CENTRO UNIVERSITÁRIO DO INSTITUTO MAUÁ DE TECNOLOGIA

MAUÁ GRAND CHALLENGES SCHOLARS PROGRAM

Simplified Instruction Manual for GCSP-IMT's Students

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This handbook provides guidelines for students selected to participate in the GCSP (Grand Challenges Scholars Program).

1 GCSP and NAE

What are the NAE?

Founded in 1964, the National Academy of Engineering (NAE) is a private, independent, nonprofit institution that provides engineering leadership in service to the nation.

What are the Great Challenges (GCs) envisioned by the National Academy of Engineering (NAE)?

The NAE long term vision on the Grand Challenges for Engineering was expressed in 2008 as what engineers must deliver throughout the XXI Century, to all people, in order to ensure continuation of life on the Planet. The vision is based on following 14 goals, grouped in 4 main thematic areas:

- **Sustainability Grand Challenge Theme:** (i) Make Solar Energy economical; (ii) Provide Energy from fusion; (iii) Develop carbon sequestration methods; (iv) Manage the nitrogen cycle; (v) Provide Access to Clean Water;
- **Health Grand Challenge Theme:** (vi) Advance health informatics; (vii) Engineer Better Medicines;
- **Security Grand Challenge Theme:** (viii) Prevent Nuclear Terror; (ix) Secure cyberspace; (x) Restore and improve urban infrastructure;
- **Joy of Living Grand Challenge Theme:** (xi) Reverse-Engineer the brain; (xii) Enhance virtual reality; (xiii) Advance personalized learning; (xiv) Engineer the tools of scientific discovery.

What are the GCSP?

It is the talent-forming component of the NAE GC program. Its objective is to encourage educational institutions from all over the world to develop activities, projects and complementary studies aiming to train their students through the acquisition of skills that can be used for the benefit of society and the common good all over the planet. The ultimate aim is that future engineers, designers and administrators trained under this program are able to face GCs during their professional lives, making our world more sustainable, safe, healthy and happy.

Each institution (university, college or school) define strategies independently, creating a portfolio of options for continuity projects and related actions, in which students can get involved, throughout the course, gradually forming a repertoire based on in the following competencies:

GCSP-IMT Competencies	Description
Technical-Creative Competency	Mentored project or research experience. Substantial team or independent project related to an IMT theme related to a Grand Challenge area or a specific challenge.
Multidisciplinary[1] Competency	Bridging engineering to other disciplines is essential for solving Grand Challenges-like problems. An overall curricular as well as co- and extra-curricular program must be designed to prepare students to work at the boundary between various engineering and non-engineering disciplines, such as public policy, international relations, business, law, ethics, human behavior, risk, medicine, the natural sciences, arts, etc. Each GCSP should have an institutionally tailored
Viable business /Entrepreneurship competency.	Implementing innovation is central to technology development. Each GC scholar must participate in a curricular or co-/extra-curricular experience that involves the process of translating invention and innovation into a viable business model for introducing technology for not-for-profits in the public interest or a market (risk-taking) venture. There should also be considerations for scaling up solutions to global reach.

[1] In this proposal the words *Multi- and Pluri-disciplinary* are used as synonyms, meaning coordination among different disciplines; the *Interdisciplinary* word is used in a deeper sense, meaning a combination of disciplines, and *Transdisciplinary* in the sense of utmost integration or fusion of disciplines.

Multicultural Empathy/Competency	Multicultural awareness is necessary for working effectively in an increasingly interdependent world. Students should develop the skills and attributes necessary for continued innovations in a global economy and address ethical issues of global concern. Domestic or abroad experiences that focus on global or
Social Consciousness Competency	Working for the benefit of others is the foundation of civil society. Participation in a curricular or extra-curricular experience that deepens the student social awareness and heightens their motivation to bring their

2 Program Registration and Admission

How to Join the GCSP?

In order to participate in the program, the student needs to pass a selection and recruitment process, since the number of places is limited. Students from Engineering, Design and Administration courses may be admitted, preferably in the second year.

