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# RES311 METHODS OF RESEARCH FOR MECHANICAL ENGINEERING *A.Y. 2021-2022*



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## RES311 METHODS OF RESEARCH FOR MECHANICAL ENGINEERING

Welcome to this course, RES311 Methods of Research for Mechanical Engineering!

With the current situation, we are experiencing a “new normal” in the delivery of higher education in the country. Every student should watch the Student Virtual Orientation SY 2020-2021 that was aired via Facebook last September 11, 2020. The video presentation is available in the official Facebook page of Romblon State University or click the link below:

<https://www.facebook.com/RomblonStateUniversity/videos/320989219129054>

At the same time, the College of Engineering and Technology also presented a live streaming of its online orientation held on September 14, 2020 and please watch again for its recorded video at:

<https://www.facebook.com/rsucetwhitewolves/videos/913465115844625>

If these links are not working properly, every student should visit the FB official pages of the RSU and CET to look for these videos, including latest news and updates.

As part of the comprehensive continuity and flexible learning plan of the university in time of pandemic, there are different learning strategies to be implemented to ensure equal opportunity of quality education through flexible learning modalities for the students. One of these modalities is the online/e-learning (blended) that involves the use of learning systems and platforms available in the digital world.

Specifically, in the delivery of this course, the primary mode of delivery of instruction is through the internet using the free and public domains powered by Google Classroom and Weebly. Other optional domains to be utilized are Canvas, Moodle and Edmodo, particularly in giving major quizzes and examinations. Please note however, that connectivity is a big challenge for faculty and students, but “flexibility” in terms of compliance with the requirements towards completion of the course will be extended. However, this flexibility will be applied to those students who have experiencing difficulties during the delivery of the course.

Please take note of the following learning platforms links specifically for this course:

[www.rsucivilengineering.weebly.com](http://www.rsucivilengineering.weebly.com)

[www.brainitiativesph.com](http://www.brainitiativesph.com)

<https://classroom.google.com/u/1/c/Mzk4NzgwNTYyNzcw>

Class code: znphwoj

**REMEMBER:** Please read carefully the syllabus for better apprehension of the course. Handouts and other instructional/reading materials will be uploaded in the above-mentioned these websites on a weekly basis. It is expected that every student should download and read these materials. E-files or hard copies are available upon request and students are responsible for having them photo copied or printed. Special arrangements will be done on case-to-case basis in accessing these hardcopies. And most importantly, please take note of the rules and policies to be strictly followed during the course.





- It is an honest, exhaustive/comprehensive, intelligent searching for facts, their meanings or implications with reference to given problem.
- It constitutes a method for the discovery of truth which is a method of critical thinking
- It is a continuous discovery and exploration of the unknown
- It is a systematic study of trend or event which involves careful collection, presentation, analysis and interpretation of quantitative data or facts that relates to man's thinking with reality
- It is a movement – movement from the known to unknown. A voyage of discovery
- It can lead to uncovering the answers to impossible questions
- Research is not about finding out something that someone else knows – research means pushing forward the boundaries of human knowledge
- Research is a process of collecting and analyzing data for the advancement of knowledge

According to online Oxford Concise Dictionary, research is *a systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions. Origin: Late 16th century from obsolete French recherche (noun), rechercher (verb), from Old French re- (expressing intensive force) + chercher 'to search'.*

#### **HOLISTIC DEFINITION OF RESEARCH**

- It is a systematic method consisting of enunciating/articulating the problem, formulating a hypothesis, collecting the facts or data, analyzing the facts and researching certain conclusions either in the form of solutions towards the concerned problem or in certain generalization for some theoretical formulation
- It comprises of defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis



***In other words, the essence of all research originates in curiosity – a desire to find out how and why things happen, including why people do the things they do, as well as whether or not certain ways of doing things work better than others.***



## 2. Why Research?

### ***It is important to conduct or do research because:***

- It is a major contributor towards attainment of national development goals
- It plays a major role in shaping the nature's future development and modernization
- In particular, undergraduate or college thesis is not compilation of the ideas of the writers or researchers but an organization of their views in one's own way to show the relation of the different ideas and if possible, to draw conclusions based on one's readings.
- Its purpose to answer a specific question, to solve a particular controversy or issue
- Its primary objective is to (a) seek new knowledge and (2) provide useful information in the form of verification.

