

**INSTRUCTIONS FOR**  
**BME403 CAPSTONE PROJECT 1**  
**BME404 CAPSTONE PROJECT 2**

Please carefully read the following instructions about the *capstone project* which describe the guidelines about the contents and formats of Capstone Projects 1 & 2.

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## 1. Group formation

Please notice that this is a **group project**. At the outset, you should form groups of 3–5 members who share similar research interests. A **group coordinator** should be also nominated for each group.

### 1.1. List of suggested research areas

The students should make a final decision based on their interests and with the help of academic members to choose the project topic. The main list for Biomedical Engineering (BME) *research areas* is given, but not limited to the, below:

**Table 1.** Suggested research areas.

No.	Title
1	Biomedical Signal Processing & Wearable Systems (IMU, EEG, GSR, Vital Signs)
2	Medical Imaging & AI-based Decision Support (LLM, image interpretation, open-source microscopy)
3	Biomaterials & Tissue Engineering (synthetic grafts, hydrogels, injectable polymers, bioadhesive patches)
4	Drug Delivery Systems (nanocarriers, liposomes, renewable resource-based platforms)
5	Regenerative Medicine (zeolite nanoparticles, wound healing, biomaterial scaffolds)
6	Exosome Research (plant/stem cell exosomes, exosome-loaded hydrogels, cytotoxicity studies)
7	Diagnostic Technologies (biosensors, diagnostic kit development, molecular imprinting strategies)
8	Environmental Biomedical Engineering (nano-beads, hydrogels for environmental/biomedical applications)
9	Biological Systems Modelling and Computational Simulation (Cellular and molecular systems, drug delivery and pharmacokinetics, tissue engineering)

### 1.2. List of BME academic members with research areas

After choosing the topic, it is time to find your supervisor based on the research areas described below. **Please beware that each academic member will have a quota in the number of groups to take on (max. 2-3 groups).** The main list for *BME academic members* is given in Table 2.

**Table 2.** Information about academic members.

No.	Name	Research Areas
1	Asst. Prof. Aytaç Durmaz	Biomedical Signal Processing, Wearable Systems, IMU-based Tremor Analysis, Vital Signs Monitoring, AI/LLM-based Decision Support, Open-Source Medical Devices
2	Asst. Prof. İlayda Duru Türkmen	Biomaterials, Tissue Engineering, Synthetic Gingival Grafts, Injectable Polymers, Bioadhesive Wound Healing Materials
3	Asst. Prof. Polen Koçak	Exosomes in Medicine, Plant/Stem Cell Exosomes, Cytotoxicity Studies, Exosome-loaded Hydrogels
4	Assoc. Prof. Ali Zarrabi	Environmental Biomedical Engineering, Nanotechnology, Hydrogels, Drug Delivery Systems, Regenerative Medicine
5	Assoc. Prof. Pınar Çakır Hatır	Drug Delivery, Diagnostic Kit Development, Biomaterials, Smart Hydrogels, Biomarker Recognition, Molecular Imprinting
6.	Asst. Prof. Tuğba Arzu Özal İlideniz	Biological Systems Modelling, Chemistry, Computational Simulation

Note that in case of working with a real dataset and a real organization problem (see Section 3.1), you can propose a co-supervisor from the organization who must have at least a Master's degree and 5-year work experience. Also, if your project is an interdisciplinary one, you can again propose another faculty-member as your co-supervisor. Both cases will be a plus for your project and will be considered in the final grading.

## 2. Project proposal

This proposal consists of several sections describing the basic aspects of your *capstone project*. The intent of writing this proposal is for you:

- ✓ To learn to articulate a reasonable, doable original research project in the last year of study under Capstone Project 1 and Capstone Project 2.
- ✓ To outline each part of the research necessary for the timely completion of your project.
- ✓ To explain in straightforward language what you will study, what question you want to answer, and/or what problem you want to address in an area of communication studies.

### 1.3. *Content*

- I. **Topic on which you want to focus on** (The specific question or hypothesis of your project).
- II. **Practical significance of the project:**
  - (a) What is the relationship between your question/hypothesis and the academic study of the problem?
  - (b) Why is it important to the field of study? What original contribution does it make to real-world problems?
- III. **Proposed method of study (How will you do the project? at least one of the following options):**
  - (a) Quantitative and Qualitative Analyses
  - (b) Optimization / Design of Experiments
  - (c) Simulation Modelling
  - (d) Conceptual Modelling & Prototyping
  - (e) Multi-Criteria Decision Analysis
  - (f) Machine Learning / Deep Learning
  - (g) Hybrid Methods
  - (h) Experimental Biomedical Research
  - (i) Synthesis and Characterization
  - (j) *In vitro* and *in vivo* Biological Evaluation
- IV. **Proposed method of data collection/organization:**
  - (a) How will you gather data/material for your project?
  - (b) What kind of data?
  - (c) How much data – and/or how many participants – do you need for your project to be legitimate?