The process includes some steps.

- Registration within the defined deadlines; the recruitment process for admission will start every year at the end of February, mainly targeting second year students.
- Delivery of a text report in English, dealing with one of the topics associated with the Grand Challenge IMT which are grouped in the following four major areas: Sustainability, Health, Safety and Joy of Living. This document should demonstrate knowledge of the NAE Grand Challenges proposal and the GCSP-IMT program and themes; initiative (to research on these topics); interpersonal communication skills, personal affinity for one of the related areas and projects existing at IMT, with a plus for innovative ideas to be explored later during the program.
- Personal video presentation.
- Participation in group dynamics activity.
- Individual interview, preferably in English, with a member of the IMT-GCSP committee to understand the purpose and convenience of participating in the IMT-GCSP (based on submitted documentation and other arguments).

More details about that recruitment process can be seen in the **Students Selection Process Guide** available in section 5 of the Open LMS.

3 GCSP Program Activity Planning and Mentoring

I was admitted to the program. What should I do now?

The first step is to define a mentor to guide the student so that he / she can complete all the activities necessary to successfully complete the program, preferably having knowledge in one of the areas of activity defined as a priority in the preparation of the work proposal. The mentor will guide the student in several aspects, including:

- definition of an individual and balanced program for each approved student based on a list of activities pre-selected by the student and the emphasis necessary for the student to acquire the desired skills; the "menu" of activity options available for the program is shown in Appendix I. In this respect, it is important to observe the continuity and thematic connectivity of each activity; the various themes available for continuity and connectivity are addressed in Appendix II. More details about that **GCSP themes** can be seen in section 4 of the Open LMS.
- providing continuous feedback on the fulfillment of activities throughout the program and on its performance;
- guide the student to deliver the reports within the established deadlines and manage to carry out their self-assessment.

How is the mentor defined? Can I choose it?

The mentor is defined by the course coordinator in order to guide students to develop activities related to one or more GCSP themes. The course coordinator can assist in the appointment of mentors and their respective areas of expertise.
The GCSP committee (Appendix III) will also be able to guide the student and assist him in this definition.
It is important that the appointed mentor can effectively contribute to directing the student throughout the performance of all activities that are part of the program and aligned with the theme chosen by the student on your admission.

4 Duties and Benefits

What are the duties of the student admitted to the program?

The student admitted to the program must:
- meet with the mentor periodically (in person or via the web) following his or her guidelines;
- fulfill the program discussed with the mentor, including all the activities to be carried out to achieve the necessary skills; adjustments to the pre-established program can be made to correct problems related to connectivity or program continuity;
- prepare a report at the end of each semester including the self-assessment items associated with each of the skills of the GCSP - IMT program;
- pay attention to the mentor's feedback regarding their performance evaluation or the results of the reports developed;
- participate actively by making presentations during the annual GCSP symposium;
- finalize the program, fulfilling all stages of development.

How will be the student assessed?

The performance evaluation will be carried out by:
- semiannual report to be delivered by the student;
- filling out a self-assessment form (rubrics) which will allow you to check if the student is acquiring the desirable skills for GCSP;
- fulfillment of the activities proposed by the mentor throughout the course according to pre-established planning at the beginning of the activities.

What benefits does the student have when participating in the program?

The participant will receive a certificate that is internationally recognized which will certainly contribute to the enhancement of their curriculum and eventually to create professional opportunities.
All students awarded with GCSP-IMT status will be listed on the IMT program page and will automatically join a community of GCSP-IMT Scholar alumni and, hopefully, a worldwide NAE GCSP Scholar community, where they will be able to share your career ideas and achievements with alumni, Non-Governmental Organizations (NGOs), industry partners and prospective students and employers.
Also, during the traditional annual graduation ceremony on campus, IMT will praise students who have successfully graduated as members of the GCSP-IMT program with special honors and a mention in the official IMT transcript.

5 More Information

Do you need more information?

For more information, contact one of the professors who are part of the GCSP - IMT team, as shown in Appendix III.

