## INDEPENDENT STUDY or RESEARCH LEARNING CONTRACT

**Joint Department of Biomedical Engineering**

B.S. in Biomedical and Health Sciences Engineering (BMHE)

This form must be completed for all Independent Study or Research for academic credit in BMHE.

* Form must be TYPED.
* BME 498/BMME 495 may be taken only once, and can meet a degree requirement
* BME/BMME 295 may be taken for 1-3 credits and will not meet a degree requirement
* UNC-based students who wish to defend a senior honors thesis (BMME 691H/692H) and receive credit for a technical elective (BMME 495) must have separate and distinct projects
* BMME 691H/692H will not meet a degree requirement. It satisfies the requirements for the Senior Honors Thesis for UNC-homed students

The form should be completed by both the student and the research advisor supervising the independent study/research. If the research advisor is not a member of the Joint BME Dept., an Instructor of Record who is a member of the Joint BME Dept. must be identified. For BME 498/BMME 495, the information provided in this form will be used by the BME Undergraduate Study Committee to evaluate whether or not the independent study contains engineering topics necessary to fulfill a technical elective requirement (see Program Outcomes, below).

One credit hour represents a minimum of three hours of student work per week. For example, to successfully complete a 3-credit hour course, the student must complete on average at least nine hours of independent research each week of the semester. The student and research advisor will determine how this time commitment is evaluated. The student must write a technical paper describing the project in detail. For BME 498/BMME 495 the student must also present the work as a poster or oral presentation in a public scientific forum such as a department seminar, the NC State Undergraduate Research Symposium or the UNC Celebration of Undergraduate Research. The attached rubric should be used for assessment unless an alternate assessment method is submitted and approved. For UNC Senior Honors, the written thesis must be orally defended in the final semester (BMME 692H). All final assessments should be submitted to the BME Undergraduate Affairs Office. Work done for Independent Study may NOT overlap any other work done for course credit without express permission from all instructors and detailed explanation of the overlap.

Return the completed form to Lesley Hubbard (lhhubbar@ncsu.edu) in 4014 EB3 (NCSU) or Rocky Rothrock (rrothroc@email.unc.edu) in 10212 Mary Ellen Jones (UNC) for evaluation by the BME Undergraduate Research Committee. Submission deadlines:

|  |  |
| --- | --- |
| Spring (for summer or fall enrollment) | First Monday in April |
| Summer (for fall enrollment) | Second Monday in July |
| Fall (for spring enrollment) | Second Monday in November |

Allow 2-3 weeks for review, revisions and approval. Final approval must be received before the last day to add a class.

**APPLICANT INFORMATION (to be completed by the student):**

Student Applicant’s Name:      PID/Student ID:

E-mail:       Phone #:

Date of Application:

Major:

Class: [ ] First Year [ ] Sophomore [ ] Junior [ ] Senior [ ] Other (explain)

Course Number – Please check: [ ] BME 498 3 Cr. [ ] BMME 495 3 Cr.

 [ ] BME 295 1-3 Cr. [ ] BMME 295 1-3 Cr.

 [ ] BMME 691H 3 Cr. [ ] BMME 692H 3 Cr.

 [ ] Other (Explain)

Credit Hours (295 only, select 1-3): [ ]  1; [ ]  2; [ ]  3;

Semester Requested:[ ] Fall [ ] Spring YEAR:

Current GPA (Cumulative):

Please check all that apply: [ ] Graded

 [ ] S/U (cannot be applied toward the BME degree or minor requirements)

 [ ] Tissue Engineering Minor

Are you being paid for this research? [ ]  YES [ ]  NO

If “yes”, see below regarding Instructor of Record

**Title of Independent Study**

**RESEARCH ADVISOR:**

Name:       Department      Home Institution

E-mail:       Phone number

Faculty members are restricted to no more than two independent study/research students per semester or summer session.

**INSTRUCTOR OF RECORD, if different from Research Advisor:**

Note: The Instructor of Record must be a member of the Joint BME Dept. and is responsible for all grading including presentations and written work. If the Research Advisor is not a member of the Joint BME Dept., or if the Research Advisor is paying the student a stipend, a separate Instructor of Record must be designated.

Name:       Department      Home Institution

E-mail:       Phone number

**COURSE REQUIREMENTS (to be completed by the Research Advisor)**. This is considered a contract between the research advisor and the student. Deviations from this contract should be updated and documented to the extent possible by the research advisor and student. Students are expected to devote at least three hours of independent work per week for each unit of credit (e.g., 9 hours per week if 3 credit hours).

a. Meeting requirements with the research advisor (e.g., individual meetings, lab meetings, etc.). Include day/time of weekly or bi-­‐weekly meetings:

b. Reading assignments (and due dates, if relevant):

c. Written assignments (page requirements/limits and due dates, if relevant):

d. Other assignments, including oral presentations (please describe):

e. See attached rubric for assessment criteria. If different criteria or percentages will be used, explain the criteria here:

f. Other information:

**Student, Faculty and Administrative signatures**

**RESEARCH ADVISOR, INSTRUCTOR OF RECORD AND STUDENT RESPONSIBILITIES:**

I have read the requirements expected of the instructor, agree to undertake these responsibilities, and will abide by the Honor Code’s responsibilities of faculty.

