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CPIO – IISc

R (PIO) RTI/2005/2023-15

8th July 2024

To,
Mr. Kareem Ansari
Yugantar (XGIV5Q2Q)
3-4-142/6, Barkatpura
Hyderabad 500027

Sir/Madam,

Ref: RTI application letter seeking certain information under RTI Act, 2005

This has reference to your RTI application, seeking certain information under RTI Act, 2005.

Reply to your RTI query is as furnished below,

Sl. No	***Information sought***	***Information furnished***
1	Provide the complete curriculum of the MTech in Electronic Systems Engineering (ESE) program at the Indian Institute of Science (IISc).	It is as per the Scheme of Instructions (SoI)
2	Provide the information on how many credits are allocated to the Workshops in the above MTech program.	Out of 25 project credits, 5 credits is allocated for Friday workshops for 2023-25 batch onwards. This information is circulated to all students. (The document circulated right at the beginning of their projects is attached for your information)
3	If the credits are allocated to Workshops, provide the breakdown on how the students are evaluated.	Based on performance in the workshop assignments and at least 75% attendance
4	If no credits are allocated to Workshops, then what action is taken by the Institute against the Chairman of the Department of Electronic Systems Engineering (DESE) and the concerned authorities for spreading misinformation that 5 credits are allocated to Workshops, which has created a panic among the students.	Query no.4 does not arise, please refer to the response to Query no.3.

"In case, if you are not satisfied, you may prefer an appeal before Capt. Sridhar Warrier (Retd.), Registrar, First Appellate Authority, Indian Institute of Science, Bangalore- 560012, Telephone 080- 22932440, 080-22932444, email: office.registrar@iisc.ac.in within 30 days from the receipt of thereply."

Yours faithfully,

Public Information Officer

लोक सूचना अधिकारी / Public Information Officer
भारतीय विज्ञान संस्थान / Indian Institute of Science
बेंगलूर / Bangalore – 560 012

Encl: As Above.

MTech Project at DESE

Department of Electronic System Engineering, DESE, IISc

ABSTRACT

This note describes the MTech(ESE) project at the department. There are several processes involved that spans almost one and a half years. Project allocation process, guidance and advice, monitoring, review and assessment processes and guidelines for writing the thesis are discussed. Out of their total 64 credits a significant portion, 25 credits is allocated for project work. The MTech project is highly demanding and challenging exercise for the student. Yet, it is probably the most satisfying part of the degree. It starts in the begining of January semester and culminates with the exposition in June of the following year. Out of the 25 project credits, 5 credits are allocated to the skill development learning through Friday workshops. The remaining 20 project credits will be for the actual project implementation. There are several tasks in the project implementation that will depend on the skills acquired during the Friday workshops. The following sections will describe the 20 credit project implementation. This is managed through the moodle portal.

I INTRODUCTION

The main task of an engineer is to apply scientific knowledge to obtain solutions for technical problems that are optimal within given material ,technological, economic, social and environmental constraints, in order to achieve societal benefits. This aim of this programme is to train the student as an effective engineer. The project is probably the most important and interesting aspect of this programme wherein a student gets to solve real-life problem with all its attendant constraints. While the core and elective courses provide the students with the understanding of all the relevant phenomena, the project on the other hand provides an opportunity to integrate different aspects of engineering learnt in theory to practical real-life problems.

The real-life probems are in general not always presented in a well defined manner. There are several dimensions to it besides the technical ones. Economic aspects are important in most engineering solutions. There are often sociological and aesthetic dimensions to these problems. Besides, there is a human dimension too. No problem is solved without a number of individuals collaborating. Often the nature of the solution produced will greatly depend on the interpersonal interaction between participating individuals. Any activity related to solving real-life problems involve:

- Problem definition
- Criteria to be satisfied in solving the problem
- Generation of several possible solutions
- Evaluation of these solutions
- Selection of the optimal solution
- Synthesis of the selected solution
- Documentation
- Management of collaboration among team members in a manner that would facilitate achieving a speedy solution along with being an enriching and safisfying experience to all members of the team

As there are several dimensions to a real-life problem, the project needs to be well structured in order to have a meaningful solution. The first step is to outline the project in a structured manner called the *Project Brief*. The project brief will provide in an unambiguous manner,

- the problem that needs to be solved
- the scope of the problem that will be considered in this project
- commerical information on similar projects
- reference resources

The projects could be broadly classified as (i) hardware centric (with embedded software), (ii) software centric and (iii) modelling and simulation centric. The planning for each category of the project will be different and this should reflect in the project brief accordingly. In this department, being an electronic systems engineering department, software centric projects are in general part of an electronic system and should tightly integrate into the overall system.

The importance of documentation can never by over-emphasised. The end result of any technical exercise is a document. Therefore the project documentation should clearly present all the decisions taken and the time evolution of the project. It is important and advantageous that a standard be followed while documenting the project. The department has prepared templates for project documentation which the students should use.