### ***Thus the value of Research to Man as follows:***

- Research improves quality of life – to ease burden of work; to relieve from suffering
- Research improves instruction – teaching techniques/methods
- Research improves student's achievement – academic accomplishment
- Research improves teacher's competence – professional growth and credibility
- Research satisfies man's needs – satisfying man's craving for understanding; and improves judgments
- Research has deep-seated psychological aspects
- Research improves the exportation of food products
- Research responds to the economic recovery and austerity measure of the country
- Research trains graduates to become responsive to the economic development of the country and compete globally (ASEAN integration and entrepreneurship)

### **Overall, some of the practical benefits of research are as follows:**

- Government policies (desired outcomes for better living condition of the people and its communities)
- Decision-making (effective and strategic planning)
- Social and cultural interactions (better collaborations and programs for people)
- Medicinal and health purposes (well-being)
- Environmental awareness and protection (disaster and calamities)
- Inventions of products (to live easier for humans and animals)

## 3. Benefits of research writing process (Individually)

- It help hone important and necessary individual skills such as critical thinking, organization, self-discipline, and teamwork.  
Critical Thinking: to able to reason analytically; examining the information in terms of logic, reason, and strength of claims; learning to look at alternative reasons or showing different sources of evidence; recognizing other people's arguments and become aware of inconsistencies.



Organization: ability to focus in thinking and writing, to be cohesive (consistent) and coherent (clear or logical).

Self-discipline and perseverance: it is about delaying gratification (satisfaction/fulfillment) to gain something of greater value; or not giving up despite difficulties and challenges.

Teamwork: It is the willingness to work on a common aim; communicate effectively, clarify expectations and discuss differences amicably (harmoniously).

#### 4. Characteristics of Research

- a. Empirical – direct/practical experience or observation
- b. Logical – valid procedures and principles; orderly manner
- c. Cyclical- it starts with a problem and ends with a problem; continuous endeavor
- d. Analytical – utilize proven analytical procedures in gathering data, whether historical, descriptive, experimental and case study
- e. Critical – exhibits careful and precise judgment; to establish a higher level of confidence
- f. Methodical – in methodical or orderly manner without bias using systematic/organised methods and procedures
- g. Replicability – research design and procedures are replicated or repeated to enable the researchers to arrive at valid and conclusive results. It mean using the same instrument, method and procedure but to different venues and subjects

#### 5. Qualities of a Good Researcher

R = research-oriented, E=efficient, S= scientific, E= effective,  
A=active, R=resourceful, C=creative, H=honest, E= economical, and  
R=religious (*Paler-Calmorin & Calmorin, 2007*)

**R= responsibility, E=excellence, S=scholarly, E=enhancement,  
A=acceptability, R=re-invent, C=career, H=heart, E=extension,  
R=rewards/recognition**

#### 6. Characteristics of the Researcher

- a. Intellectual curiosity – deep thinking and inquiry
- b. Prudence –careful to conduct research at the right time and place, wisely, efficiently and economically.
- c. Healthy criticism – always doubtful as to the truthfulness and veracity/authenticity of the results
- d. Intellectual Honesty – honest to collect or gather data or facts in order to arrive at honest results
- e. Intellectual Creativity – creates new researches and innovative





## 7. Types of Research

- a. Basic Research – called fundamental research or pure research which seeks to discover basic truths or principles. (Boyle’s Law, Charles Law, Archimedes Law, Newton’s Law, Hooke’s Law)
- b. Applied Research – seeking new applications of scientific knowledge to the solution of a problem
- c. Developmental Research – decision-oriented research involving the application of the steps of the scientific method in response to an immediate need to improve existing practices

## 8. Classification of Research

- Library Research – done in the library where answers to specific questions or problems. Field and laboratory researches also make use of the library researches
- Field Research – conducted in a natural setting and applicable to descriptive survey and experimental methods
- Laboratory Research – conducted in artificial or controlled conditions by isolating the study in a thoroughly specified and equipped area. It is applicable to experimental, descriptive and case study methods

**According to Calderon & Gonzales (2016)**, there are many kinds of research which are classified according to their distinctive features such as follows: (a) according to purpose – predictive, directive, illuminative; (b) according to goal – basic, pure or applied; (c) according to the levels of investigation – exploratory, descriptive, experimental; (d) according to the type of analysis – analytic or holistic; (e) according to scope – action research (problem solving); (f) according to choice of answers to problems – evaluative or developmental; (g) according to statistical content – quantitative or non-quantitative (qualitative); according to time element – historical (what was), descriptive (what is), experimental (what will be) - there are the three major research methods; (h) according to the area or field of activity – sociological, social, psychological, chemical, physical, industrial, business, economics, health, educational, etc.)

## 9. Ethics and Research

The terms “ethics” refers to questions of right and wrong (Fraenkel, Wallen & Hyun, 2013). Every conduct research project should follow or carry out a certain right procedures or without violating of ethical practice. There are a number of ethical principles in the conduct of research study. “Ethical” principles mean that “conforms to the standards of conduct of a given profession or group.” Therefore, “ethical writing” should be “clear, accurate, fair and honest (cited by Faltado et al, 2016).