V. **Expected accomplishments:**

- (a) What achievements do you expect from your project?
- (b) How can you implement and realize your main results?
- (c) How much flexibility can you estimate to extend your achievements in case of any fluctuations in the data or incorporating new assumptions/options for future research?

VI. **Timeline:**

- (a) How can you define the timeline based on the deadlines given to each section?  
(Use a **Gantt chart** as necessary)

### 3. Capstone Project 1

Here, we will have online courses to learn the fundamental principles on different topics

- w1\_Lifelong learning, access to information, following developments in science and technology
- w2\_Ethical principles and standards used in engineering practices
- w3\_Project management, risk management, change management and applications in business life
- w4\_Entrepreneurship, Innovation and Sustainable development
- w5\_The effects of engineering practices on health, environment and safety in universal and societal dimensions, Legal implications of engineering solutions

along weekly quizzes for the first five weeks.

Meanwhile, you can proceed with your project when your proposal is approved by your supervisor. In the first part of your project (Semester 7), we seek presenting the problem, related literature and a review of potential methodologies for the research problem at hand. The deliverable items of Capstone Project 1 are shown in Table 3. You are asked to revise them continuously based on the comments and feedback you received from your supervisors, and then, an *interim report* is provided after making final corrections, including sections of *Introduction, Literature Survey and Review of Potential Methodologies*.

#### 3.1. Data availability

Data availability issue is one of the most critical steps in the project. You have several options to utilize the data collected from

- a. Internships 1 & 2 companies (see notice below)
- b. Any company or organization using questionnaires or forms (see notice below)
- c. Secondary data collected from various data sources
- d. Literature review as benchmarks
- e. Data collected from experiments
- f. Or eligible third-party which needs an approval by the supervisor

Note that options **a** and **b** where you intend to use real data strictly require a permission from the company as well as Istinye University Etik Kurulu. However, such projects are highly encouraged and will be positively discriminated in final grading!

### 3.2. *Interim Report for Capstone Project 1*

This interim report will be part of your final report and should include the **corrected** versions of the following sections (based on supervisor feedback):

1. ***Introduction*** (representing the problem significance and applications)
  - 1.1. *Objectives*
  - 1.2. *Questions*
  - 1.3. *Contributions*
  - 1.4. *Structure of the project*
2. ***Literature survey*** (creating a comparison table is recommended)
3. ***Review of Potential Methodologies*** (presentation of the proposed methodologies)
  - 3.1. *Optimization/Simulation/Conceptual Model*
  - 3.2. *Solution Method (If applicable)*
  - 3.3. *Data collection method*
- References***

## 4. Capstone Project 2

In the second part of your capstone project (Semester 8), we seek presentation of the data collected from your biomedical research experiments demonstrate the implementation of your final methodology. Here, you should clearly report the biomedical research, collected data, as well as the implementation and results of the developed methodology. The deliverable of this part is a final report including 4 sections, namely, *Final Methodology*, *Implementation Results*, *Discussion*, and *Conclusion*.

#### 4.1. Final Report for Capstone Project 2

In addition to Sections 1-3 from Capstone Project 1:

**4. Final Methodology** (add an explanation about the final methodology to be used and its technical details)

#### 5. Implementation Results

5.1. Data/Case

5.2. Numerical/Analytical Results

**6. Discussion & Conclusion** (practical implications and managerial insights, summary of the main findings, limitations and future research directions)

