



## Course Specification of Hospital Systems Design & Management

### **Course Code (BE374)**

I. Course Identification and General Information:						
1	Course Title:	Hospital Systems Design & Management				
2	Course Code & Number:	BE374				
3	Credit hours:	C.H			TOTAL	
		Th.	Seminar	Pr		Tr.
		2	--	--	2	3
4	Study level/ semester at which this course is offered:	4 <sup>th</sup> Level / 2 <sup>nd</sup> Semester				
5	Pre –requisite (if any):	Engineering Drawing (BR003).				
6	Co –requisite (if any):	None				
7	Program (s) in which the course is offered:	Biomedical Engineering Program				
8	Language of teaching the course:	English				
9	Location of Teaching the Course:	Faculty of Engineering				
10	Prepared by:	Dr. Waleed Al-talabi				
11	Reviewed by:	Dr. Mohammed Al-olofi				
12	Date of Approval:					

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**I. Course Description:**

The Hospital Systems: Design & Management course aims to introduce students the knowledge about the classification, structure, and designing hospitals. Explains the major concepts of hospital management and the biomedical engineer role on it. The course covers variety of major topics, including: hospital planning and design, classification of hospital & modern hospital architecture, design of hospital departments (intensive care units, operations, emergency, and radiology department), and systems (medical gases network, ventilation, and electrical power). In addition to information system, and medical equipment management. The course focuses on discussion the hospital design aspects from the biomedical engineer's point of view.

<b>III. Course Intended learning outcomes (CILOs) of the course</b> (maximum 8CILOs)	<b>Referenced PILOs</b> (Only write code number of referenced Program Intended learning outcomes)
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**Knowledge and Understanding:** Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:

a1	Demonstrate understanding of the historical timeline, principles, concepts, management ,and criteria related to hospital engineering and tasks of biomedical engineer inside the hospital.	A1 Describe and explain the underlying mathematical methods and theories; life scientific-principles; and engineering core concepts related to the Biomedical Engineering context.
a2	Identify the principles of design and development of hospital departments and systems, the specifications of the hospitals, the kinds of the hospitals and the medical sectors within any hospital.	A2 Clarify the design principles and techniques and the engineering materials characteristics and how these are relevant to the developments and technologies in a biomedical systems context.

**B. Cognitive/ Intellectual Skills:** Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:

b1	Design hospitals and its departments that meet modern needs with consideration	B3 Design the biomedical systems or processes within realistic constraints such as economic,
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	of public health, safety, and welfare, as well as environmental considerations and sustainable engineering solutions in hospital engineering and management.	environmental, social, political, ethical, health and safety, manufacturability and sustainability.
b2	Evaluate the hospitals according the standard specifications.	B5 Distinguish the main characteristics of biomedical systems, apply diagnostic skills and technical knowledge and perform failure analysis to these systems.
<b>C. Professional and Practical Skills:</b> Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
c1	Use a wide range of managerial and analytical techniques, modern architecture and IT tools to solve the rising challenges and specific necessities of modern day hospitals, to promote better management of information regarding hospital technology, and to analyze the distribution of the medical sectors with real hospitals.	C2 Use a wide range of analytical tools, techniques, IT, modern engineering tools, software packages and develop required computer programs to solve, modeling and analyzing Biomedical Engineering problems.
c2	Investigate, evaluate and develop better management of information regarding identification of biomedical and hospital technology, planning, procurement, and operation requirements.	C5 Demonstrate basic organizational and project management skills, apply quality assurance procedures, practice neatness and aesthetics and follow codes and standards to improve biomedical products design or services.
<b>D. Transferable Skills:</b> Upon successful completion of the undergraduate Biomedical Engineering Program, the graduates will be able to:		
d1	Demonstrate the ability to collaborative	D1 Lead and motivate individuals, show

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	work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace, and the significance of time management in group work. In addition to work independently while maintaining a high-level of professionalism.	capability to work in stressful environments and within constraints, collaborate effectively within multidisciplinary team.
d2	Develop self-learning initiatives and integrate learned knowledge for problem solving.	D3 Recognize the needs for, and engage in life-long self-learning.