II PROJECT PLANNING

The project involves considerable amount of resources in terms of material resources and human resources. Therefore a careful planning for the project is essential. There are several persons including students, faculty and other resource persons that need to interact to make the project happen. There will be several constraints with regard to materials and time schedules. All these need to be carefully accounted for and planned to achieve a successful and timely completion of the project.

The credits alloted to each STUDENT for the project is 20 credits. During Jan-April, each student needs to spend approximately 3 credits of person hours. This amounts to around 50 person hours per student. During May-June each student contributes another 50 person hours (3 credits) towards their projects. August-December semester too amounts to another 3-credits of project work. The following Jan to June, each student will contribute the remaining 11 credits (aproximately 200 person hours) during this period to complete the project. To ensure that all aspects of learning are satisfied, it is necessary to have an effective time plan for all activities during the project period. All project related activities may be classified as follows:

1. Project Allocation
2. Pre-study phase
3. Study phase
4. Design phase
5. Engineering phase

The above mentioned project activites have well defined time slots which are common to all the projects in the department. These activites are elaborated further in sections to follow.

2.1 Log book

Every student must maintain a project logbook. It provides an insight to the project management skills. The student should log all project related events on daily basis. It should include notes, events of project progress. The logbook should be checked and signed (digitally) by the supervisor at regular meetings. The project logbook is not formally graded, however submission of the project logbook is a mandatory requirement of the evaluation process.

The keeping of logbooks is standard practice in industry and will be of invaluable help when writing the project report. This habit will be well received by the industry too. The logbook can be maintained in an electronic format. One can use Latex, MS Word, LibreOffice writer, plain text editor, excel for this purpose. It may be placed in your onedrive and shared with your supervisors and reviewers. The main benefit of keeping a record of the project work is that the logbook allows students to use their time in the most effective way, by avoiding the duplication of work and losing important ideas or information. Students will also find it helpful to make a note of any references they use (books, technical journals, papers, etc.).

2.2 Project Management and Gantt Chart

A successful project outcome is usually related to proper planning and definition of expected outcomes. The following should be considered when developing the project plan:

- Pre-study: Project brief, product survey, market survey, and user survey, identify literature resources, gap analysis, wish specifications. (This event should be completed by April)
- Study: Literature survey, resource identification, tool chain setup, software and hardware structure diagram, module solutions, evaluation of solutions, selection of the optimal solution, target specifications. (This event should be completed by June)

- Design: hardware design, software design, thermal design, enclosure design, reliability design. (This event must be completed by December)
- Engineer: schematics, layout, route, gerber, enclosure fabrication, component population, mounting, thermal, wiring, bill of materials, software, embedding, integration, testing. (This event should be completed by April end of following year)
- Thesis writing: allocate time for thesis writing and collation
- Estimate the time needed in days, to complete each activity and sub-activity. Allow for time in case things go wrong.
- Check the resources available and draw up the schedule taking into account holidays, time to obtain materials, equipment and other work
- Use the Gantt Chart and include project milestones. (One can use MS Project, ProjectLibre, OpenProject, Clickup, ...)
- Identify critical path from the Gantt Chart.
- Re-plan and re-schedule as necessary. It is important that you identify any hardware components or items of software which are difficult to obtain, or those with long delivery times, as soon as possible.
- All components and software (critical path items) must be ideally ordered by December.

The project is student driven and needs to be managed by the student. You should prepare a detailed plan that will indicate all your steps from start to completion of the project. You should include all key decision gates, estimate the time required for each event and indicate your critical path. Each task should be no longer than 2 weeks and must have a measurable outcome. It is important to identify possible threats to the success of the project and plan for unexpected delays. This Gantt Chart will be also the starting point for the project management review element of your final thesis, therefore the more effort you put into preparing it now, the more it will benefit you throughout your project.

A resources analysis needs to be done in order to identify what is required to carry out the project. This should be prepared as a list. Distinction should be made for resources that are already available in the lab and those that need to be procured. The resource checklist should be completed in consultation with your Supervisor.

All students should make a detailed project plan as detailed above including timelines, milestones, resources and threats to the project. MS Project is a good project management tool to use. The open source alternative is ProjectLibre which is also a good project management tool. Clickup is a browser based project management tool which is also free. OpenProject is also an open source alternative. One of these can be used to manage your project.

III PROJECT ACTIVITIES

3.1 Project Allocation

The very first activity is project allocation. There are several ways by which projects can be allocated to the students. Several programmes follow different methods. However, as the programme in this department is oriented very much to real-world problem solving, a more participate approach towards project allocation is followed. Department faculty identify problems and define the project. This results in a list of projects that will be offered to the students. A seminar is organised wherein every faculty will present the offered projects to the students. This will generally happen in mid December. The students will meet amongst themselves and through a process of negotiation arrive at a project allocation list, mapping every student to a project. This is the first lesson in collaboration.

