HASSE Space School Program: University Credited

1. **Course title:** Space Mission Challenge - Planning and Implementation Management
2. **Target students:** Students of undergraduate and postgraduate levels
3. **Set student number:** 30-36
4. **Program location:** Houston, Texas, United States
5. **Program language:** English
6. **Course objectives:** This course addresses challenges to successful space missions by cultivating project management and planning skills. Inspirational sessions such as Theme of the Day are designed to instill passion and active learning attitude to cultivate professional ethics and social responsibility. Through situational and simulation sessions the students learn to manage crisis and resources, and to design and plan landing devices and habitats. The students learn from role models who are dedicated to their research in space when they visit space related institutes. The students also learn 3D design concepts and must design their devices when they visit Maker's Place. The space experts provide instant feedback. Together with the course instructors, they provide guidance for the students to practice, design, make mistakes, test, and modify strategy. The students learn to concentrate, communicate, and collaborate. They practice management skills in time, resources, and budget. An official presentation must be given by the students at the end of the course to describe in detail the rationale of the design and the challenges encountered in the process towards the final competition. Finally, the students provide a business proposal to address their objective, implementation plans and timeline.
7. **Course outlines and schedule:**
   - 7.1. Mars and long-distance space exploration;
   - 7.2. Project management: make plans for the space mission and establish project structure and task breakdown;
   - 7.3. Business management skill practice;
   - 7.4. A business proposal: students work as a team to produce a complete business proposal to address their business objectives, potential risks and predicted solutions, and funding requirement and opportunity;
   - 7.5. Budgeting: practice the skills to manage budget and understand the concept about funding;
   - 7.6. Risk assessment and management;
   - 7.7. Theme of the Day: inspiring life stories of great figures to encourage the students to explore self, set life goals, and carry out dreams;
   - 7.8. Project-based learning: centering around a simulation voyage of going to Mars that starts from planning the journey, landing, to building a habitat in Mars;
   - 7.9. Problem-based learning: visit Hacker's (Maker's) Place to prepare, make, and produce landing

devices to roar on the Moon;

7.10. Teamwork: team formation, communication, collaboration, reflection, and presentation;

7.11. Machine shop and warehouse experiences;

7.12. Establish prototyping;

7.13. Functional verification of prototyping;

7.14. Final design presentation;

7.15. Group competition;

7.16. Visit NASA's Johnson Space Center;

7.17. Visit NASA's Neutral Buoyancy Laboratory (NBL);

7.18. Visit NASA's Mission Control Center; and,

7.19. Visit private space companies and research centers.

8. **Course description:**

8.1. Course title: Mission Mars - Designing and Presentation of Martian Habitat

8.1.1. Objectives: Mission Mars is a project-based course taking place at SICSA, University of Houston. The course starts from a guided talk focusing on elements to human survival on Mars, team discussions on the habitat prototype design, to hands-on production of the habitat, and, finally, a presentation to explain the design, the science behind the design and justifications of the design choices. Mission Mars requires students to research and take into consideration key elements such as supplies in terms of air, water and food. Mission Mars emphasizes management skills in time, human resources, collaboration, designing, model making, communication, process documentation, presentation and budgeting. Teaching staff provides guidance, observation and feedback. At the end of the course students are expected to practice and learn multi-tasking skills in working as a team and providing a formal presentation.

8.1.2. Instructor: Dr. Olga Bannova, Professor, SICSA, University of Houston

8.1.3. Time: 24 hours

8.1.4. Units:

1). Elements of Life

2). Resources and Resource Management

3). Supplies and Transportation Management

4). Martian Habitat: Planning

5). Martian Habitat: Designing, Prototype Making, Presentation

6). Teamwork and Team Management

7). Budget Management

8). Time Management

9). Business Model and Proposal Management

9. **Learning outcomes:**

9.1. Ability to apply knowledge of mathematics, science and engineering.

9.2. Ability to design and conduct experiments, as well as to analyze and interpret data. Ability to use the techniques, skills, and engineering tools necessary for engineering practice.

