

COURSE OUTLINE FOR URECA STUDENTS AT NTU

Academic Year	1	Semester	2
Course Coordinator	<i>A/P Sivakumar AI, Siva Director, URECA Programme</i>		
Course Code	<i>xx9015 - UNDERGRADUATE RESEARCH 1st URECA xx9016 - UNDERGRADUATE RESEARCH 2nd URECA xx9017 - UNDERGRADUATE RESEARCH 3rd URECA (first and second letters - School/Programme which offer the course)</i>		
Course Title	<i>URECA Undergraduate Research</i>		
Pre-requisites	<ul style="list-style-type: none"> • <i>A full-time matriculated NTU undergraduate;</i> • <i>Meet enrolment criteria as set by the university;</i> • <i>2nd Year (in a 3-year Bachelor's degree programme);</i> • <i>2nd or 3rd Year (in a 4-year Bachelor's degree programme);</i> • <i>2nd, 3rd or 4th Year (in a 5-year Bachelor's degree programme);</i> • <i>Require a minimum of 1 academic year remaining (semester 1 and semester 2) before graduating.</i> 		
No of AUs	<i>4</i>		
Contact Hours	<i>52 hours</i>		

Course Aims

The URECA undergraduate research programme aims to cultivate a research culture among the outstanding undergraduates in NTU. The 11-month (August to June) URECA programme provides you with an opportunity to pursue appropriate independent research under the supervision of a professor of your choice in your chosen field of research. You will learn to apply knowledge beyond textbook and classroom, develop a deeper understanding of what you are studying, handle open ended research challenges and acquire the research skills necessary to your field of study and future career in research or elsewhere. URECA programme aims to prepare you for your postgraduate research studies by providing appropriate foundations in research in your chosen area.



Intended Learning Outcomes (ILO)

By the end of the course, you should be able to:

- 1. define research problems;*
- 2. conduct literature review;*
- 3. formulate hypothesis and research planning;*
- 4. analyze and interpret research data;*
- 5. identify appropriate research methodologies;*
- 6. reflect on how you have conducted the research in your chosen area;*
- 7. communicate research ideas and information across different platforms (poster, academic writing & presentation).*

Course Content

You will experience independent learning through research work of your chosen project under the supervision of a professor.

Assessment (includes both continuous and summative assessment)

Component	Course ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/ Individual	Assessment rubrics
<i>1. Workshops & Quiz</i>	<i>2, 4, 7</i>	Communication Creativity, Civic-Mindedness, Competence and Character	<i>15%</i>	<i>Individual</i>	
<i>2. Research poster</i>	<i>1,2,3,4, 5,7</i>	Communication, Creativity, Civic-Mindedness, Competence and Character	<i>20%</i>	<i>Individual</i>	<i>Appendix 1</i>
<i>3. Abstract of research</i>	<i>1,2,3,5, 7</i>	Communication, Creativity, Civic-Mindedness, Competence and Character	<i>10%</i>	<i>Individual</i>	<i>Appendix 2</i>
<i>4. Research paper</i>	<i>1,2,3,4, 5,6,7</i>	Communication, Creativity, Civic-Mindedness, Competence and Character	<i>30%</i>	<i>Individual</i>	<i>Appendix 3</i>



5. Reflection of research experience	6	Communication, Creativity, Civic-Mindedness, Competence and Character	10%	Individual	Appendix 4
6. Professor assessment of research experience demonstrated during URECA	1,2,3,4,5,6,7	Communication, Creativity, Civic-Mindedness, Competence and Character	15%	Individual	Appendix 5
Total			100%		

Formative feedback

You will receive individual formative feedback either written / verbal or both written and verbal from your supervising professor on the progress of your research project and URECA deliverables.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Research Experience	<i>You will need to adopt a hands on method of achieving research experience in which you are usually assigned to the laboratory or research groups of postdoctoral researchers and PhD research students of your supervising professor. This inculcates a culture of research mindset and learning under open endedness. You will review published literature to achieve a greater understanding of your research area, which leads you to define the research problem under the guidance of your supervising professor. The roles of your supervising professors are to mentor students, facilitate discussion and to guide you to acquire research experience, research fundamental and methodologies related to the chosen research area. You are expected to do independent research, under the mentorship and guidance of the supervising professor. You are expected to apply theories and methodologies and conduct appropriate experiments, surveys or analysis as appropriate to your research area. Finally you are expected to communicate your research through research poster, abstract of research and finally conclude your work with preparing a research paper in journal format. The workshops are integral part of this programme which provides the necessary skills to do the above.</i>



Reading and References

List of readings and references are dependent on the research field of your chosen project. Supervising professor will recommend the list of readings and references.