The following are some of the basic principles of ethical practice (Faltado et al, 2016; Fraenkel, Wallen & Hyun, 2013; and Philippine Social Science Council).

1. Obtained informed consent from participants – the research is communicated properly
2. There should be no pressure on individuals to participate – Incentives/tokens for encouragement
3. Respect individual autonomy – withdrawal from the study; freedom to decide
4. Avoid causing harm/protecting participants from harm – informed consent; voluntary participation; beneficence – “do good; do not harm”
5. Maintain anonymity and confidentiality – data privacy to protect participant’s identity
6. Take particular care in research with vulnerable/marginalized/disadvantaged groups or at-risk individuals and groups – young children/minors, disabled people, indigenous people; regardless of their age, gender, social class, disability ethnicity, and physical/mental health.
7. Integrity – commitment to accuracy, intellectual honesty and truthfulness (PSSC)
8. PLAGIARISM – It is using of someone else’s words or ideas, and passing them off as your own. It is considered as an academic cheating – without proper use of someone’s words with referencing the source of citing the information. This will be fully discussed in the “Review of Literature.” This also related to Republic Act No. 8293, the Intellectual Property Code of the Philippines where original works of others are protected as copyrighted or patented.



#### **10. Basic Definition of Terms**

**KNOWLEDGE:** It is a prime source of beauty, sociability, practicability, work and reason, discussion and speculations. It is one aspect or other exists in a person in an unusual manner which is transferred from generation to another generation. Knowledge can be derived or sourced from: formal (experience, nature), informal (logic, efforts, intuition), informal (mistakes common sense), and educational (practical).

**INQUIRY/ENQUIRY:** It is an approach to learning that involves a process of exploring the natural or material world that leads to asking questions and making discoveries in the search for new understandings. It is a process that has the aim of augmenting knowledge, resolving doubt or solving a problem. The nature of inquiry:

- It is in the form of problem, question, an obstacle, discussion, interview or encounter, hypothesis, verifiable, checklist and divergent (different/opposing) thinking



**SCIENTIFIC THINKING:** It is an inductive-deductive mode of thinking or reasoning. It is based on empirical (experimental/observed/realistic) evidences and establishes cause and effect relationship. Thus, a research is an example of scientific thinking

**CRITICAL THINKING:** It defined as having a healthy skepticism (doubt or disbelief) that is able to reason analytically. Analyze where the ideas come from and if the information is factual; examine logic, reason, and strength of claims; formulate reasons and come-up with methods fostered/taken from critical thinking; test your own claims and how reasonable your claims are; learn to look at alternative reasons or show different sources of evidences. Critical thinking helps researcher to arrive at a sound decision especially when there are inconsistencies in various arguments.

**THEORY:** It indicates towards the value of artificial and innovative usability. It is an attempt to develop a general explanation for some phenomenon. It is concerned with explanation and therefore focuses on determining cause-effect relationship. It is also clarifies the relationship between evidences and at the same time it gives meaning to the existed relationship and thus presents it in an appropriate form.

**SCIENTIFIC METHOD:** It involves testing of ideas in the public arena. Private procedures, speculations, and conclusions are not scientific until they are made public. The general order of the scientific method is as follows: (a) identifying a problem or question, (b) clarifying the problem, (c) determining the information needed and how to obtain it, (d) organizing the information, and (e) interpreting the results.

#### REQUIRED READING MATERIALS

- Hoffman, H. (2014). *The Engineering Capstone Course Fundamentals for Students and Instructors*, London: Springer. Retrieved from <https://www.pdfdrive.com/the-engineering-capstone-course-fundamentals-for-students-and-instructors-e177323539.html>
- Dawson, C. (2009). *Introduction to Research Methods, A Practical Guide for Anyone Undertaking a Research Project*, 4<sup>th</sup> Edition, UK: How to Content. Retrieved from <https://www.pdfdrive.com/introduction-to-research-methods-a-practical-guide-for-anyone-undertaking-a-research-project-d157725135.html>
- Vanderstoep, S. & Johnston, D. (2009). *Research Methods for Everyday Life: Blending Qualitative and Quantitative Approaches*, USA: Jossey-Bass. Retrieved from <https://www.pdfdrive.com/research-methods-for-everyday-life-blending-qualitative-and-quantitative-approaches-research-methods-for-the-social-sciences-d161070302.html>
- Neuman, W. (2014). *Social Research Methods: Qualitative and Quantitative Approaches*, 7<sup>th</sup> Edition, UK: Pearson Education Limited. Retrieved from <https://www.pdfdrive.com/social-research-methods-qualitative-and-quantitative-approaches-e19744746.html>
- Johnson, R. & Christensen, L (2014). *Educational Research: Quantitative, Qualitative, and Mixed Approaches*, USA: SAGE Publications, Inc. Retrieved from <https://ismailsunny.files.wordpress.com/2017/07/educational-research-quantitat-r-robert-burke-johnson.pdf>



**MODULE ASSESSMENT**

**ASSESSMENT #1: IDENTIFICATION OF RESEARCH TOPICS OF INTEREST**

Download the list of theses submitted to the College of Engineering and Technology (CET). Identify those theses submitted in the Mechanical Engineering Program. Submit at least five (5) titles of the theses. For each title briefly explain why these selected titles are considered capstone projects. You have to be specific in your answers per title as guided by Module #1 in terms of the coverage and relevance/significance of a capstone project.