Research Advisor \_\_\_\_\_\_\_\_\_\_\_\_\_Date \_\_\_\_\_\_\_\_\_\_\_\_\_

Instructor of Record, if

different from Research Advisor\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_Date \_\_\_\_\_\_\_\_\_\_\_\_\_

I have read the requirements expected of the student, agree to undertake these responsibilities, and will abide by the Honor Code’s responsibilities of students.

Student \_\_\_\_\_\_\_\_\_\_\_\_Date

**\*INDEPENDENT STUDY COORDINATOR**

**This application for Independent Study has been reviewed. The proposal is**

[ ] APPROVED AS IS

[ ] REQUIRES MORE INFORMATION (provide details and return to instructor and student)

[ ] NOT APPROVED (provide rationale)

School/Department/Program Independent Study Coordinator Date

* If the Independent Study Coordinator is not the Department/Curriculum Chair, the Director of Undergraduate Studies (DUS), or another Faculty Designee of the Chair, then the Chair or the DUS must also approve this contract.

**\*\* CHAIR OR DIRECTOR OF UNDERGRADUATE STUDIES (whichever is applicable):**

This application for Independent Study has been reviewed. The proposal is

[ ] APPROVED AS IS

[ ] REQUIRES MORE INFORMATION (provide details and return to instructor and student)

[ ] NOT APPROVED (provide rationale)

Chair/Director of Undergraduate Studies/Faculty Designee/SAD Date

**\*\*** If the Chair is the student’s independent study instructor, this form must be signed by the Chair’s Senior Associate Dean (SAD).

Note: Departments/Curricula must maintain copies of this contract for a minimum of two years.

**PROPOSAL INSTRUCTIONS:** Attach a detailed description of the planned project, approximately 1000 words (2 pages single spaced) not including references and figures. This proposal must be written by the student and should not contain material taken directly from grant proposals, research program descriptions or posters/publications from the research advisor’s group. If the project is part of a larger and/or ongoing research program, the proposal should clearly indicate what will be done by the student. Use of the first person is encouraged. Suggested format is that of a research proposal including introduction, methods, specific aims and research plans. The proposal should be comprehensible to individuals outside the specific area of research, for example, adequate background should be provided, acronyms should be spelled out and technical terms should be explained. Include a bibliography in standard format, citing all appropriate references. Note for BMME691H/692H : a single proposal covering the full project should be submitted by the Fall deadline (BMME691H), however, the proposal should be resubmitted by the Spring deadline (BMME692H) with a new signature page, which serves as verification by the Research Advisor that adequate progress is being made.

For the Program Outcomes below, specifically describe how the independent study or research project will address the outcome. Do not cut and paste from the proposal, rather describe how various elements of the proposal will fulfill the described outcomes. Text fields will expand indefinitely.

Respond to ALL Program Outcomes. Depending on the project, the Program Outcomes may be addressed in limited or substantial ways. For BME 498/BMME 495, **at least four** of the grey highlighted outcomes 1, 2, 3, 6 and 7 **must be addressed by the project in a substantial way**. For all other independent study courses, **at least three** of outcomes 1, 2, 3, 6 and 7 must be addressed **in a substantial way**.

**PROGRAM OUTCOMES**

1: *An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.*

Substantial? [ ]  Yes [ ]  No

>Describe the problem to be addressed, and the general relevant principles. List the courses (numbers) that taught the original scientific and engineering concepts, e.g. MAE 214, BME 210, BME 342, BMME 160, BMME 350, etc. For senior level electives, this independent study/research project should draw upon knowledge learned in junior level courses.

2: *An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.*

Substantial? [ ]  Yes [ ]  No

>Briefly describe the engineering design component(s) of the project, for example, a tool or device that will be designed, an analytical model that will be developed, or a process that will be created. Describe how the solution considers listed factors.

3: *An ability to communicate effectively with a range of audiences.*

Substantial? [ ]  Yes [ ]  No

>Describe any written reports or other materials, poster presentations or oral presentations required. For required oral presentations, list at least one potential venue for the presentation (note – this is not a commitment to a specific venue; the venue may be changed).

4: *An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.*

>Describe the ethical implications of the project and professional responsibilities from an engineering standpoint, including the potential scope of the project’s impact.