APPENDIX I - Description of Activities Available for the GCSP- IMT program.

1. Description of Programs / Projects / Activities

1.1. CAPSTONE DESIGN PROJECT

All the curricular matrices of the CEUN-IMT undergraduate schools include in their final year a Capstone Design Project. The main objective of this project is to allow the student to integrate and consolidate the knowledge and skills they have acquired in their academic career, through an activity of synthesis and integration of knowledge. Teams of up to 5 students elect their faculty mentor and the research theme. The students have a year to create, design, solve real-world problems and test their ideas and the researches are the culmination of the CEUN-IMT schools´ experiences. Research projects must be pre-approved by the mentor before the research begins and the works are submitted to a final examining board and presented to the community and companies at the Eureka Expo.

1.2. ELECTIVE COURSES

CEUN-IMT's undergraduate courses contain a set of elective courses, which aim to make the curriculum more flexible. Electives are courses designed to allow students the opportunity to vary their curriculum according to individual interests. Electives are intended to supplement the core curriculum and all students choose elective courses in addition to their required courses. They are chosen and taken in the last series of the undergraduate course, with each course having its own hourly load requirement. The selection of elective courses should be considered both in personal interest and in career aspirations in order to ensure that some maturity is achieved in a specific area chosen.

1.3 MINORS

CEUN-IMT seeks to foster interdisciplinarity between different programs through Minor programs. In addition to adding qualifications, knowledge and skills to student's experience, it is intended that Minor expand the opportunities for undergraduates in their field of study. The Minor Program is an organized set of a cohesive unit of modules worth a total of 240 hours of studies focused on a specific area of knowledge different from their major studies, which allows the student to explore an interdisciplinary theme with less commitment of time than a major degree program diversifying their education and broadening their worldview. The application for enrollment in the Minor Program is made when the student requires enrollment in all subjects that make up the chosen Minor Program. The selection of students considers the student's performance coefficient as a requirement for occupying 200 enrollment places that are currently offered. The following Minor programs are currently offered: Energy and Sustainability, Design and Innovation, Business management, Robotics and Machine Intelligence, Systems engineering and Data Sciences.

1.4 CO-CURRICULAR ACTIVITIES (Special Project and Activities – SPAs)

Co-curricular activities (Special Project and Activities – SPAs) are offered to students from the first to the penultimate year of the undergraduate studies. Students must complete 80 to 160 hours of activities per year, as established in the pedagogical project for each program.

They aim the development of skills, abilities and creative attitudes, through elective and student-centered practical activities. Co-curricular student experiences are activities and initiatives that take place primarily outside of formal educational content, processes and courses. The purpose of such activities is to encourage the student to carry out independent, transversal and interdisciplinary studies, in order to promote, in conjunction with other academic activities, their intellectual development, the skills and competences related to the profession, as well as the development of actions related to the exercise of citizenship and sustainability. Activity examples include training in interpretation and analysis skills, problem solving methodologies, project development, technical visits, lectures, workshops, group discussion, seminars and technological competitions, participation in monitoring programs, scientific research projects, as well as participation in social responsibility projects, leadership training and start-up academies. The activities are designed to work in conjunction with the formal curriculum. These activities facilitate the development of various domains of mind and personality such as intellectual, emotional, social, and aesthetic development. CEUN-IMT provides various co-curricular activities which gives an opportunity to students to discover their talent in various fields along with their studies. The offering of Special Project Activities – SPAs should take place with groups that mix, whenever possible, students from different courses and grades, in which open and real problems are privileged.

1.5 UNDERGRADUATE FORMAL RESEARCH PROGRAM

This program aims to insert students in scientific research, placing them in direct contact with the methodologies and theoretical foundations necessary for the development of a research project. The Institutional Program for Research Scholarships focused on the scientific research introduction of undergraduate students in the areas of knowledge in which the institution operates, has a leading role in encouraging the formation of new researchers. This year-long program gives a student the chance to conduct research under the supervision of faculty members. The granting of scholarships is made through a selective process to privilege research projects with academic quality and scientific merit, enabling the good training of participating students. The official completion of the work includes the delivery of a report, participation in the Mauá Undergraduate Formal Research Program (annual) and presentation in an external Congress on Undergraduate Research.