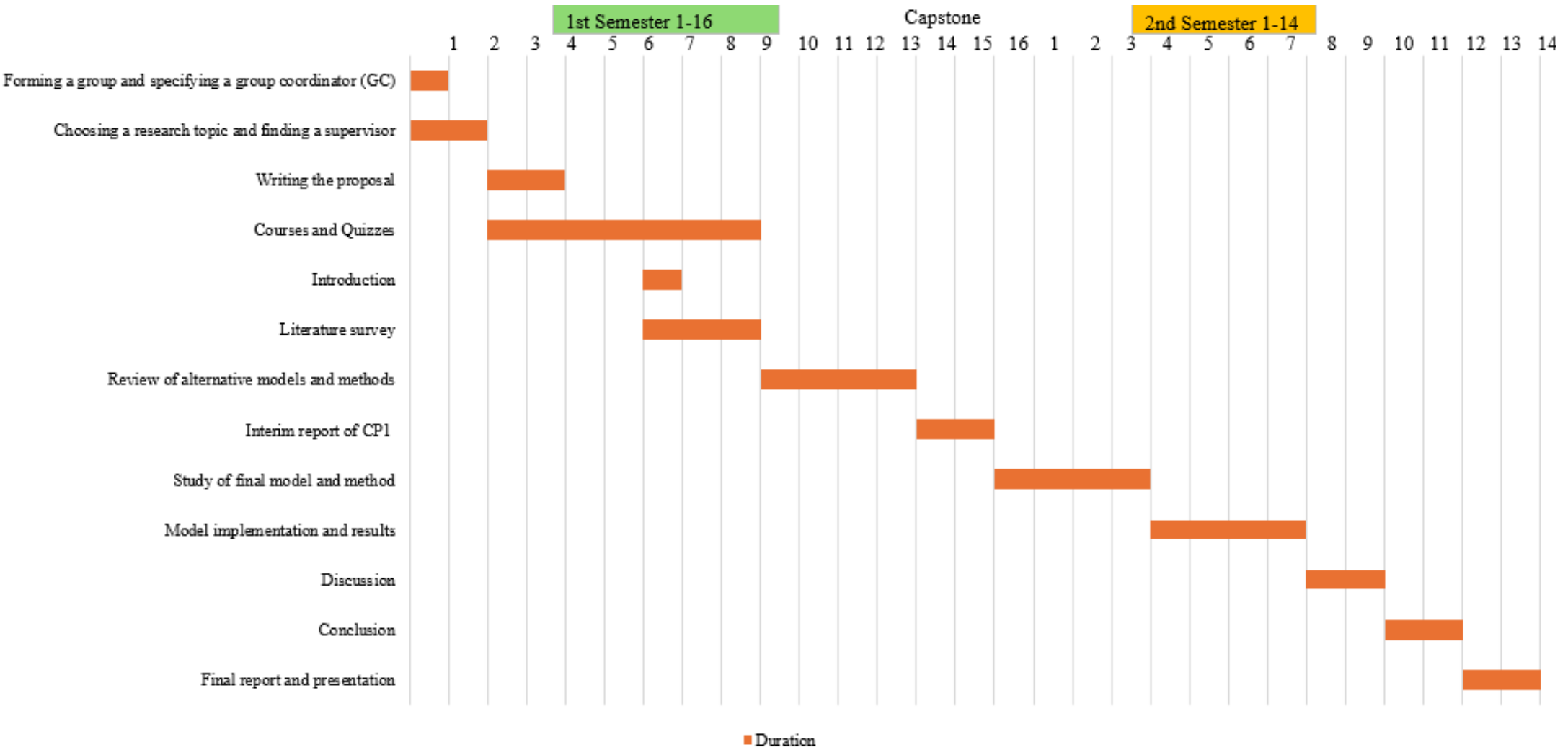
**References** (merged with references from Capstone Project 1)

## 5. Deadlines

Table 3 displays the proposed deadlines to be carefully taken into account.

**Table 3.** Important deadlines for Capstone Project 1.

Actions	Deadlines	Deliverable items
<b>Courses and Quizzes</b>	<b>Weeks 3-7 (1<sup>st</sup> semester)</b>	Records of online courses and quizzes on Blackboard
Forming a group and specifying a group coordinator (GC)	Week 1 (1 <sup>st</sup> semester)	An email to the Capstone Projects Coordinator by the GC
Choosing a research topic and finding a supervisor	Week 3 (1 <sup>st</sup> semester)	An email to the Capstone Projects Coordinator by the GC
Writing the proposal	Week 5 (1 <sup>st</sup> semester)	Approved report (with or without modification) by supervisors (upload it)
Introduction	Week 7 (1 <sup>st</sup> semester)	Approved report (with or without modification) by supervisors (upload it)
Literature survey	Week 10 (1 <sup>st</sup> semester)	Approved report (with or without modification) by supervisors (upload it)
Review of alternative models and methods	Week 14 (1 <sup>st</sup> semester)	Approved report (with or without modification) by supervisors (upload it)
Interim report of CP1	Week 16 (1 <sup>st</sup> semester)	Interim report (upload it)
Study of final model and method	Week 4 (2 <sup>nd</sup> semester)	Approved report (with or without modification) by supervisors (upload it)
Implementation and results	Week 8 (2 <sup>nd</sup> semester)	Approved report (with or without modification) by supervisors (upload it)
Discussion	Week 10 (2 <sup>nd</sup> semester)	Approved report (with or without modification) by supervisors (upload it)
Conclusion	Week 12 (2 <sup>nd</sup> semester)	Approved report (with or without modification) (upload it)
Final report and presentation	Week 14 (2 <sup>nd</sup> semester)	Approved report (with or without modification) by supervisors (upload it)