<b>(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>a1.</b> Demonstrate understanding of the historical timeline, principles, concepts, management ,and criteria related to hospital engineering and tasks of biomedical engineer inside the hospital.	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Directed self- study.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Home works and assignments,</li> <li>• Presentations.</li> </ul>
<b>a2.</b> Identify the principles of design and development of hospital departments and systems, the specifications of	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Home works and assignments,</li> </ul>

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the hospitals, the kinds of the hospitals and the medical sectors within any hospital.	<ul style="list-style-type: none"> <li>Directed self- study.</li> </ul>	<ul style="list-style-type: none"> <li>Presentations.</li> </ul>
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**(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>b1.</b> Design hospitals and its departments that meet modern needs with consideration of public health, safety, and welfare, as well as environmental considerations and sustainable engineering solutions in hospital engineering and management.	<ul style="list-style-type: none"> <li>Interactive lectures &amp; examples,</li> <li>Interactive class discussions,</li> <li>Workshops practices,</li> <li>Directed self- study,</li> <li>Team work (cooperative learning),</li> <li>Field visits/training,</li> <li>Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>Written tests (mid and final terms and quizzes),</li> <li>Short reports,</li> <li>Lab\Project report</li> <li>Home works and assignments,</li> <li>Presentations.</li> </ul>
<b>b2.</b> Evaluate the hospitals according the standard specifications.	<ul style="list-style-type: none"> <li>Interactive lectures &amp; examples,</li> <li>Presentation/seminar,</li> <li>Interactive class discussions,</li> <li>Directed self- study,</li> <li>Team work (cooperative learning),</li> <li>Field visits/training.</li> </ul>	<ul style="list-style-type: none"> <li>Written tests (mid and final terms and quizzes),</li> <li>Short reports,</li> <li>Home works and assignments,</li> <li>Presentations.</li> </ul>

**(C) Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:**

Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
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<p><b>c1.</b> Use a wide range of managerial and analytical techniques, modern architecture and IT tools to solve the rising challenges and specific necessities of modern day hospitals, to promote better management of information regarding hospital technology, and to analyze the distribution of the medical sectors with real hospitals.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Home works and assignments,</li> <li>• Presentations.</li> </ul>
<p><b>c2.</b> Investigate, evaluate and develop better management of information regarding identification of biomedical and hospital technology, planning, procurement, and operation requirements.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Computer laboratory-based sessions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Coursework activities assessment,</li> <li>• Home works and assignments,</li> <li>• Presentations.</li> </ul>

<b>(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:</b>		
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies
<b>d1.</b> Demonstrate the ability to	<ul style="list-style-type: none"> <li>• Interactive lectures &amp;</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid</li> </ul>

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<p>collaborative work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace, and the significance of time management in group work. In addition to work independently while maintaining a high-level of professionalism.</p>	<p>examples,</p> <ul style="list-style-type: none"> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Workshops practices,</li> <li>• Directed self- study,</li> <li>• Team work (cooperative learning),</li> <li>• Field visits/training,</li> <li>• Mini/major project.</li> </ul>	<p>and final terms and quizzes),</p> <ul style="list-style-type: none"> <li>• Short reports,</li> <li>• Lab\Project report</li> <li>• Coursework activities assessment,</li> <li>• Home works and assignments,</li> <li>• Presentations.</li> </ul>
<p><b>d2.</b> Develop self-learning initiatives and integrate learned knowledge for problem solving.</p>	<ul style="list-style-type: none"> <li>• Interactive lectures &amp; examples,</li> <li>• Presentation/seminar,</li> <li>• Interactive class discussions,</li> <li>• Directed self- study.</li> </ul>	<ul style="list-style-type: none"> <li>• Written tests (mid and final terms and quizzes),</li> <li>• Presentations.</li> </ul>

IV. Course Content:					
A – Theoretical Aspect:					
Order	Units/Topics List	Sub Topics List	Number of Weeks	contact hours	Learning Outcomes
1	<b>Introduction</b>	<ul style="list-style-type: none"> <li>– Introduction to the course.</li> <li>– Course outlines.</li> <li>– Project description.</li> <li>– History of hospital engineering and health care management.</li> </ul>	1	2	a1, d1
2	<b>Hospital Engineering</b>	<ul style="list-style-type: none"> <li>– Introduction.</li> <li>– The concept of hospital engineering science.</li> </ul>	1	2	a1, a2



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		<ul style="list-style-type: none"> <li>– The relationship between Biomedical engineering and Hospital engineering.</li> <li>– Hospital classification.</li> <li>– The start point in hospital designing.</li> </ul>			
3	<b>Hospital Planning and Design</b>	<ul style="list-style-type: none"> <li>– Methods of planning and design.</li> <li>– Location of hospital.</li> <li>– Basic considerations in the design of hospitals.</li> <li>– The different directions in the design of hospitals' buildings.</li> <li>– Departmental planning and design.</li> <li>– Motion axes in the hospital</li> <li>– Supportive services and auxiliary services of hospital.</li> <li>– Planning and programming construction.</li> <li>– Evaluation of district hospital facilities.</li> </ul>	1	2	a2, b1, b2, d2
4	<b>Classification of Hospital &amp; Modern Hospital Architecture</b>	<ul style="list-style-type: none"> <li>– General hospital, specialized hospital, primary health care – their role and functions.</li> <li>– Aspects of hospital services – inpatient, outpatient and emergency.</li> <li>– Hierarchy of medical and paramedical staff &amp; their functions and responsibilities.</li> <li>– Modern hospital architecture.</li> <li>– Location and environment of hospital.</li> <li>– Space in a hospital building.</li> </ul>	1	2	a2, b1, d1, d2