9.3. Ability to design an engineering system, component, or process.

9.4. Ability to communicate effectively and function in a team.

9.5. Ability to identify, formulate, and solve engineering problems.

9.6. Knowledge of contemporary issues, understanding of the impact of engineering solutions in a global, environmental, and societal context, and ability to engage in life-long learning.

9.7. Understanding of professional ethics and social responsibility.

10. **Evaluation:**

10.1. Reflection: HASSE Quiz

10.2. Learning journey establishment: Daily Mission Log

10.3. Theme-based

10.4. Project-based

10.5. Team Competition

10.6. Organizational Skills

10.7. Business Model and Business Proposal

10.8. Teamwork

11. **References**

Bannova, O. (2010). Terrestrial Analogs Selection Considerations for Planetary Surface Facility Planning and Operations. In Benaroya, H. (ed.) *Lunar Settlements*. (pp. 375-386). New York: CRC Press.

Häuplik-Meusburger, S. and Bannova, O. (2016). *Space Architecture Education for Engineers and Architects*. Switzerland: Springer

Otaguro, Y., Takizawa, K., and Tezduyar, T. (2017). Space-time VMS computational flow analysis with isogeometric discretization and a general-purpose NURBS mesh generation method. *Computers & Fluids*, 158, pp. 189-200. ELSEVIER

Tezduyar, T., Behr, M., and Liou, M. (1992). A new strategy for finite element computations involving moving boundaries and interface-The deforming-spatial-domain/space-time procedure: II. Computation of free-surface flows, two liquid flows, and flows with drifting cylinders. *Computer Methods in Applied mechanics and Engineering*, 94(3), pp. 353-371.

12. HASSE **Space School Program: University Credited**

Day	Morning	Afternoon	Evening
1	Depart for Houston		Arrive in Houston Check-in
2	HASSE Opening HASSE Orientation	Team Goal Setting Mission Patch Design Presentation	Challenger Program Briefing Team Time
3	Theme of the Day Rice University	Challenger Program Mission Simulation	Challenger Program Debrief HASSE XPrize Briefing
4	Theme of the Day NASA Guest Speaker	Houston Makerspace 3D Design Concept Rover Design	Team Time
5	Theme of the Day Rocket Engine Briefing	Company Visit Ad Astra	NBA
6	Theme of the Day Houston Makerspace	3D Design Rover Making	HASSE Presentation Team Time
7	Theme of the Day Fluid Dynamics iFly	Houston Business Culture	Team Time
8	Theme of the Day NASA Restricted Area: NBL NASA Expert Project	ISS Mission Control NASA Robotics Laboratory Astronaut Training Center NASA Expert Project	Team Time
9	Theme of the Day Space Center Houston: History of Manned Space Exploration NASA Expert Project	Future of Space Exploration Orion Exhibition Space Shuttle Exhibition NASA Expert Project	NASA Guest Speaker
10	Theme of the Day University of Houston	Space Architecture Research Center: Mars Habitat Design	HASSE Dance Competition
11	Theme of the Day University of Houston	Space Architecture Research Center: Mars Habitat Making	HASSE XPrize Judged by NASA Industry Experts
12	Theme of the Day University of Houston	Space Architecture Research Center: Mars Habitat Presentation	NASA Expert Presentation HASSE Graduation
13	Return Home		

*Dates and courses may be subject to change, HASSE reserves the rights to make any schedule changes as it sees fit.

**Based on availability, HASSE reserves the rights to arrange professional ball games (NBA/MLB) as it sees fit.

HASSE Space School Program
Daily Mission Log: Reflection

➢ **Personal information:**

Date	Name	Program	Team
DD/MM/YYYY			

➢ **Pick a situation/event/technology/skill/interaction to describe, interpret, and evaluate:**

Describe	• What happened? • Who were there?	
Interpret	• How did it happen? • Why did they do it?	
Evaluate	• In what way would you do it differently?	