Title of the Thesis	Briefly explain why you selected this topic/title. Why this topic/title relevant or important?
1-5 List of ME Thesis	

**Reminder: Copying from your classmates will not be tolerated. It can be considered as “plagiarism.” Similar answers will mark a “failing score.”**

**Submit your answers thru Google Classroom. Point deduction for late submission. Write your answers in a notebook. This is a handwritten assignment and take a photo of the pages of your answers and submit with a file name: SURNAME\_ASSESSMENT#1. Write also your name on the pages of your notebook for easy identification.**

**DEADLINE: TO BE ANNOUNCED IN THE CLASS**

**“PLAGIARISM IS AN ACADEMIC OFFENSE, NOT TO BE TOLERATED”**

**REFERENCES AND OTHER SUGGESTED READING MATERIALS**

Albert, J. R. (2008). *Basic Statistics for the Tertiary Level*, Padua, Patungan & Marquez (eds), Manila: Rex Book Store

Ariola, M. (2016). *Principles and Methods of Research*, 1<sup>st</sup> Edition, Quezon City: Rex Store, Inc.

Asaad, A. S. (2008). *Statistics Made Simple for Researchers*, Manila: Rex Book Store

Calderon, J. & Gonzales, E. (2016). *Methods of Research and Thesis Writing*, Mandaluyong City: National Book Store

Castillo, F. S. (2007). *Research Education and Scientific Writing*, Latest Edition, Manila: Booklore Publishing Corporation

Faltado, R., Bombita, M, Boholano, H. & Pogoy, A. (2016). *Practical Research 2. Quantitative Research for Senior High School*, Metro Manila: Lorimar Publishing, Inc.

Finkelsten, L. Jr (2005). *Pocket Book of Technical Writing for Engineers and Scientists*, 2<sup>nd</sup> Edition, McGraw-Hill (Asia)



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- Fraenkel, K. R., Wallen, N. E., and Hyun, H. H. (2013). *How to Design and Evaluate Research in Education, 8<sup>th</sup> Edition*, New York, USA: McGraw-Hill International Edition
- Frankfort-Nachmias, C., and Nachmias, D. (1997). *Research Methods in the Social Sciences, 5<sup>th</sup> Edition*, London: Arnold.
- Fraenkel, K. R., and Wallen, N. E. (2010). *How to Design and Evaluate Research in Education, 7<sup>th</sup> Edition*, New York, USA: McGraw-Hill International Edition
- Hair, J., Celsi, M., Ortinau, D. and Bush, R. (2017). *Essentials of Marketing Research, 4<sup>th</sup> Edition*, New York: McGraw Hill Education
- Jha, A. S. (2011). *Research Methodology*, Delhi, India: APH Publishing Corporation
- Lavina, C., Manabo, R., Hernandez, G., Hablanida, F., Lacorte, A., & Gaza-Ebron, J. (2016). *Outcomes-based Practical Guide to Thesis and Capstone Project Writing in Computing*, Manila: Mindshapers, Co., Inc.
- Mustafa, A. (2010). *Research Methodology*, India: AITBS Publishers
- Paler-Calmorin, L, & Calmorin, M. A. (2007). *Research Methods and Thesis Writing, 2<sup>nd</sup> edition*, Manila: Rex Book Store
- Philippine Social Science Council (n.d.). *Code of Ethics in Social Science Research*. Retrieved from <https://pssc.org.ph/sserb>
- Sanchez, C. A. (1997). *Methods Techniques of Research, 3<sup>rd</sup> Edition*, Manila: Rex Book Store
- Tayie, S. (2005). *Research Methods and Writing Research Proposals*, Pathways to Higher Education Project, Center for Advancement of Postgraduate Studies and Research in Engineering Sciences, Faculty of Engineering – Cairo University
- Trinidad, J.E (2018). *Researching, Philippine Realities: A Guide to Qualitative, Quantitative, and Humanities Research*, Quezon City: Ateneo De Manila University Press
- Walliman, N. (2018). *Research Methods the Basics, Second Edition*, London and New York: Routledge Taylor & Francis Group.

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