## 6. Grading

Timely delivery of each section is highly appreciated. Missing each section will affect the remaining sections. Please be careful about the timeline to prevent losing grades. In the following, Tables 4 and 5 respectively show the grading procedure of Capstone Projects 1 & 2 which are defined based on *content quality*, *correctness*, *writing/English* and *timely delivery*.

**Table 4.** Grading of **capstone project 1.**

<b>Deliverable</b>	<b>Grade</b>
Quizzes	25
Proposal	15
Introduction section (Chapter 1)	15
Literature review section (Chapter 2)	15
Methodology section (Chapter 3)	20
Quality of interim report (based on the template)	10

**Table 5.** Grading of **capstone project 2.**

<b>Deliverable</b>	<b>Grade</b>
Methodology section	15
Implementation and Results section	30
Discussion & Conclusion section	20
Quality of Final Report	10
Presentation and Jury Evaluation	25

Please be informed that a **grading policy** will be adopted along with jury (faculty members) grading to calculate your *final grade*. In particular, your project should meet the standards given in the capstone guidelines document.

### 6.1. General grading criteria for each deliverable item: Capstone project 1



#### **Quizzes**

- ✓ Grades obtained from the online exams.



#### **Project Proposal**

- ✓ Are research problem and main idea clearly defined?
- ✓ Are the objectives clear and non-imaginary?
- ✓ How is the quality of writing with respect to the guidelines and English?



#### **Introduction section**

- ✓ Is background information given?
- ✓ Is the significance of the problem explained?
- ✓ Is the problem stated clearly?
- ✓ Are the research objectives and possible contributions clearly defined?



#### **Literature review section**

- ✓ At least 25 high-quality papers must be reviewed from international journals indexed in Scopus and/or WoS, and cited in the report.
- ✓ How relevant are the reviewed papers?
- ✓ A comparison of the literature (tabular form is recommended)
- ✓ How well the gaps are found and discussed?



#### **Methodology section (sub-section 1: review of possible methodologies)**

- ✓ Are the potential methodologies clearly discussed and compared?
- ✓ Are the data requirements and data acquisition methods defined clearly?
- ✓ Has the choice of methodology been discussed and justified?



#### **Interim Report**

- ✓ Are the corrections thoroughly made based on the comments?
- ✓ Is the report in compliance with the writing format?
- ✓ Is the report according to the timeline suggested in the proposal?
- ✓ Is there any significant deviation from the objectives?
- ✓ Are there any inevitable changes to the timeline or project plan affecting the remaining steps?
- ✓ What are the major research outcomes achieved so far?

- ✓ How is the writing quality of interim report?

## 6.2. *General grading criteria for each deliverable item: Capstone project 2*



### **Methodology section (sub-section 2: methodology/-ies used in the project)**

- ✓ Are the research problem and proposed methodology (research framework) well-illustrated?
- ✓ Are the implementation steps explained in detail?
- ✓ Is(are) the data collection technique(s) clearly discussed?
- ✓ Is(are) the data analysis method(s) delineated?
- ✓ How are the evaluation and justification of the methodological choices you make (criteria you use)?



### **Results section**

- ✓ Are the quantitative research results reported using tables, charts, etc.?
- ✓ How well significant and interesting findings are described in conjunction with each illustration?
- ✓ Comparative and sensitivity analyses are recommended.



### **Discussion & conclusion section**

- ✓ Are the key findings discussed properly without missing any specific parts?
- ✓ Are the theoretical and operational limitations of the project and results explained?
- ✓ Are the theoretical and practical implications elaborated?
- ✓ Is the reader reminded of the main research question of the project in a clear way?
- ✓ Is the research project well-summarized with respect to its main sections?
- ✓ Is the key finding of the project highlighted clearly?
- ✓ Are the recommendations for future study given based on the limitations?

## **7. Writing format**

This section gives the required details about the standards to write your proposal and reports.

### *7.1. Writing format of the proposal*

Please follow the format given below to prepare a project proposal:

**Cover page...**

**Abstract...**

**1. Problem Statement...**

**2. Background...**

**3. Project Goals and Objectives...**

**4. Methods...**

**5. Expected Outcomes...**

**6. Timeline...**

**Appendix (if needed)**

**References...**

Moreover, the *cover page format* of the proposal can be found in the **Proposal Template**.

