surveillance, access management
- Maintenance Workshop: Tools, spare parts, repair services
- Garden and Landscaping: Therapeutic green spaces
- Outdoor Seating: Benches for patients and visitors
- Drinking Water: Safe water stations, dispensers

PART 2: STANDARDS IN HOSPITAL

1. General Standards for Hospitals

1.1 Accreditation Standards

- JCI (Joint Commission International): International standard for hospital quality
- NABH (National Accreditation Board for Hospitals & Healthcare Providers - India): National standard
- ISO Standards: Quality management systems, patient safety
- AABB Standards: Blood bank and transfusion medicine

1.2 Quality Management Standards

- Patient Safety Programs: Incident reporting, error prevention
- Infection Control Standards: Hand hygiene, environmental cleaning, isolation protocols
- Documentation Standards: Complete, timely, accurate medical records
- Staff Competency: Training, certification, continuing education
- Patient Rights: Informed consent, privacy, complaint redressal

1.3 Clinical Standards

- Clinical Practice Guidelines: Evidence-based treatment protocols

- Medicine Standards: Drug selection, dosing, interactions
- Surgery Standards: Pre-op assessment, operative technique, post-op care
- Emergency Standards: Triage, resuscitation, stabilization

2. Voluntary and Mandatory Standards

2.1 Voluntary Standards

Standard	Focus Area	Key Requirements
JCI	International quality and safety	Patient safety, risk management, staff training
NABH	National quality for India	Adapted to Indian context and regulations
ISO 9001	Quality management	Process control, documentation

2.2 Mandatory Standards

Standard	Authority	Focus
NBC Building Code	Govt. of India	Building construction standards
Biomedical Waste Rules	Ministry of Environment	Waste segregation and disposal
Drugs and	FDA/DCGI	Pharmacy operations,

Standard	Authority	Focus
Cosmetics Act		medicines

3. Mechanical Standards

3.1 HVAC (Heating, Ventilation, and Air Conditioning)

- **Air Changes Per Hour (ACH):** OT: 12-15, ICU: 10-12, General wards: 6-8, Isolation: negative pressure
- **Filtration:** HEPA filters for OT and critical areas; regular replacement
- **Temperature:** 20-24°C in clinical areas; patients comfortable, equipment optimal
- **Humidity:** 40-60% relative humidity; prevents equipment malfunction
- **Ductwork:** Sealed, regularly cleaned; prevent microbial growth
- **Maintenance:** Quarterly filter changes, annual duct cleaning

3.2 Elevator Standards

- Load Capacity: 800-1000 kg (10-13 persons)
- Speed: 0.5-1 m/sec for smooth operation
- Emergency: Power failure backup, alarm bell, telephone
- Maintenance: Monthly safety checks, annual certification
- Dimensions: Minimum 2.2m × 1.4m for stretcher passage

3.3 Plumbing and Water Systems

- Water Supply: 500-600 litres/bed/day capacity
- Purification: Filtration, chlorination, UV treatment
- Storage Tanks: Elevated for gravity feed; 24-hour supply buffer
- Hot Water: Separate system; 45-50°C for hand washing

- Drainage: Proper slope (1:100), trapped siphons, regular cleaning
- Sewage Treatment: Primary, secondary, tertiary treatment plants
- Testing: Monthly water quality analysis

4. Electrical Standards

4.1 Power Supply

- Main Supply: Three-phase, 400V; Single-phase for equipment
- Load Calculation: 30-40 kVA per 100 beds
- Distribution: Separate circuits for critical loads
- Backup Power: Generator (15-20 kVA); fuel storage for 24-48 hours
- UPS: For critical systems; 15-30 minutes transition time
- Stabilizer: Voltage regulation (±10%)

4.2 Grounding and Safety

- Earthing: Minimum 2 earthing points; resistance <5 ohms
- Isolated Ground: In OT and ICU for equipment protection
- Surge Protection: For sensitive equipment
- MCB/RCD: Circuit protection and leakage detection
- Cable Standards: Appropriate gauge for load; heat-resistant

4.3 Lighting Standards

- Minimum Illumination: General ward 100 lux, OT 500 lux, Corridor 50 lux
- Colour Temperature: 4000K (neutral) for clinical areas
- Emergency Lighting: Battery backup on all exit routes
- OT Lighting: Operating light with minimum 160,000 lux at surgical site
- LED Preference: Energy efficient, long life, low heat

5. Centralized Medical Gas System

5.1 Components and Specifications

- Oxygen: 99.5% purity; cylinders, bulk storage, manifold
- Nitrous Oxide: For anaesthesia; secure storage
- Compressed Air: For surgical tools, pneumatic systems
- Vacuum: Central suction system; exhaust to atmosphere
- Pressure: Oxygen 50-55 psi, N2O 40-45 psi, Vacuum 4-8 psi

5.2 Safety Requirements

- Storage: Away from heat, sunlight, flammable materials
- Piping: Copper or stainless steel; color-coded
- Outlets: Wall-mounted or pendant; quick couplers
- Regulators: Pressure control, alarm for low pressure
- Backup: Cylinder backup for oxygen and N2O
- Maintenance: Monthly checks, annual certification

6. Biomedical Waste Management

6.1 Classification of Biomedical Waste

Color Code	Type	Examples	Treatment
Yellow	Hazardous/Infectious	Pathology, cultures, sharps, blood	Incineration

Color Code	Type	Examples	Treatment
Red	Non-hazardous	Plastic, paper, non-sharps	Recycling/Landfill
Blue	Glass/Breakables	Bottles, glass vials	Separate disposal
Black	General waste	Food, office waste	Landfill
Green	Composting	Garden, plant waste	Composting

6.2 Waste Management Process

1. **Segregation:** At point of generation into proper containers
2. **Storage:** In designated areas; maximum 48 hours in warm climate
3. **Transportation:** Using separate carts; never mix waste categories
4. **Treatment:** Incineration (1000°C minimum), autoclaving, chemical disinfection
5. **Final Disposal:** Landfill or certified waste facility
6. **Documentation:** Records of waste generation, treatment, disposal

6.3 Safety and Precautions

- PPE: Gloves, apron, mask, shoes for waste handlers
- Training: Staff training on waste segregation and handling
- Sharps Container: Puncture-resistant, labelled, properly disposed
- Needle Stick Protocol: Post-exposure prophylaxis available

- Regular Audits: Compliance checks, corrective actions