1.6 SUPERVISED INTERNSHIP

The Supervised Internship is mandatory in all CEUN-IMT courses. Internships are short-term work experiences that allow students to observe and participate in professional environments, they are also a form of experiential learning that integrates knowledge and theory learned in the classroom with practical application and skills development in a professional setting. Supervised internships can be carried out from the fourth grade onwards and cannot last less than 160 hours. The institution identifies internship opportunities for students and maintains agreements for internships with more than 4,200 public and private companies. The Research Center also can offer supervised internship in its laboratories. Before the internship starts, the student submits an internship plan for approval and after completing the Internship, the student presents the final report. A supervising faculty member is indicated for each student who is doing a Supervised

Internship and is chosen according to the area of the internship so that he can contribute positively to the activity.

1.7 STUDY ABROAD ACTIVITIES

In order to improve the internationalization process, CEUN-IMT seeks to develop a proactive and shared approach to internationalization that complements and enhances the core activities of education and research. The International Office offers support for funding opportunities and scholarships for international mobility. There are opportunities for undergraduate students to carry out part of their program or complement their studies abroad, as well as students from partner universities to study at CEUN-IMT. The institution has concluded agreements on university-endorsed student exchange programs with approximately 34 overseas partner institutions. These programs offer students an opportunity to study for one year at any one of the partner institutions. Through international exchange of students, CEUN-IMT expects students to develop an international awareness and broaden their intellectual horizon. Students who wish to study abroad must undergo a selection procedure, they can go abroad to study either on scholarships or at their own expense. Credits earned abroad may be used as credits required for graduation, which enable students to complete their studies. CEUN-IMT also participates in Mercosur Degree Accreditation System (ARCU-SUR), which is a permanent regional accreditation system to provide public assurance about the academic level of selected degrees.

1.8 ACADEMIC COMPETITIONS FOR STUDENTS

Student participation in competitions and awards offers students the opportunity to develop skills, gain experience and knowledge, find a solution to a problem, develop an idea or product and work as part of a team. In the case of developing projects for competitions, one or more teachers coordinate the activity that begins with a lecture to expose the theme to the academic community and ends with participation in a national or international competition. CEUN-IMT annually defines a financial allocation for these activities and the amount allocated is controlled by the teams themselves during the development of the work. Students are responsible for the design, manufacture, assembly, tests and adjustments of the object of the activity, and also for the organization to participate in the competition, following a pre-established schedule. It is the philosophy of the institution to encourage student and faculty participation. Each year the CEUN- IMT support a number of different competitions and awards for students:

1.8.1 Aero design - SAE (S*ociety of Automotive Engineers*)

The SAE Aero Design competition is a real-world design challenge designed to compress a typical aircraft development program into one calendar year, taking participants through the system engineering process of breaking down requirements. It exposes participants to the nuances of conceptual design, manufacturing, system integration/test, and sell-off through demonstration.

1.8.2 Baja - SAE (S*ociety of Automotive Engineers*)

Baja SAE challenges engineering students to design and build an off-road vehicle that will survive the severe punishment of rough terrain and in some competitions, water. As in real work situations, these future engineers work together as a team to discover and resolve technical challenges in design, test, and manufacturing, as well as business issues.

1.8.3 EcoMauá - Energy Efficiency Vehicle Competition

Students are challenged to create more economical and environmentally friendly vehicles. In addition to energy efficiency, issues such as technological innovation, pilot safety and environmental impact are crucial for the assessment of the teams. The participation of students starts from the initial idea of the prototypes, the project, the construction, even the competition.

1.8.4 Egg Protection Equipment (EPE)

This competition sponsored by IBRACON intends to test the competitor's abilities to develop structural elements that are able to resist impact loads, taking the most out of reinforced concrete properties. The proposed challenge consists of projecting and casting a moment-resisting frame in reinforced concrete, according to the model established in the regulation.