Course Policies and Student Responsibilities

During Add/Drop Period

You may change URECA project/supervising professor or withdraw from URECA programme during the Add/Drop period (up to end of September).

URECA programme withdrawn during the Add/Drop period will not be reflected in the official transcript.

During add/drop period, with the approval of your URECA supervising professor you may change supervisor or withdraw from the URECA programme by requesting your URECA supervising professor to deregister you. You should receive an auto notification email of your withdrawal after your URECA supervising professor has activated it.

After Add/Drop Period

A student who is still registered for URECA programme after the URECA Add/Drop period but did not subsequently complete the project will be deemed to have read and failed the course. An 'F' grade will appear on your official transcript.

True exception

After add/drop period you can only withdraw from URECA under truly exceptional circumstances. In such exceptional circumstance you may complete the URECA De-registration form from URECA website and submit for approval. Your withdrawal is subject to approval from all concerned. Once approved, your URECA supervising professor will deregister you and you will receive an auto notification email of your withdrawal.

FYP and URECA

If you have started / are starting / will be starting your FYP (Semester 1 or 2) in the same academic year as the URECA, you are not eligible to take up URECA. A student cannot simultaneously be registered for URECA and FYP in the same academic year. No exceptions will be given. URECA and FYP are both intensive projects, hence cannot be completed in the same academic year.

ABP and URECA

If you are an ABP (Accelerated Bachelor Programme) student who will be starting your FYP (Semester 1 or 2) in the same academic year as URECA, you will have to DROP ABP in order to take up URECA. A student cannot simultaneously be registered for URECA and FYP in the same academic year. If you are currently under ABP, please

make a choice between the two immediately. No exception will be given. URECA and FYP are both intensive projects, hence cannot be completed in the same academic year.

If you would like to take up URECA, you need to inform the Office of Academic Services to be dropped from ABP.

If you decide to continue with ABP and have registered for URECA, you need to inform your URECA professor to deregister you from URECA as soon as possible.

Internship / Exchange programme and URECA

You are strongly encouraged to discuss the detailed plan with the supervising professor for mutual agreement before enrolling in the URECA programme if you are going / are currently on Internship / Exchange programme. As projects have different requirements, it is important to consider each case prior to enrollment.

You must complete all URECA deliverables by the stipulated deadline while on Internship / Exchange programme with no exception as the URECA deliverables are submitted through StudentLink.

Academic Integrity

Good academic work depends on honesty and ethical behavior. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honor Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Collaboration is encouraged for your research because peer-to-peer learning helps you understand the subject better and working in a team trains you to better communicate with others. As part of academic integrity, crediting others for their contribution to your work promotes ethical practice.

You must write up your URECA deliverables by yourself and understand anything that you hand in.

If you do collaborate, you must write on your solution sheet the names of the students you worked with. If you did not collaborate with anyone, please explicitly write, "No collaborators." Failure to do so constitutes plagiarism.

Collaboration is encouraged for your research because peer-to-peer learning helps you understand the subject better and working in a team trains you to better communicate with others. As part of academic integrity, crediting others for their contribution to your work promotes ethical practice.

You must write up your URECA deliverables by yourself and understand anything that you hand in.

If you do collaborate, you must write on your paper the names of the students you worked with. If you did not collaborate with anyone, please explicitly write, "No collaborators." Failure to do so constitutes plagiarism.

Use of materials outside the course is strongly discouraged. If you use outside source, you must reference it in your solution.