## *7.2. Writing format of the final report*

When you are done with this section, the final report should be prepared in six main sections based on the following format:

**Cover page**

**Abstract** (summarizes the project w.r.t. its significance, contributions and achievements)

**Table of Contents**

**List of Tables**

**List of Figures**

**List of Abbreviations**

**1. Introduction...**

**2. Literature review...**

**3. Methodology...**

**4. Results...**

**5. Discussion and Conclusion**

**Acknowledgement**

**Appendices**

**References**

**Based on the writing format described below, your final report should be restricted to 50 pages (excluding cover page, acknowledgement, references and appendices).**

Moreover, the *cover page format* of the final report can be found in the **Final Report Template**.

### 7.3. *General rules for writing*

#### ❖ **Abstract and keywords**

The abstract should be at least 150 words. The abstract should consist of a single paragraph. The maximum numbers of keywords are 5.

#### ❖ **Length of paper and margins**

In formatting your A4-size paper, the top, bottom, left and right margins should be set to 1 inch.

#### ❖ **Font specification and spacing**

The “main body” of the paper should be set in the Times New Roman font using a 12-point font size. Please set 1 inch margin from left, right, top and bottom.

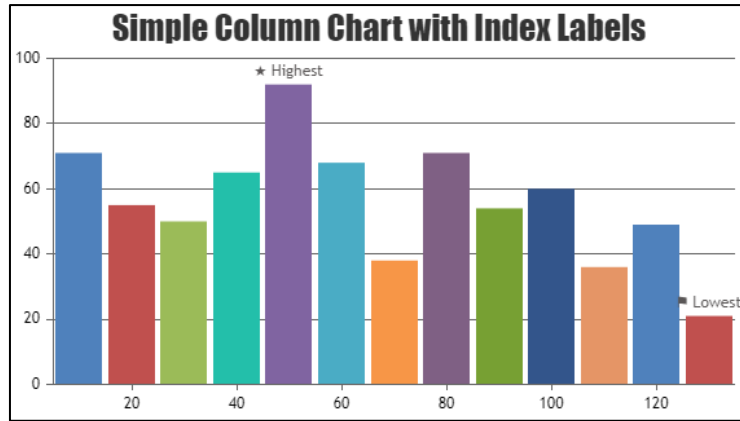
The report should be with 1.5 lines spacing. Use 11-point Times New Roman for the “abstract” and “keywords”.

#### ❖ **Figures and tables**

Figures and tables should be centered within the text and should not extend beyond the right and left margins of the paper. Figures and tables are numbered sequentially, but separately. All tables and figures should be explicitly referenced in the text and they should not be placed before they are referenced.

Use 11-point Times New Roman for the “contents of the tables and figures” and also use 11 points (bold) Times New Roman for the “captions of the tables and figures”. Each figure should appear in the text after the paragraph in which the figure is first referenced.

Figure 1 is an example that authors may find useful. Table 1 in Subsection 1.2 is also a useful example of the tables.



**Fig. 1.** Obtained results of the study.

### ❖ Equations and formulas

Equations and formulae should be typed and numbered consecutively with Arabic numerals in parentheses on the right-hand side of the page (if referred to explicitly in the text),

$$w = \frac{x_1 + 3x_2}{y^2(1 - k)}. \quad (1)$$

### ❖ Acknowledgment

Place the acknowledgments section, if needed, after the main text, but before any appendices and references. The section heading is not numbered.

### ❖ Appendix

Place any appendices after the References and label them A, B, C, and so forth.

### ❖ References

Your references should be published materials accessible to the public. “References” should be set in *APA format* and the Times New Roman font using an **11-point font size**.

Place the list of references after the appendices. The section heading is “References” and is not numbered. List only references that are cited in the text. Arrange the references in alphabetical order.

#### Journals:

Chaturvedi, S., Rajasekar, E., & Natarajan, S. (2020). *Multi-objective building design optimization under operational uncertainties using the NSGA II algorithm*. Buildings, 10(5), 88.

Books or conferences:

Jensen, P. A., & Bard, J. F. (2002). *Operations research models and methods*. John Wiley & Sons.

Radivojević, G., & Milosavljević, L. (2019). *The concept of logistics 4.0*. In 4th Logistics International Conference, 23-25.

Web references:

Wikipedia, “Bee”. Available at <https://en.wikipedia.org/wiki/Bee>. [Accessed on February 21, 2016].