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		<ul style="list-style-type: none"> <li>– Design of plumbing &amp; sanitation, waste disposal, cleaning, sterilizing, laundry, storage, central labs, blood banks, and OPD.</li> </ul>			
5	<b>Design of Intensive Care Units, Ward, Nursing Department</b>	<ul style="list-style-type: none"> <li>– Patient rooms.</li> <li>– Services.</li> </ul>	1	2	b1,c1, d1, d2
6	<b>Design of Operations Department</b>	<ul style="list-style-type: none"> <li>– Operations department site.</li> <li>– Design considerations of the department.</li> <li>– Operations department sections.</li> <li>– Movement analysis inside the department.</li> <li>– Wound infections.</li> <li>– Leaked anaesthesia gases.</li> <li>– Thermal convection currents.</li> <li>– Environmental control in the department.</li> </ul>	1	2	b1,c1, d1, d2
7	<b>Design of Emergency Department</b>	<ul style="list-style-type: none"> <li>– Emergency department features.</li> <li>– Patient flow regulate.</li> <li>– Design and general functional requirements.</li> </ul>	1	2	b1,c1, d1, d2
8	<b>Mid-Term Theoretical Exam</b>	– All previous topics	1	2	a1, a2, b1, b2, c1
9	<b>Design of Radiology Department</b>	<ul style="list-style-type: none"> <li>– Radiology department site.</li> <li>– Elements of the radiology department.</li> <li>– Movement axes.</li> <li>– An overview of the hardware and</li> </ul>	1	2	b1,c1, d1, d2

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		requirements.			
10	<b>Design of Medical Gases Network</b>	<ul style="list-style-type: none"> <li>- The foundations of calculate and design the medical gases network.</li> <li>- Gas supply.</li> </ul>	1	2	a1, a2, b1, b2, d2
11	<b>Design of Ventilation System in Hospitals</b>	<ul style="list-style-type: none"> <li>- Introduction.</li> <li>- The effectiveness of the ventilation system.</li> <li>- The basic types of air movement within the room.</li> <li>- Ventilation systems in hospitals.</li> </ul>	1	2	a1, a2, b1, b2, d2
12	<b>Design of Electrical Power Systems in Hospitals</b>	<ul style="list-style-type: none"> <li>- Safety of electrical systems, protective systems - interference of patient's protection grounding.</li> <li>- Design of sub stations, breakers, Surge protectors, EMI filters, voltage stabilizers, generator sets and UPS.</li> <li>- Uninterrupted power supply for ICU and computerized monitoring units. Specification &amp; estimation for hospital wiring.</li> </ul>	1	2	a2, b1, b2, c2, d1, d2
13	<b>Hospital Management and Information System (HMIS)</b>	<ul style="list-style-type: none"> <li>- Introduction.</li> <li>- The need for managers and their perspectives.</li> <li>- <b>Management:</b> definition, functions, and competencies.</li> <li>- <b>Management positions:</b> the control in the organizational hierarchy.</li> <li>- Roles of the manager.</li> <li>- Role of database HMIS.</li> <li>- Need of networking.</li> </ul>	1	2	a1, c1, c2, d1, d2

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		<ul style="list-style-type: none"> <li>- HMIS and Internet.</li> <li>- Centralized data record system.</li> <li>- <b>ERP system modules for hospitals:</b> (Front office and billing system, stores &amp; inventory / pharmacy system, pathology &amp; other diagnostics centre, record room management system, payroll &amp; HR system, financial accounting system, doctors lounge, patient history, maintenance, claims, over time scheduling.).</li> </ul>			
14	<b>Management of Medical Equipment</b>	<ul style="list-style-type: none"> <li>- Introduction.</li> <li>- Acquisition of medical equipment.</li> <li>- Essential medical equipment.</li> <li>- Management of medical equipment maintenance.</li> <li>- Stores and spare parts management.</li> <li>- Training of technicians for medical equipment maintenance.</li> </ul>	1	2	a1, c2, d1, d2
15	<b>Project Presentation</b>	<ul style="list-style-type: none"> <li>- Student's presentations.</li> </ul>	1	2	a1, a2, b1, b2, c1, c2
16	<b>Final Theoretical Exam</b>	All topics.	1	2	a1, a2, b1, b2, c1, c2
<b>Number of Weeks /and Units Per Semester</b>			<b>16</b>	<b>32</b>	