1.8.5 Concrebol

This contest, sponsored by IBRACON, intends to test the competitors' ability in developing construction methods and the production of lightweight homogeneous concrete with optimized strength parameters. The proposed challenge is to build a sphere (ball) of lightweight concrete able to roll in a rectilinear trajectory, within the materials and dimensions established.

1.8.6 Cocar- High-Resistance Colorful Concrete

The purpose of this activity is to mold a specimen with high-performance colored concrete, with pre-established dimensions that is capable of achieving high strengths in the axial compression test. In the contest, the final grades of the teams are awarded considering the pigmentation tonality and homogeneity and the resistance achieved in the axial compression test.

1.8.7 "Those who know it, do it live"

The purpose of this Contest is to evaluate the competitor's ability to measure cohesive and translucent self-compacting concretes with the lowest possible cement consumption, which present the greatest resistance in 24 hours.

1.8.8 "Ousadia" Challenge for Engineering and Architecture

In this competition the participants must elaborate the basic structural design of a concrete work and develop the preliminary planning of its construction, aiming to show the most daring solution to this challenge, according to the criteria defined in the regulation.

1.8.9 Composite Material Competition

The Mauá composites team was created to participate in the SAMPE Student Bridge Contest, promoted by the Society for the Advancement of Materials and Process Engineering. This

contest allows students to design and build a composites bridge using an assortment of pultrusion, cores, fabrics and other materials supplied in kit form.

1.8.10 Fórmula Mauá – SAE (*Society of Automotive Engineers*)

Formula SAE is a student competition promoted by SAE Brasil. The competitions challenge teams of university undergraduate and graduate students to conceive, design, fabricate, develop and compete with small, formula style vehicles. The competition requires performance demonstration of vehicles in a series of events, both off track and on track against the clock.

1.8.11 Gravity Car Racing Mauá

Gravity Racing is a speed competition between vehicles without engines, developed by universities, which compete against each other or against the clock down a slope. Students from all years of Design, Engineering and Administration courses can participate in the Gravity team creating and building a car on a 1: 1 scale.

1.8.12 Mauá Robotics Team

This activity aims to complement the studies in the areas of robotics and artificial intelligence; stimulate and boost related research, involving areas such as robotics, computing, electronics, automation, artificial intelligence and image processing and mechanics. Over the years, the teams successfully participated in several national and international robotics competitions: Robot Combat (Beetleweight, Hobbyweight, Featherweight and Middleweight), Robot Sumo (LEGO Sumo, Autonomous Sumo and Sumo RC), Hockey and Robot Trekking.

1.8.13 IDEEA - International Design and Engineering Education Association

The objective of IDEEA is to develop the engineers and designers of the future in upcoming technologies relevant to mobility, product development and industry 4.0. IDEEA - International Design and Engineering Education Association hosts annual forums to provide a platform for academia, students and industry to meet, exchange ideas, foster collaboration and make new friendships. The CEUN-IMT organizes an international and interdisciplinary student team to present their product concepts – virtually and physically at the IDEEA annual Conference. The team uses an additional pre-conference phase to work together in labs and to meet after several months of online collaboration. For 2020 there will be collaborative global teamwork on this project with student teams, guided by two team faculty mentors, which will develop, build and simulate a final drone concept.

2 INSTITUTIONAL PROGRAMS ON HUMANITIES (EPICS)

The Engineering Projects in Community Service are designed via collaboration between university and community partners, such as non-governmental organizations or government agencies. This gives students experiential opportunities to learn in real world contexts and develop skills of community engagement, while affording partners opportunities to address society needs. Below we list the programs sponsored by the CEUN-IMT:

2.1 PROALFA

PROALFA is a youth and adult literacy and education initiative created in 1999 to eradicate illiteracy in the city of São Caetano do Sul. CEUN- IMT participates in the project by providing resources for the payment of the scholarship to the literacy facilitators. PROALFA facilitators are mostly students from the CEUN-IMT enrolled during the day, since classes are taught at night.