Course Instructors

Instructor	Office Location	Phone	Email
<i>Individual supervising professor.</i>	<i>From various schools</i>	N/A	N/A

Planned Schedule

Below is a timeline, which indicates the deadline by which the URECA activities and assessment should be completed.

Month	Topic	Course ILO	Readings/ Activities
<i>Oct-Dec & Jan-Mar</i>	<i>Workshops & Quiz</i>	<i>2,4,7</i>	<i>Varies depending upon selected field of research: chosen based on your research with guidance and supervision of your professor.</i>
<i>End December</i>	<i>Epigeum Research Integrity Course module</i>	<i>1,2,3,4,5,6,7</i>	
<i>End January</i>	<i>Research poster</i>	<i>1,2,3,4,5,7</i>	
<i>End May</i>	<i>Abstract of research</i>	<i>1,2,3,5,7</i>	
<i>End June</i>	<i>Research paper</i>	<i>1,2,3,4,5,6,7</i>	
<i>End June</i>	<i>Reflection of research experience</i>	<i>1,2,3,4,5,6,7</i>	
<i>End June</i>	<i>Research experience demonstrated</i>	<i>1,2,3,4,5,6,7</i>	

Appendix 1: Assessment Criteria for Research poster (20%)

Adopted from [Cornell College](#)

Criteria	Exceed Expectation (A)	Meet Expectation (B)	Below Expectation (C)	Does Not Meet Expectation (D)
Presentation of Research poster (LO 1, 2, 3, 5 7)	<i>Prominently positions title/authors of paper thoroughly but concisely presents main points of introduction, hypotheses/ propositions, research methods, results, and conclusions in a well-organized manner Narration and/or answering of questions is engaging, thorough, and adds greatly to the presentation</i>	<i>Contains title/authors of paper adequately presents main points of introduction, hypotheses/ proposition, research methods, results, and conclusions in a fairly well-organized manner Narration and/or answering of questions is adequate and adds to the presentation</i>	<i>Contains title/authors of paper presents main points of introduction, hypotheses/ propositions, research methods, results, and conclusions but not as sufficiently and not as well-organized Narration and/or answering of questions is somewhat lacking</i>	<i>Title/authors absent Does not sufficiently present main points of introduction, hypotheses/ propositions, research methods, results, and conclusions and is not well-organized Narration and/or answering of questions is lacking</i>
Visual Presentation (LO 7)	<i>Overall visually appealing; not cluttered; colours and patterns enhance readability; Uses font sizes/variation s which facilitate the organization,</i>	<i>Overall visually appealing; not cluttered; colours and patterns support readability Adequate use of font sizes/variation s to facilitate the organization, presentation,</i>	<i>Visual appeal is adequate; somewhat cluttered; colours and patterns detract from readability Use of font sizes/variation s to facilitate the organization, presentation,</i>	<i>Not very visually appealing; cluttered; colours and patterns hinder readability Use of font sizes/variation s to facilitate the organization,</i>

	<i>presentation, and readability of the research Graphics (e.g., tables, figures, etc.) are engaging and enhance the text content and clearly arranged so that the viewer can understand without narration</i>	<i>and readability of the research Graphics (e.g. tables, figures, etc.) enhance the text content is arranged so that the viewer can understand order without narration</i>	<i>and readability of the research is somewhat inconsistent/distractions Graphics (e.g., tables, figures, etc.) adequately enhance the text Content arrangement is somewhat confusing and does not adequately assist the viewer in understanding order without narration</i>	<i>presentation, and readability of the research is inconsistent/distractions Graphics (e.g., tables, figures, etc.) do not enhance the text Content arrangement is somewhat confusing and does not adequately assist the viewer in understanding order without narration</i>
Documentation of Sources, Quality of Sources (LO 2)	<i>Cites all data obtained from other sources. Appropriate citation style (APA, IEEE etc) is accurately used.</i>	<i>Cites most data obtained from other sources. Appropriate citation style (APA, IEEE etc) is accurately used.</i>	<i>Cites some data obtained from other sources. Citation style is either inconsistent or incorrect.</i>	<i>Does not cite sources.</i>
Spelling & Grammar	<i>No spelling & grammar mistakes.</i>	<i>Minimal spelling & grammar mistakes.</i>	<i>Noticeable spelling and grammar mistakes.</i>	<i>Excessive spelling and/or grammar mistakes.</i>

