

COURSE CONTENT

(1) GENERAL INFO

SCHOOL	ENGINEERING		
DEPARTMENT	BIOMEDICAL ENGINEERING		
MSc PROGRAM	BIOMEDICAL ENGINEERING AND TECHNOLOGY		
STUDY LEVEL	POSTGRADUATE, MSc		
COURSE CODE	BMET102	SEMESTER	A
COURSE TITLE	Research methodology		
TEACHING		HOURS	ECTS
	LECTURES	39	2
COURSE TYPE	SPECIALIZATION		
COURSE REIUREMENTS:	-		
TEACHING AND EXAMINATION LANGUAGE:	ENGLISH		
IS THIS COURSE OFFER TO ERASMUS STUDENTS	YES (IN ENGLISH)		
COURSE WEBPAGE (URL)	https://eclass.uniwa.gr/courses/299/		

(2) LEARNING OUTCOMES

Learning outcomes
<p>Course Objectives: The course will introduce the basic principles of research methodology (initial hypothesis, data collection, data analysis, publication of results, ethics, and personal data protection issues) and the methodology of drafting scientific articles. Upon completion of this course, students will have a comprehensive understanding of the basic principles of research methodology, they will know how to write a scientific report/essay, and they will be prepared to communicate technical concepts and ideas clearly and concisely through written reports, oral presentations, and visual aids.</p> <p>Learning Outcomes:</p> <ol style="list-style-type: none"> 1. Gain a comprehensive understanding of research methodology. 2. Describe and differentiate the different types of research with emphasis the biomedical engineering domain. 3. Recognize and address ethical considerations in research, ensuring responsible conduct throughout the research process. 4. Apply statistical techniques to analyze quantitative and qualitative data, interpreting results and drawing valid conclusions from statistical analyses using relevant software tools. 5. Construct a well-organized and persuasive research proposal, including a clear introduction, literature review, methodology, and ethical considerations. 6. Produce clear and concise research reports, with appropriate formatting and citation styles, and communicate research findings to diverse audiences through written assignments and oral presentations. 7. Critically evaluate and apply advanced topics in research methodology, such as meta-analysis, longitudinal studies, and emerging trends in research methods. <p>Achievement of Course Objectives and Learning Outcomes: To fulfill the above objectives and learning outcomes, students will be taught basic concepts of research methodology, the different types of research with emphasis to the biomedical engineering domain, the methods for formulating research questions, the methods for designing a solid research protocol, data collection approaches, ethical considerations for data collection and relevant approvals, data analysis approaches, writing of research proposals, writing of research papers and scientific publishing, presentation skills. Students will be asked to conduct a small-scale research protocol which</p>

will include data collection, data analysis, writing of a scientific article and presentation of results in front of audience.

General abilities

- Search, analysis and synthesis of data and information, using the necessary technologies
- Adaptation to new situations
- Decision-making
- Autonomous work
- Teamwork
- Working in an international environment
- Working in an interdisciplinary environment

(3) COURSE CONTENT

«Introduction to research methodology»

Definitions, basic concepts, importance of research, research in academic and professional contexts, basic vs applied research, types of research, ethics in research, research in biomedical engineering.

«Formulating research questions»

Definitions, basic concepts, development of clear and concise research questions, definition of research objectives and hypotheses.

«Research design and data collection»

Definitions, basic concepts, experimental vs non-experimental design, surveys and questionnaires, data collection methods, ethical considerations for data collection and relevant approvals.

«Data analysis»

Definitions, basic concepts, quantitative data analysis, statistical analysis, qualitative data analysis, questionnaire data analysis, combination of quantitative, qualitative and questionnaire data analysis.

«Writing of research proposals»

Definitions, basic concepts, call for applications for funding of research proposals, components of a research proposal, proposal writing techniques and guidelines.

«Writing of research papers»

Definitions, basic concepts, components of a research paper, scientific writing techniques and guidelines, characteristics and structure of research paper, peer-review, scientific publishing, open access, impact factor, h-index, qualitative and quantitative metrics in scientific publishing.