<b>C. Tutorial Aspect:</b>				
No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CLOs)
1	These will cover similar material to the lectures.	15	30	a1, a2,b1, b2, c1, c2
<b>Number of Weeks /and Units Per Semester</b>		<b>15</b>	<b>30</b>	

<b>V. Teaching Strategies of the Course:</b>
<ul style="list-style-type: none"> <li>- Interactive lectures &amp; examples,</li> <li>- Presentation/seminar,</li> <li>- Interactive class discussions,</li> <li>- Exercises and home works,</li> <li>- Computer laboratory-based sessions,</li> <li>- Workshops practices,</li> <li>- Directed self- study,</li> <li>- Team work (cooperative learning),</li> <li>- Field visits/training,</li> <li>- Mini/major project.</li> </ul>

<b>VI. Assessment Methods of the Course:</b>
<ul style="list-style-type: none"> <li>- Written tests (mid and final terms and quizzes),</li> <li>- Short reports,</li> <li>- Lab\Project report</li> <li>- Coursework activities assessment,</li> <li>- Home works and assignments,</li> <li>- Presentations.</li> </ul>

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<b>VII. Assignments:</b>				
No	Assignments	Aligned CILOS(symbols)	Week Due	Mark
1	Lectures 1,2,3, and 4 Assignment	a1, a2, b1, b2, d1, d2	5	6
2	Lectures 5,6,7, and 9 Assignment	b1, c1, d1, d2	10	7
3	Lectures 10,11,12, and 13 Assignment	a1, a2, b1, b2, c1, c2, d1, d2	14	7
4	Project/ Presentation	a1, a2, b1, b2, c1, c2	15	10
<b>Total</b>				<b>30</b>

<b>VIII. Schedule of Assessment Tasks for Students During the Semester:</b>					
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Project/ Assignments	5,10,14,15	30	20%	a1, a2, b1, b2, c3, c4, d1, d2
2	Quiz 1	4	10	6.67%	a1, a2
3	Midterm Exam	8	30	20%	a1, a2, b1, b2, c3
4	Quiz 2	12	10	6.67%	a2, b1, b2, c3
5	Final Exam	16	70	46.67%	a1, a2, b1, b2, c3, c4
<b>Total</b>			<b>150</b>	<b>100%</b>	



<b>IX. Learning Resources:</b>	
<b>1- Required Textbook(s) ( maximum two ).</b>	
	<ol style="list-style-type: none"> <li>1. BM Sakharkar, 2009, “<b>Principles of Hospital Administration and Planning</b>”, 2<sup>nd</sup> Ed., India, Jaypee Brothers Medical Publishers (P) Ltd.</li> <li>2. Cynthia McCullough, 2010, “<b>Evidence-based design for healthcare facilities</b>”, USA, Sigma Theta Tau International.</li> </ol>
<b>2- Essential References.</b>	
	<ol style="list-style-type: none"> <li>1. Dev Raheja, 2019, “<b>Safer Hospital Care Strategies for Continuous Quality Innovation</b>”, 2<sup>nd</sup> Ed., USA, Taylor &amp; Francis Group.</li> <li>2. Sharon B. Buchbinder, Nancy H. Shanks, 2017, “<b>Introduction to Health Care Management</b>”, 3<sup>rd</sup> Ed., USA, Jones &amp; Bartlett Learning, LLC.</li> <li>3. Stefano Capolongo, Marta Carla Bottero, Maddalena Buffoli, Emanuele Lettieri, 2015, “<b>Improving Sustainability During Hospital Design and Operation A Multidisciplinary Evaluation Tool</b>”, Switzerland, Springer International Publishing.</li> <li>4. Annmarie Adams, 2008, “<b>Medicine by Design: The Architect and the Modern Hospital, 1893–1943</b>”, UK, University of Minnesota press.</li> <li>5. John E. Millsap, 2007, “<b>Understanding the Hospital Planning, Design, and Construction Process</b>”, USA, California Healthcare Foundation.</li> <li>6. Ian W. Gibson, 2007, “<b>An Approach To Hospital Planning And Design Using Discrete Event Simulation</b>”, Proceedings of the 2007 Winter Simulation Conference</li> </ol>
<b>3- Electronic Materials and Web Sites etc.</b>	
	<p><b>Websites:</b></p> <ol style="list-style-type: none"> <li>1- American Society for HealthCare Engineering is the largest association devoted to professionals who design, build, and operate hospitals and other health care facilities.  <a href="https://www.ashe.org/">https://www.ashe.org/</a></li> <li>2- Hospitalmanagement.net a comprehensive reference source covering all aspects of the hospital environment, introducing technologies, services and procedures to improve the management of facilities.  <a href="https://www.hospitalmanagement.net/">https://www.hospitalmanagement.net/</a></li> <li>3- Hospitals design.  <a href="https://www.dezeen.com/tag/hospitals/">https://www.dezeen.com/tag/hospitals/</a></li> </ol>