2.2 ENACTUS MAUÁ

Enactus Mauá is a non-profit organization that seeks sustainable solutions through entrepreneurial action for communities in situations of social vulnerability based on three pillars: social, environmental and economic. The organization brings together students and business leaders to promote a series of projects that help people to evolve socially and economically. Some of these are: Transform Project, which helps women to have their own business and higher income; The Amet Project, which aims at the production of ecological bricks by homeless people, in order to reinsert them into the current job market.

2.3 MAUÁ JUNIOR

Mauá Jr. is a non-profit civil association that offers consultancy to clients. It is an entity formed by students from CEUN-IMT with the guidance of a faculty member. Students have the opportunity to gain experience in business management and in the development of projects in the areas of engineering, information technology and design to inspire their entrepreneurial side and to prepare themselves to enter the job market. The selection process of Mauá Jr. takes place annually, during the first semester.

3 INSTITUTIONAL PROGRAMS ON INNOVATION, LEADERSHIP AND ENTREPRENEURSHIP.

3.1 INOVAMAUÁ

InovaMauá is a group that aims the development of sustainable technologies, focused on research and innovations. This team's mission is to promote learning, professional experience, teamwork and the development of innovative ideas and research.

3.2 NINE – Business and Entrepreneurship Innovation Center

The Business and Entrepreneurship Innovation Center – NINE was created to articulate, coordinate, induce and expand actions aimed at fostering entrepreneurial education in the academic community of IMT. The main objective is promoting entrepreneurial training both for those who wish to be proactive within companies (intra-entrepreneurs) and for those who wish to be founders and partners of startups (entrepreneurs). NINE interacts with other instances for promoting entrepreneurship, such as: SPAs, the SMILE week, the Eureka exposition, the IMT Fab Lab, Lay-out inducing integration projects, continuous education and graduate student programs.

3.3 MAUÁ BUSINESS CLUB

Mauá Business Club is a student organization seeking to improve knowledge in the areas of strategic consulting and the business world. The entity aims to develop individuals with analytical, strategic thinking and soft skills based on three pillars: study groups, networking and relationship.

3.4 IMT FINANCE

IMT Finance represents the investment education league of CEUN-IMT. Students who are interested in the financial Market are trained both at a basic level and at more advanced levels, through the elaboration of more complex cases of great academic impact and presence in the main university competitions. They also promote lectures or strategic consultancies, bringing them closer to the market.

3.5 BIZUP!

Bizup is a business leverage organization that connects companies to opportunities, with the aim of improving their financial results in a sustainable way through the right people allocated to each project. They select some Capstone Design Projects to receive mentoring, activate the transformation of products or services for the Market.

4 INSTITUTIONAL PROGRAMS FOR FOSTERING INTERDISCIPLINARITY ON COMPLEX PROBLEMS

These programs represent challenges in the field of systems engineering, usually developed in partnership with relevant industry partners.

4.1 HPA - Human-Powered Aircraft

At CEUN-IMT, HPA is an important theme for hands-on Projects and Special Activities (PAEs)

and also the object of study of several Capstone Design Projects. An HPA-IMT is an aircraft powered exclusively by human power. The HPA-IMT, called Tuiuiú, is undergoing development since 2017 and more than 60 engineering and design students have contributed to the project so far. The main objective of this program is to offer a project-centered learning theme with significant technical and behavioral challenges to interested students from any CEUN-IMT program. Currently the project has
involvement and support from Flyer Indústria Aeronáutica®, DuPont®, ANSYS®, ESSS® and Dassault Systèmes®.

4.2 HAB MAUÁ - High-Altitude Balloon

The objective of this multidisciplinary project is the design and construction of a High-Altitude Balloon, the HAB-Mauá, with the aim of launching scientific experiments in the stratosphere. The initial motivation was an astrobiology research from partnering universities. HAB-Mauá challenges students to obtain a hands-on experience for approximately one year. The participants experience the stages of designing the electronic and mechanical subsystems, the integration and testing process of these subsystems, the development of all project documentation and, finally, the actual operation of the equipment.