Appendix 2: Assessment Criteria for Abstract of Research Project (10%)

Adopted from [Manchester University](#)

Criteria	Exceed Expectation (A)	Meet Expectation (B)	Below Expectation (C)	Does Not Meet Expectation (D)
Introductory Statement (LO 1, 2)	<i>Clear, concise, engaging; Describes, connects the topic to literature and purpose of research.</i>	<i>Clear, but not engaging; Attempts to connect to literature</i>	<i>Unclear; Does not connect to literature</i>	<i>Missing</i>
Purpose (LO 1, 3)	<i>Clear, concise, and relevant.</i>	<i>Clear but not concise; Might contain irrelevant or unimportant information; lacks specifics</i>	<i>Unclear; Contains irrelevant or unimportant information</i>	<i>Missing</i>
Methodological Approach (LO 5)	<i>Connected to the purpose of the research; Identifies method used to support research or answer the research question.</i>	<i>Unclear or not connected to purpose of research</i>	<i>Not mentioned but implied; or, not appropriate for purpose of research</i>	<i>Missing</i>
Findings (LO 4, 7)	<i>Clear, connected to the purpose of research; Provides explanation of what was expected, discovered, accomplished, collected, produced</i>	<i>Attempts to present findings but might be unclear; or some information missing</i>	<i>Unclear; Or not related to the purpose of the research; Or misinterpretation of results</i>	<i>Missing</i>
Contribution to Discipline (LO 7)	<i>Clearly states how work advances knowledge in the discipline, why it's important, or how it can be used</i>	<i>Attempts to connect work to discipline, but might be unclear</i>	<i>Unclear and lacks detail of contribution to the discipline</i>	<i>Missing</i>

Professional Writing	<i>Writing appropriate for the profession; Defines all acronyms at first use; Appropriate verb tense (present/past tense) when talking about the study, may use future tense for the contribution to the discipline.</i>	<i>Few grammatical errors or typos; Mixed verb tense</i>	<i>Many grammatical errors, typos but they do not impede understanding; inappropriate verb tense</i>	<i>Grammatical errors, typos impede understanding; inappropriate verb tense</i>
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Appendix 3: Assessment Criteria for Research Paper (30%)

Adopted from [Cornell University](http://www.cornell.edu)

Criteria	Exceed Expectation (A)	Meet Expectation (B)	Below Expectation (C)	Does Not Meet Expectation (D)
Abstract	<i>Refer to Appendix 2</i>			
Introduction (LO 1)	<i>The introduction is engaging, states the main topic and previews the structure of the paper.</i>	<i>The introduction states the main topic and previews the structure of the paper.</i>	<i>The introduction states the main topic but does not adequately preview the structure of the paper.</i>	<i>There is no clear introduction or main topic and the structure of the paper is missing.</i>
Content (LO 1 to 7)	<i>Each paragraph has thoughtful supporting detail sentences that develop the main idea.</i>	<i>Each paragraph has sufficient supporting detail sentences that develop the main idea.</i>	<i>Each paragraph lacks supporting detail sentences.</i>	<i>Each paragraph fails to develop the main idea.</i>
Organization Structural Development of the Idea	<i>Writer demonstrates logical and subtle sequencing of ideas through well-developed paragraphs; transitions are used to enhance organization.</i>	<i>Paragraph development present but not perfected.</i>	<i>Logical organization; organization of ideas not fully developed.</i>	<i>No evidence of structure or organization.</i>