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	<p><b>Journals:</b></p> <p>1- Journal of Healthcare Engineering  <a href="https://www.hindawi.com/journals/jhe/">https://www.hindawi.com/journals/jhe/</a></p> <p>2- The Journal of Healthcare Engineering.  <a href="http://www.multi-science.co.uk/jhe.htm">http://www.multi-science.co.uk/jhe.htm</a></p> <p><b>Other Web Sources:</b></p> <p>1- The Medical Futurist works for making a bold vision about the future of healthcare reality today.  <a href="https://medicalfuturist.com/the-future-of-hospital-design-inside-the-point-of-care/">https://medicalfuturist.com/the-future-of-hospital-design-inside-the-point-of-care/</a></p> <p>2- Health Management and Leadership promotion, cross-collaboration amongst key disciplines.  <a href="https://healthmanagement.org/">https://healthmanagement.org/</a></p>
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X. Course Policies:	
<b>1</b>	<p><b>Class Attendance:</b></p> <p>A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be required to retake the entire course again.</p>
<b>2</b>	<p><b>Tardy:</b></p> <p>For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.</p>
<b>3</b>	<p><b>Exam Attendance/Punctuality:</b></p> <p>A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam</p>
<b>4</b>	<p><b>Assignments &amp; Projects:</b></p>



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	In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.
<b>5</b>	<p><b>Cheating:</b></p> <p>For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.</p>
<b>6</b>	<p><b>Plagiarism:</b></p> <p>Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.</p>
<b>7</b>	<p><b>Other policies:</b></p> <ul style="list-style-type: none"> <li>- Mobile phones are not allowed to use during a class lecture. It must be closed; <b>otherwise</b> the student will be asked to leave the lecture room.</li> <li>- Mobile phones are not allowed in class during the examination.</li> <li>- Lecture notes and assignments might be given directly to students using soft or hard copy.</li> </ul>



## Template for Course Plan (Syllabus)

### Hospital Systems: Design & Management BE374

I. Course Identification and General Information:					
1	<b>Course Title:</b>	Hospital Systems: Design & Management			
2	<b>Course Code &amp; Number:</b>	BE374			
3	<b>Credit Hours:</b>	<b>Credit Hours</b>	<b>Theory Hours</b>		<b>Lab. Hours</b>
			<b>Lecture</b>	<b>Exercise</b>	
		3	2	2	--
4	<b>Study Level/ Semester at which this Course is offered:</b>	4 <sup>th</sup> Level / 2 <sup>nd</sup> Semester			
5	<b>Pre –Requisite (if any):</b>	Engineering Drawing (BR003).			
6	<b>Co –Requisite (if any):</b>	None			
7	<b>Program (s) in which the Course is Offered:</b>	Bachelor of Biomedical Engineering			
8	<b>Language of Teaching the Course:</b>	English			
9	<b>Location of Teaching the Course:</b>	Faculty of Engineering			
10	<b>Prepared by:</b>	Dr. Waleed Al-talabi			
11	<b>Reviewed by:</b>	Dr. Mohammed Al-olofi			
12	<b>Date of Approval:</b>				



## II. Course Description:

The Hospital Systems: Design & Management course aims to introduce students the knowledge about the classification, structure, and designing hospitals. Explains the major concepts of hospital management and the biomedical engineer role on it. The course covers variety of major topics, including: hospital planning and design, classification of hospital & modern hospital architecture, design of hospital departments (intensive care units, operations, emergency, and radiology department), and systems (medical gases network, ventilation, and electrical power). In addition to information system, and medical equipment management. The course focuses on discussion the hospital design aspects from the biomedical engineer's point of view.