4.3 IMT CUBESAT

The Cubesat Project, coordinated by the Embedded Electronic Systems Center (NSEE) of CEUN-IMT, involves the application of complex and multidisciplinary electronic systems in the construction of a cube-shaped satellite miniature (10x10x10 cm), applied to space research and radio amateur communications.

4.4 GMT – The Giant Magellan Telescope

The GMT is an earth-based telescope of the new, very large diameter class. The project is carried out by an intergovernmental consortium involving the USA, Australia, Korea and the State of São Paulo, Brazil. The IMT is part of a few Universities in Brazil involved in the project and provides research opportunities for professors and scholarships for students in software development and CFD simulations.

4.5 SMILE – Mauá Week of Innovation, Leadership and Entrepreneurship

The Mauá Week of Innovation, Leadership and Entrepreneurship - SMILE is an integrating event between the areas of Management, Design and Engineering, which aims to present new trends, technologies and content in order to encourage the exchange and updating of knowledge among professionals and students. The main expected return with this initiative is the expansion of the culture of innovation across the campus, with the participation of students, alumni, faculty members and the community, showing that the diversity of ideas and the integration of fields are promoters of development. The activities include:

- High Impact Lectures;
- Technical Lectures on new technologies and innovation;
- Courses;
- Technical Visitations;

- Student Competitions;
- Hackathons;
- Overseas activities;
- Meeting with alumni;
- Companies-sponsored expositions with internship opportunities;
- International Schools' exposition and speeches;
- Faculty Academy training activities.

APPENDIX II – GCSP-IMT Themes Available for the Continuity and Connectivity of the Program.

Table A1 - Partial list of IMT Projects whose themes overlap with NAE Grande Challenge areas, and ready to receive GCSP-IMT students.

NAE Grand Challenge Theme	Theme codes	GCSP-IMT Related Project Theme	Coordinating Entity	# of Expert Faculty-member available for	Sponsors (IMT, Industries, other College or Universities, government research- funding institutions, etc.)	Research Fund status	Number of existing activities suitable for GCSP-IMT students	Readiness status for GCSP-IMT involvement
Sustainability, Health, Safety, Joy of Living	A, B, C, D	River and Flood alert Monitoring System	CP-IMT, Mechanical Engineering, Electronics Engineering, Control, and Automation Engineering, Computer Engineering, Design	2	São Caetano do Sul County/ USCS / Thales/ IMT	granted	large	awaiting Industry partner actions to start
Sustainability, Health	A, B	Food processing - residues saving	Food Engineering	2	Industry partner	granted	large	ready
Sustainability	A	Waste treatment	Chemical Engineering	2	FAPESP; CNPq; CAPES	granted	large	ready
Joy of living	D	Chemical and Biochemical Processes - Microwave applications	Chemical Engineering	1	IMT, FAPESP	granted	large	ready
Safety, Joy of Living	C, D	Construction of Building Information Modeling (BIM)	Civil Engineering	1	internal, with external industry and public entities awards, received in the last few years	all hardware and software infrastruct	large	ready

Sustainability, Joy of Living	A, D	Civil Engineering Materials	Civil Engineering	3	IMT	Granted	large	ready
Sustainability, Safety	A, C	Modeling and Methods on Structural Analysis	Civil Engineering	3	IMT, Eco-Rodovias	Granted	large	ready
Safety	C	Information Security / Cyber Security	Computer Engineering	1	IMT, FAPESP	granted	enough	ready
Sustainability, Health, Safety, Joy of Living	A, B, C, D	Smart Campus - IoT	CP-IMT, Electrical Engineering	1	IMT	granted	large	ready
Sustainability, Health, Joy of Living	A, B, D	Smart Vegetable Garden	CP-IMT, Electronics Engineering, Chemical Engineering; Food Engineering; Computer Engineering.	1	IMT	granted	large	ready
Sustainability, Health, Safety, Joy of Living	A, B, C, D	Mobility with Fuel Cell vehicles	CP-IMT, Mechanical Engineering, Electronics Engineering, Electrical Engineering, Control, and Automation Engineering.	3	Equatorial/AVL/Daimon	partially granted	large	ready
Sustainability, Health	A, B	Narrowband Equipment for remote sensing	CP-IMT, Electronics Engineering	3	Thales/Gemalto	granted	large for applications	ready