Conclusion (LO 6, 7)	<i>The conclusion is engaging and restates the paper.</i>	<i>The conclusion restates the paper.</i>	<i>The conclusion does not adequately restate the paper.</i>	<i>Incomplete and/or unfocused.</i>
Mechanics	<i>No errors in punctuation, capitalization and spelling.</i>	<i>Almost no errors in punctuation, capitalization and spelling.</i>	<i>Many errors in punctuation, capitalization and spelling.</i>	<i>Numerous and distracting errors in punctuation, capitalization and spelling.</i>
Usage	<i>No errors sentence structure and word usage.</i>	<i>Almost no errors in sentence structure and word usage.</i>	<i>Many errors in sentence structure and word usage.</i>	<i>Numerous and distracting errors in sentence structure and word usage.</i>
Citation (LO 2)	<i>All cited works, both text and visual, are done in the correct format with no errors.</i>	<i>Some cited works, both text and visual, are done in the correct format. Inconsistencies evident.</i>	<i>Few cited works, both text and visual, are done in the correct format.</i>	<i>Absent</i>
Bibliography (LO 2)	<i>Done in the correct format with no errors. Includes more than 8 major references (e.g. science journal articles, books, but minimizing internet sites. Periodicals available on-line are not considered internet sites).</i>	<i>Done in the correct format with few errors. Includes at least 5 major references (e.g. science journal articles, books, but minimizing internet sites. Periodicals available on-line are not considered internet).</i>	<i>Done in the correct format with some errors. Includes below 5 major references (e.g. science journal articles, books, but minimizing internet sites. Periodicals available on-line are not considered internet).</i>	<i>Done in the correct format with many errors. Includes 3 or less major references (e.g. science journal articles, books, but minimum internet sites. Periodicals available on-line are not considered internet sites).</i>

Appendix 4: Assessment Criteria for Reflection of research experience (10%)

Adopted from [Manchester University](#)

Criteria	Exceed Expectation (A)	Meet Expectation (B)	Below Expectation (C)	Does Not Meet Expectation (D)
Introductory Statement (LO 6)	<i>Clear, concise, engaging; Describes, connects the URECA experience and purpose.</i>	<i>Clear, but not engaging; Attempts to connect to literature.</i>	<i>Unclear; Does not connect to literature.</i>	<i>Missing</i>
Uniqueness of the experience (LO 6)	<i>Clear, concise, and relevant.</i>	<i>Clear but not concise; Might contain trivial or unimportant information; lacks specifics.</i>	<i>Unclear; Contains trivial or unimportant information.</i>	<i>Missing</i>
Overall perception of the research experience (LO 6)	<i>Connected to the purpose of the research and experience gained.</i>	<i>Unclear or not connected to purpose of research experience.</i>	<i>Not mentioned but implied; Or not appropriate as perception of research experience.</i>	<i>Missing</i>
What would you do different as a result of URECA experience (LO 6)	<i>Clear, unique and specific to the experience gained or accomplished.</i>	<i>Attempts to present specifics and unique experience.</i>	<i>Unclear; Or trivial or not relevant.</i>	<i>Missing</i>

Appendix 5: Assessment Criteria for Professor Assessment on Student Research Experience (15%)

Adopted from [Toronto District School Board](#)

Criteria	Exceed Expectation (A)	Meet Expectation (B)	Below Expectation (C)	Does Not Meet Expectation (D)
Knowledge/ Understanding	<i>Demonstrates thorough understanding of the research project</i>	<i>Demonstrates considerable understanding of the research project</i>	<i>Demonstrates some understanding of the research project</i>	<i>Demonstrates limited understanding of the research project</i>
Thinking	<i>Develops research questions and ideas with a high degree of effectiveness</i>	<i>Develops research questions and ideas with considerable effectiveness</i>	<i>Develops research questions and ideas with some effectiveness</i>	<i>Develops research questions and ideas with limited effectiveness</i>
Communication	<i>Shares research topic ideas, choices, and plans with a high degree of effectiveness</i>	<i>Shares research topic ideas, choices, and plans with considerable effectiveness</i>	<i>Shares research topic ideas, choices, and plans with some effectiveness</i>	<i>Shares research topic ideas, choices, and plans with limited effectiveness</i>
Application	<i>Identifies, with a high degree of understanding, how research skills and knowledge can be applied</i>	<i>Identifies, with considerable understanding, how research skills and knowledge can be applied</i>	<i>Identifies, with some understanding, how research skills and knowledge can be applied</i>	<i>Identifies, with limited understanding, how research skills and knowledge can be applied</i>