## III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)

**A. Knowledge and Understanding:** Upon successful completion of the course, students will be able to:

- |    |   |
|----|---|
| a1 | Demonstrate understanding of the historical timeline, principles, concepts, management ,and criteria related to hospital engineering and tasks of biomedical engineer inside the hospital.          |
| a2 | Identify the principles of design and development of hospital departments and systems, the specifications of the hospitals, the kinds of the hospitals and the medical sectors within any hospital. |

**B. Intellectual Skills:** Upon successful completion of the course, students will be able to:

- |    |   |
|----|---|
| b1 | Design hospitals and its departments that meet modern needs with consideration of public health, safety, and welfare, as well as environmental considerations and sustainable engineering solutions in hospital engineering and management. |
| b2 | Evaluate the hospitals according the standard specifications.   |

**C. Professional and Practical Skills:** Upon successful completion of the course, students will be able to:

- |    |  |
|----|--|
| c1 | Use a wide range of managerial and analytical techniques, modern architecture and IT tools to solve the rising challenges and specific necessities of modern day hospitals, to promote better management of information regarding hospital technology, and to analyze the distribution of the medical sectors with real hospitals. |
|----|--|

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<b>III. Course Intended Learning Outcomes (CILOs): (مخرجات تعلم المقرر)</b>	
c2	Investigate, evaluate and develop better management of information regarding identification of biomedical and hospital technology, planning, procurement, and operation requirements.
<b>D. Transferable Skills:</b> Upon successful completion of the course, students will be able to:	
d1	Demonstrate the ability to collaborative work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace, and the significance of time management in group work. In addition to work independently while maintaining a high-level of professionalism.
d2	Develop self-learning initiatives and integrate learned knowledge for problem solving.

<b>IV. Course Contents:</b>				
<b>A. Theoretical Aspect:</b>				
No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	<b>Introduction</b>	<ul style="list-style-type: none"> <li>– Introduction to the course.</li> <li>– Course outlines.</li> <li>– Project description.</li> <li>– History of hospital engineering. and health care management.</li> </ul>	1	2
2	<b>Hospital Engineering</b>	<ul style="list-style-type: none"> <li>– Introduction.</li> <li>– The concept of hospital engineering science.</li> <li>– The relationship between Biomedical engineering and Hospital engineering.</li> <li>– Hospital classification.</li> <li>– The start point in hospital designing.</li> </ul>	1	2
3	<b>Hospital Planning and Design</b>	<ul style="list-style-type: none"> <li>– Methods of planning and design.</li> <li>– Location of hospital.</li> <li>– Basic considerations in the design of hospitals.</li> </ul>	1	2

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<b>IV. Course Contents:</b>				
<b>A. Theoretical Aspect:</b>				
<b>No.</b>	<b>Units/Topics List</b>	<b>Sub Topics List</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>
		<ul style="list-style-type: none"> <li>– The different directions in the design of hospitals' buildings.</li> <li>– Departmental planning and design.</li> <li>– Motion axes in the hospital</li> <li>– Supportive services and auxiliary services of hospital.</li> <li>– Planning and programming construction.</li> <li>– Evaluation of district hospital facilities.</li> </ul>		
<b>4</b>	<b>Classification of Hospital &amp; Modern Hospital Architecture</b>	<ul style="list-style-type: none"> <li>– General hospital, specialized hospital, primary health care – their role and functions.</li> <li>– Aspects of hospital services – inpatient, outpatient and emergency.</li> <li>– Hierarchy of medical and paramedical staff &amp; their functions and responsibilities.</li> <li>– Modern hospital architecture.</li> <li>– Location and environment of hospital.</li> <li>– Space in a hospital building.</li> <li>– Design of plumbing &amp; sanitation, waste disposal, cleaning, sterilizing, laundry, storage, central labs, blood banks, and OPD.</li> </ul>	1	2
<b>5</b>	<b>Design of Intensive Care Units, Ward, Nursing Department</b>	<ul style="list-style-type: none"> <li>– Patient rooms.</li> <li>– Services.</li> </ul>	1	2
<b>6</b>	<b>Design of Operations</b>	<ul style="list-style-type: none"> <li>– Operations department site.</li> <li>– Design considerations of the department.</li> </ul>	1	2