Joy of Living	A, B, C, D	Hardware Platform for Web lab Applications – Personal Education	CP-IMT, Mechanical Engineering, Electronics Engineering, Control and Automation Engineering.	3	IMT	granted	large	ready
Joy of Living	D	Improving Virtual and Enhanced Reality experiences	Design	1	IMT	N/N	large	ready
Safety	C	Electrical Installations	Electrical Engineering	3	IMT	N/N	large	ready
Sustainability	A	Renewable energy - Solar Energy	Electrical Engineering	1	IMT	granted	enough	ready
Safety	C	Internet of things (IoT), including Smart Campus, Smart Parking and Smart Cities	Electrical Engineering, Computer Engineering	3	IMT, CP-IMT	granted	large	ready
Sustainability, Health, Safety, Joy of Living	A, B, C, D	Technological Applications in Precision Agriculture, biomedical engineering, and process control.	Electrical Engineering, Computer Engineering	1	IMT	all hardware and software infrastructure in place	large	ready
Joy of Living	D	Development of Scientific Instruments and Software for Earth- based, atmospheric, or space-flight systems.	Electronics Engineering, Computer Engineering	4	IMT, FAPESP, GMTO, ESA	granted	large	ready
Safety	C	Chemical and Biochemical Processes -	Electrical Engineering	1	IMT, FAPESP	granted	large	ready

		Microwave applications						
Sustainability	A	Renewable Energy - Improving Efficiency in the use of Sugarcane-Ethanol in Internal Combustion Engines	Mechanical Engineering	3	IMT, FAPESP, PSA, CP-IMT, Other Universities	granted	large	ready
Sustainability, Health	A, B	Recycling processes: polyester-fiberglass composites; PET for 3D printing; printed circuit-boards for extracting metallic nanomaterials	Mechanical Engineering, Design	3	IMT, FAPESP	granted	large	ready
Sustainability, Safety	A, C	Development of Superhydrophobic materials for safety and cleaning-water use reduction	Mechanical Engineering	2	IMT	granted	large	ready

CAPES	Federal Research-Support Foundation (Brazil)
CNPQ	National Council for Scientific and Technological Research (Brazilian Ministry of Sciences, Technology, Innovation, and Communications)
Celesc	A Santa Catarina State Holding - Electricity Generation and Distribution Services.
Cognitivos	A Sustainability Services Company
CP-IMT	IMT Research Center
Daimon	An energy sector Corporation
Danfoss	Danfoss HVAC Corporation
Daikin	Daikin HVAC Corporation
ESA	European Space Agency

EPUSP	São Paulo State Polytechnic School of Engineering
FAPESP	São Paulo State Research-Support Foundation
Gemalto	A World Leader in Digital Security
GMTO	Giant Magellan Telescope Office (Australian, Brazilian, Korean and American Joint-Venture)
IMT	The IMT non-profit parent organization grant funds twice annually for internal and external (non-IMT students) approved researches.
N/N	Specific funding Not Necessary. Activities developed under the budget of the regular courses.
PSA	Peugeot-Citroen Automotive Group
Sulgipe	A Sergipe State Holding - Electricity Generation and Distribution Services.
Thales	An Aerospace, Defense, and Security, French Company
USCS	São Caetano City University

APPENDIX III - The GCSP-IMT Assessment and Implementation Team

The following IMT Rectory, Coordinators, faculty, and support members have contributed to the GCSP-IMT program proposal in many ways, either by identifying the opportunity and shedding the spark that initiated the internal project or by direct or indirect participation in the strategic alignment and viability analysis plus the proposal-writing and adjustment that followed suit.

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