3.2 Pre-study phase

The main deliverable of the project is called the product. The preparation of a well defined set of wish specifications constitute the main deliverable of this phase. The nature of the product, its intended use, the nature and extent of interaction between the user and the product, the environment in which it is used, knowledge and skill levels required by the user of the proposed product, and economic implications are expected to be analysed and specified. The project brief preparation is also a part of this phase. The project brief helps to define the project clearly. It is a document that aims at helping the design team to understand clearly and identify the various aspects of the project. The potential customer could be the industry sponsor or the faculty advisor playing the role of the potential customer. The project brief contains answers to several questions that usually arise when a new project is initiated. They include background, function, performance measures, user, power supply, electronic packaging, production aspects, safety, environmental aspects, electromagnetic compatibility, and reliability aspects.

The project brief activity will be followed by surveying the literature, internet and market for similar products. Bench mark features should be defined. Product survey, market survey and user survey should be made. A gap analysis need to be performed to find out the features which the existing products lack. From this will emerge the concept of the proposed product. Compare the proposed product with the existing ones against the bench mark features. Based on this study, develop a set of wish feature and specifications for the specific application. A feature is generally a qualitative description whereas a specification is a quantitative description. For design, the specification giving the quantitative description of the product is very important. The wish specification need not be bound by technological constraints. The wish specification is infact a dream specifications which may or may not be realisable. But this will be a bench mark specification for the product against which, all products can be compared. The pre-study phase report will consist of the following elements:

- Product brief
- Product, market and user surveys
- Gap analysis
- Wish features
- Wish specifications
- Project time plan

The pre-study report will be due for submission by April end. During May-June, the students will get intense training in skill development like making PCBs and designing to address EMI/EMC issues. Skill development activities are very important and will provide a flavour to the type of skills that will be needed in the electronic industry. All need to go through the skill development activities irrespective of the nature of project.

3.3 Study phase

The main activity of this phase is to conduct an in-depth study of the proposed product and the preparation of the realisable target specifications from the wish specifications. Prepare detailed functional block diagrams and establish the functional feasibility of the modules and sub-modules of the product. This would imply conceptualising several options and solutions and evaluate them to select the best solution for the application. This phase will consist of some investigative work to arrive at the best solution. Note that at the end of the project schedule, one will have to demonstrate the project to meet the target performance specifications. This plan has to be prepared well in advance prepared during this phase. The tasks to be addressed in this phase are

- Functional block diagram - hardware
- Structure diagram - software
- Standards to be followed for both hardware and software
- Identification of off-the-shelf modules and/or bought out modules
- Demo plan

The above activities include functional partitioning of the product, choise of components, hardware-software trade-offs, modularisation, interfacing aspects, and selection of critical components. Note that there will be no unique solution for any problem. There can be several solutions. The problem is to choose one among the several options. *The study phase report should be submitted by July end.*

3.4 Design phase

This phase involves the translation of the target specfications into a plan to make a prototype. The team will have to solve all aspects of the product and make decisions such that eventually all target specifications are met. The aspects that should be addressed during this phase are:

- Circuit design
- PCB design
- Software design

- Electromagnetic compatibility
- Thermal design
- Formal aspects

Note that design is iterative. The team may have to do several iterations of synthesis and testing to arrive at acceptable results.
The design phase report should be submitted by December end.

3.5 Engineering phase

The engineering phase involves the implementation of the design into a working prototype. The working prototype is tested and evaluated against the target specifications to measure the degree of adherence. The tasks performed during this phase include

- Structure diagram of the project
- Flow charts, state machines and Pseudocodes for software part
- Circuit schematic
- Layout
- Routing
- PCB and screens
- Bill of materials
- Vendor list
- PCB population and bring-up
- Testing the PCB
- System integration, wiring diagram, connector diagram
- Test vectors for software
- Software tesing, PCB testing and Product testing

Collation of the documentation of the above activities along with the user manual for the product will be the engineering report.
The engineering report should be submitted by March end.

IV PROJECT EVALUATION

The projects are evaluated through out the project period from project allocation to exposition. The deliverables of each phase are milestones that will be evaluated. Pre-study phase, study phase and design phase will consist of 3 credits each. During the study phase and design phase, each student must make a presentation of their work. The engineering phase, demo, thesis and viva-voce will comprise the remaining 11 credits. It is also desirable though not mandatory, for each project team to publish their work in journals or conferences. This will provide an opportunity for the team to express their work and get a flavour on the art of publishing, besides getting feedback from unknown reviewers. The following activities will be undertaken in May-June of the second year to evaluate the project.

- Demo - this will occur in the last week of May
- Thesis - The compete thesis which will be the collation of pre-study, study, design, engineering phase reports will need to be submitted by 1st week of June
- Preparation of a paper on the project for journal or conference.
- Viva-Voce - this will occur in the 2nd or 3rd week of June