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<b>IV. Course Contents:</b>				
<b>A. Theoretical Aspect:</b>				
<b>No.</b>	<b>Units/Topics List</b>	<b>Sub Topics List</b>	<b>Number of Weeks</b>	<b>Contact Hours</b>
	<b>Department</b>	<ul style="list-style-type: none"> <li>– Operations department sections.</li> <li>– Movement analysis inside the department.</li> <li>– Wound infections.</li> <li>– Leaked anaesthesia gases.</li> <li>– Thermal convection currents.</li> <li>– Environmental control in the department.</li> </ul>		
<b>7</b>	<b>Design of Emergency Department</b>	<ul style="list-style-type: none"> <li>– Emergency department features.</li> <li>– Patient flow regulate.</li> <li>– Design and general functional requirements.</li> </ul>	1	2
<b>8</b>	<b>Mid-Term Theoretical Exam</b>	<ul style="list-style-type: none"> <li>– All previous topics</li> </ul>	1	2
<b>9</b>	<b>Design of Radiology Department</b>	<ul style="list-style-type: none"> <li>– Radiology department site.</li> <li>– Elements of the radiology department.</li> <li>– Movement axes.</li> <li>– An overview of the hardware and requirements.</li> </ul>	1	2
<b>10</b>	<b>Design of Medical Gases Network</b>	<ul style="list-style-type: none"> <li>– The foundations of calculate and design the medical gases network.</li> <li>– Gas supply.</li> </ul>	1	2
<b>11</b>	<b>Design of Ventilation System in Hospitals</b>	<ul style="list-style-type: none"> <li>– Introduction.</li> <li>– The effectiveness of the ventilation system.</li> <li>– The basic types of air movement within the room.</li> <li>– Ventilation systems in hospitals.</li> </ul>	1	2
<b>12</b>	<b>Design of Electrical</b>	<ul style="list-style-type: none"> <li>– Safety of electrical systems, protective</li> </ul>	1	2

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IV. Course Contents:				
A. Theoretical Aspect:				
No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
	<b>Power Systems in Hospitals</b>	systems - interference of patient's protection grounding. – Design of sub stations, breakers, Surge protectors, EMI filters, voltage stabilizers, generator sets and UPS. – Uninterrupted power supply for ICU and computerized monitoring units. Specification & estimation for hospital wiring.		
13	<b>Hospital Management and Information System (HMIS)</b>	– Introduction. – The need for managers and their perspectives. – <b>Management</b> : definition, functions, and competencies. – <b>Management positions</b> : the control in the organizational hierarchy. – Roles of the manager. – Role of database HMIS. – Need of networking. – HMIS and Internet. – Centralized data record system. – <b>ERP system modules for hospitals</b> : (Front office and billing system, stores & inventory / pharmacy system, pathology & other diagnostics centre, record room management system, payroll & HR system, financial accounting system, doctors lounge, patient history, maintenance, claims, over time scheduling.).	1	2





IV. Course Contents:				
A. Theoretical Aspect:				
No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
14	Management of Medical Equipment	<ul style="list-style-type: none"> <li>– Introduction.</li> <li>– Acquisition of medical equipment.</li> <li>– Essential medical equipment.</li> <li>– Management of medical equipment maintenance.</li> <li>– Stores and spare parts management.</li> <li>– Training of technicians for medical equipment maintenance.</li> </ul>	1	2
15	Project Presentation	Student's presentations.	1	2
16	Final Theoretical Exam	All topics.	1	2
<b>Number of Weeks /and Units Per Semester</b>			<b>16</b>	<b>32</b>

C. Tutorial Aspect:			
No.	Tutorial	Number of Weeks	Contact Hours
1	These will cover similar material to the lectures.	15	30
<b>Number of Weeks /and Units Per Semester</b>		<b>15</b>	<b>30</b>

V. Teaching Strategies of the Course:
<ul style="list-style-type: none"> <li>– Interactive lectures &amp; examples,</li> <li>– Presentation/seminar,</li> <li>– Interactive class discussions,</li> <li>– Exercises and home works,</li> </ul>



**V. Teaching Strategies of the Course:**

- Computer laboratory-based sessions,
- Workshops practices,
- Directed self- study,
- Team work (cooperative learning),
- Field visits/training,
- Mini/major project.

**VI. Assessment Methods of the Course:**

- Written tests (mid and final terms and quizzes),
- Short reports,
- Lab\Project report
- Coursework activities assessment,
- Home works and assignments,
- Presentations.

**VII. Assignments:**

No.	Assignments	Week Due	Mark
1	Lectures 1,2,3, and 4 Assignment	5	6
2	Lectures 5,6,7, and 9 Assignment	10	7
3	Lectures 10,11,12, and 13 Assignment	14	7
4	Project/ Presentation	15	10
<b>Total</b>			<b>30</b>

**VIII. Schedule of Assessment Tasks for Students During the Semester:**

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No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1	Project/ Assignments	5,10,14, 15	30	20%
2	Quiz 1	4	10	6.67%
3	Midterm Exam	8	30	20%
4	Quiz 2	12	10	6.67%
5	Final Exam	16	70	46.67%
<b>Total</b>			<b>150</b>	<b>100%</b>