5: *An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.*

>Describe the team environment for this project, including the student’s role, and the roles of others associated with the project and/or the research group. How are the components of this outcome met?

6: *An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.*

Substantial? [ ]  Yes [ ]  No

>Describe the student’s role in developing the experimental approach and the protocols, and in the analysis and interpretation of data. Where is engineering judgement applied?

7: *An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.*

Substantial? [ ]  Yes [ ]  No

>Describe what new knowledge, including skills, the student will need, and how it/they will be acquired.

**Independent Study or Research for Academic Credit grading rubric (submit to Undergraduate Office upon project completion)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | *poor or incomplete (below 65 pts)* | *moderate or developing (65 -74 pts)* | *competent and nearly complete (75 - 84 pts)* | *accomplished (85 -94 pts.)* | *exemplary (95-100 pts.)* |
| **Development** | Incomplete understanding | Understands the | Able to understand the | Able to understand the | Able to understand the |
| **of Research** | of the problem, research | problem, the research | problem, the research | problem, devise a | problem, devise a research |
| **Plan** | strategy, and limitations | strategy, and the | strategy, and the | research strategy that | approach independently or |
| **(15%)** | when assisted by the | limitations of the | limitations or the | can be implemented | suggest a novel approach, |
|  | instructor | approach when assisted | strategy when explained | with limited assistance, | and demonstrate a solid |
|  |  | by the instructor, but | by the instructor | and consider limitations | understanding of the |
|  |  | requires a high level of |  | of the research method | limitations of the proposed |
|  |  | supervision |  |  | research method |
| **Execution of** | Does not complete the | Completes a small | Completes the majority | Completes the research | Completes the research |
| **Research** | research protocol, is | component of the | of the research protocol | protocol and | protocol and demonstrates a |
| **Plan (25%)** | unreliable, and is not | research protocol and | and demonstrates | demonstrates | high skill level with all of |
|  | competent with the | demonstrates | proficiency with the | proficiency with the | the research methods and |
|  | research techniques | proficiency in some of | majority of the research | research methods and | techniques |
|  |  | the research methods | methods and techniques | techniques |  |
|  |  | and techniques |  |  |  |
| **Data** | Does not complete the | Completes some, but | Nearly completes the | Completes the data | Completes the data analysis |
| **Analysis** | data analysis or | not all, of the data | data analysis or requires | analysis without need | without correction and is |
| **(30%)** | demonstrates | analysis or needs | some minor correction | for correction | able to independently |
|  | incompetence in the data | frequent correction |  |  | understand and analyze the |
|  | analysis methods |  |  |  | significance of the data |
| **Written** | Does not complete the | Misses some major | Completes the major | Completes the major | Manuscript is complete and |
| **Report** | written report, incorrectly | features of the results, | points in the abstract, | points in the abstract, | well-written. Figures and |
| **(15%)** | reports the results, is | or tables; figures and | introduction, methods, | introduction, methods, | tables are complete and |
|  | unable to write an | text need significant | results, conclusions, | results, conclusions, | well-designed. All |
|  | abstract, poor | editing | and references; | and references; | important conclusions of the |
|  | construction of tables and |  | completes figures and | completes figures and | research are accurately |
|  | figures |  | tables; but some editing | tables. | reported in the manuscript. |
|  |  |  | and corrections remain |  |  |
| **Oral** | Unable to communicate | Arguments are unclear | Arguments are | Arguments are clear. | Presentation is well |
| **Presentation** | and articulate the methods | and poorly structured. | sometimes unclear. | Presentation follows a | articulated. Findings are |
| **(15%)** | and conclusions in a way | Does not present the | Some material is not | logical order. Material | presented in an appropriate |
|  | that others can | material at a level | presented at a level | is presented at the | style and format. Grammar |
|  | understand; Grammar is | appropriate for the | appropriate for the | appropriate level. | is excellent. Uses media |
|  | poor | audience. Some | audience. |  | effectively. |
|  |  | grammatical errors. |  |  |  |

|  |  |
| --- | --- |
|  | *Points = % x pts.* |
| **Development of Research Plan****(15%)** |  |
| **Execution of****Research Plan (25%)** |  |
| **Data Analysis (30%)** |  |
| **Written****Report (15%)** |  |
| **Oral Presentation****(15%)** |  |
| **TOTAL****POINTS (100%)** |  |

|  |  |
| --- | --- |
| Range | Grade |
| 92 - 100 | A |
| 90-<92 | A- |
| 88-<90 | B+ |
| 82-<88 | B |
| 80-<82 | B- |
| 78-<80 | C+ |
| 72-<78 | C |
| 70-<72 | C- |
| 68-<70 | D+ |
| 62-<66 | D |
| 60-<62 | D- |
| <60 | F |