«Presentation skills»

Definitions, basic concepts, developing effective oral and poster presentations, identifying the target audience, communicating research findings to diverse audiences, structuring poster and oral presentation.

«How to read scientific literature»

Definitions, basic concepts, scientific databases (PubMed, IEEE Xplore, Scopus, Google Scholar, etc.), searching for relevant scientific literature using keywords and filters, anatomy of a research article, evaluating research validity, critical analysis.

(4) TEACHING AND LEARNING METHODS - EXAMINATIONS

COURSE DELIVERY	Physical presence, face to face at the auditorium
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	The course involves the use of a projector for presenting fundamental concepts and is supplemented by the use of the blackboard at the auditorium.

TEACHING ORGANIZATION	Activity	Semester workload
	Teaching / lectures	39
	Lecture material study	30
	Unsupervised literature review and preparation of the final project	56
	Total	125
STUNDET EVALUATION	50% Final exam paper with multiple-choice questions, short-answer questions, and problem-solving questions. 30% Individual written assignment. 20% Oral presentation of assignment.	

(5) SUGGESTED LITERATURE

Books, scientific articles and related scientific resources:

- [1] C.R Cothari, Research methodology, methods and techniques, New Age international Publishers, 2004.
- [2] V. Y. Totten, E. A. Panacek, and D. Price, Basics of research (Part 14). Survey research methodology: designing the survey instrument, Air Med J, vol. 18, pp. 26-34, Jan-Mar 1999.
- [3] M. P. Smeltzer and M. A. Ray, Statistical considerations for outcomes in clinical research: A review of common data types and methodology, Exp Biol Med (Maywood), vol. 247, pp. 734-742, May 2022.
- [4] H. H. Goh and P. Bourne, Ten simple rules for writing scientific op-ed articles, PLoS Comput Biol, vol. 16, p. e1008187, Sep 2020.
- [5] I. G. Stiell and E. M. W. G. Canadian, Guide to writing and publishing a scientific manuscript: part 2- the process, CJEM, vol. 24, pp. 120-122, Mar 2022.
- [6] B. Dietz, Towards a history of scientific publishing, Hist Sci, vol. 60, pp. 155-165, Jun 2022. J. Webster, Medical Instrumentation: Application and Design, Wiley; 4th edition, 2009.
- [7] D. L. Baptiste, N. Caviness-Ashe, N. Josiah, Y. Commodore-Mensah, J. Arscott, P. R. Wilson, et al., Henrietta Lacks and America's dark history of research involving African Americans, Nurs Open, vol. 9, pp. 2236-2238, Sep 2022.
- [8] R. D. Truog, A. S. Kesselheim, and S. Joffe, Research ethics. Paying patients for their tissue: the legacy of Henrietta Lacks, Science, vol. 337, pp. 37-8, Jul 6 2012.
- [9] Ethics and data protection, https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-and-data-protection_he_en.pdf
- [10] J. H. Abbott, Reporting Guidelines and Checklists Improve the Reliability and Rigor of Research Reports, J Orthop Sports Phys Ther, vol. 46, p. 130, Mar 2016.
- [11] I. Simera, D. Moher, A. Hirst, J. Hoey, K. F. Schulz, and D. G. Altman, Transparent and accurate reporting increases reliability, utility, and impact of your research: reporting guidelines and the EQUATOR Network, BMC Med, vol. 8, p. 24, Apr 26 2010.
- [12] M. R. Munafo and J. Flint, How reliable are scientific studies?, Br J Psychiatry, vol. 197, pp. 257-8, Oct 2010.
- [13] E. S. Allen, J. M. Burke, M. E. Welch, and L. H. Rieseberg, How reliable is science information on the web?, Nature, vol. 402, p. 722, Dec 16 1999.

Scientific journals:

- [1] Research on Biomedical Engineering, <https://link.springer.com/journal/42600>.
- [2] BMC Medical Research Methodology, <https://bmcmmedresmethodol.biomedcentral.com/>.
- [3] Research Methods in Medicine & Health Science, <https://journals.sagepub.com/home/rmm>.
- [4] IEEE Transactions on Biomedical Engineering, <https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=10>.