<b>IX. Learning Resources:</b>	
<b>1- Required Textbook(s) ( maximum two ).</b>	
	<ol style="list-style-type: none"> <li>1. BM Sakharkar, 2009, “<b>Principles of Hospital Administration and Planning</b>”, 2<sup>nd</sup> Ed., India, Jaypee Brothers Medical Publishers (P) Ltd.</li> <li>2. Cynthia McCullough, 2010, “<b>Evidence-based design for healthcare facilities</b>”, USA, Sigma Theta Tau International.</li> </ol>
<b>2- Essential References.</b>	
	<ol style="list-style-type: none"> <li>1. Dev Raheja, 2019, “<b>Safer Hospital Care Strategies for Continuous Quality Innovation</b>”, 2<sup>nd</sup> Ed., USA, Taylor &amp; Francis Group.</li> <li>2. Sharon B. Buchbinder, Nancy H. Shanks, 2017, “<b>Introduction to Health Care Management</b>”, 3<sup>rd</sup> Ed., USA, Jones &amp; Bartlett Learning, LLC.</li> <li>3. Stefano Capolongo, Marta Carla Bottero, Maddalena Buffoli, Emanuele Lettieri, 2015, “<b>Improving Sustainability During Hospital Design and Operation A Multidisciplinary Evaluation Tool</b>”, Switzerland, Springer International Publishing.</li> <li>4. Annmarie Adams, 2008, “<b>Medicine by Design: The Architect and the Modern Hospital, 1893–1943</b>”, UK, University of Minnesota press.</li> <li>5. John E. Millsap, 2007, “<b>Understanding the Hospital Planning, Design, and Construction Process</b>”, USA, California Healthcare Foundation.</li> <li>6. Ian W. Gibson, 2007, “<b>An Approach To Hospital Planning And Design Using Discrete Event Simulation</b>”, Proceedings of the 2007 Winter Simulation Conference</li> </ol>



3- Electronic Materials and Web Sites etc.	
	<p><b>Websites:</b></p> <ol style="list-style-type: none"> <li>1- American Society for HealthCare Engineering is the largest association devoted to professionals who design, build, and operate hospitals and other health care facilities.  <a href="https://www.ashe.org/">https://www.ashe.org/</a></li> <li>2- Hospitalmanagement.net a comprehensive reference source covering all aspects of the hospital environment, introducing technologies, services and procedures to improve the management of facilities.  <a href="https://www.hospitalmanagement.net/">https://www.hospitalmanagement.net/</a></li> <li>3- Hospitals design.  <a href="https://www.dezeen.com/tag/hospitals/">https://www.dezeen.com/tag/hospitals/</a></li> </ol> <p><b>Journals:</b></p> <ol style="list-style-type: none"> <li>1- Journal of Healthcare Engineering  <a href="https://www.hindawi.com/journals/jhe/">https://www.hindawi.com/journals/jhe/</a></li> <li>2- The Journal of Healthcare Engineering.  <a href="http://www.multi-science.co.uk/jhe.htm">http://www.multi-science.co.uk/jhe.htm</a></li> </ol> <p><b>Other Web Sources:</b></p> <ol style="list-style-type: none"> <li>1- The Medical Futurist works for making a bold vision about the future of healthcare reality today.  <a href="https://medicalfuturist.com/the-future-of-hospital-design-inside-the-point-of-care/">https://medicalfuturist.com/the-future-of-hospital-design-inside-the-point-of-care/</a></li> <li>2- Health Management and Leadership promotion, cross-collaboration amongst key disciplines.  <a href="https://healthmanagement.org/">https://healthmanagement.org/</a></li> </ol>

X. Course Policies:	
<b>1</b>	<p><b>Class Attendance:</b></p> <p>A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hours, student will be</p>

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	required to retake the entire course again.
<b>2</b>	<p><b>Tardy:</b></p> <p>For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.</p>
<b>3</b>	<p><b>Exam Attendance/Punctuality:</b></p> <p>A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam</p>
<b>4</b>	<p><b>Assignments &amp; Projects:</b></p> <p>In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.</p>
<b>5</b>	<p><b>Cheating:</b></p> <p>For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.</p>
<b>6</b>	<p><b>Plagiarism:</b></p> <p>Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.</p>
<b>7</b>	<p><b>Other policies:</b></p> <ul style="list-style-type: none"> <li>- Mobile phones are not allowed to use during a class lecture. It must be closed; <b>otherwise</b> the student will be asked to leave the lecture room.</li> <li>- Mobile phones are not allowed in class during the examination.</li> <li>- Lecture notes and assignments might be given directly to students using soft or hard copy.</li> </ul>