Innovation Curriculum

(Detailed)

for Engineering & Management Courses

in any discipline

Under Graduate | Post Graduate | Executive | Open Programmes

December 2022

Contents

Part 1: Fundamentals of Innovation

Topic 1-1: Introduction to Innovation

No.	Contents	Hrs
01	***What is innovation?*** *Pedagogy: Discussion* Identify a few innovations that come to your mind and think why do you consider these as innovation? Discuss within your team and synthesise why do we consider something innovative. Share it with all and evolve a common understanding of innovation.	0.5
02	***Role of innovation in evolution of mankind*** *Pedagogy: Discussion* Identify innovations over a few generations and think of the impact it had on mankind in-general. Discuss within your team and synthesise how have these brought about the changes in human lives or otherwise. Share it with all and evolve a common understanding on different types and levels of impact these have had in different contexts.	0.5
03	***What are the types of innovations?*** *Pedagogy: Discussion* From the examples shared, identify the types of innovations e.g. Levels of complexity/ impact, contexts, domains etc. Evolve some examples from different domains.	0.5
	Assignment: Identify at least 3 innovations in at least 3 different domains of at least 3 different levels of complexities/ impact and contexts with explanations where necessary.	Offline
04	***What are the stages of a typical innovation journey?*** *Pedagogy: Discussion* From the various innovations identified so far and any more that come to mind, map the journey to understand the stages that each went through. Summarise all the stages into some fundamental stages of an innovation journey with outcomes at the end of each stage	0.5
05	***What differentiates innovators?*** *Pedagogy: Discussion* Identify a few innovators that come to your mind and think why do you consider them as innovators? OR for the innovations identified earlier, think about what type of challenges did the individual/ team may have had to go through at each stage of the journey. Discuss within your team and synthesise what do innovators do differently? Share it with all and evolve a common understanding for differentiators of innovators.	1.0

Commented [SB1]: Facilitator may need to have some triggers ready.

Commented [SB2]: To be submitted online.

One may be able to see posts of others AFTER certain duration of time post the last submission date.

Topic 1-2: Introduction of Intellectual Property Rights

No.	Contents	Hrs
01	**Introduction to IPR** *Pedagogy: Presentation* Different types of Intellectual Property Rights e.g. Copyright, Trademark, Patent, Trade-secret etc. How to obtain each type of IPR in specific region and across regions?	1.5
	Assignment: Quiz with different cases to identify different type of IPRs and uniqueness that can be claimed.	Online

Topic 1-3: Generating Innovative Ideas

No.	Contents	Hrs
01	***What are the different types of thinking for innovation?*** *Pedagogy: Simulation* Understanding how thoughts flow during brainstorming and methodical ways of thinking	1.0
02	***What are some of the methodical ways of thinking for innovation?*** *Pedagogy: Interactive Presentation* Introduction to Lateral Thinking, Design Thinking, TRIZ, Systematic Inventive Thinking, Biomimicry™, Orbit-shift Thinking™. Discussing their pros, cons and ways to interplay between these. Evolve an understanding of what could be some core ways of thinking for innovation	0.5
03	***What are some core ways of thinking for innovation*** *Pedagogy: Discussion* Discuss the findings of the research work done to synthesise the core ways of thinking for innovation	1.5
03	***Acquiring the core ways of methodical thinking for innovation*** *Pedagogy: Discussion* *Pedagogy: Simulation* Understanding how the core ways of thinking for innovation function and how different methodologies interplay	3.0
	Assignment: Apply all the methodical ways of thinking for innovation to a topic.	Offline

Commented [SB3]: Topics to be kept ready

Commented [SB4]: Can evolve a framework to discuss e.g.
- Type of thinking: Brainstorming, Methodical
- Source of info: Self, Other People, Patents, Nature etc.
- Suitable for: Technical/ non-technical problems
- anything else?

Commented [SB5]: Topics to be kept ready

Commented [SB6]: Current focus to be on OSI as the core way and integrate others with it.

Commented [SB7]: Topic can be given by the Facilitator or a Sponsor

Topic 1-4: Engaging with People for Innovation

No.	Contents	Hrs
01	***What is the makes people excited about any engagement?*** *Pedagogy: Interactive Presentation* Understanding what makes people engage and/ or dis-engage with other people and/ or task.	0.5
02	***How do the fundamental modes of thinking play out during engagement?*** *Pedagogy: Interactive Presentation* Understanding how a person's mode of thinking impacts the engagement with other people	0.5
03	***How to understand people at a deeper level?*** *Pedagogy: Simulation* Understanding how a person's mode of thinking impacts the engagement with other people	0.5
04	***What are some dos and don'ts of engagement*** *Pedagogy: Interactive presentation* Knowing what helps and hinders in engagement for innovation	0.5
05	***Applying the principles of engagement*** *Pedagogy: Simulation* Practice the application of these principles through simulated exercises.	0.5
	Assignment: Pick a topic and have at least 5 conversations with people to understand them on the topic. Synthesise the different perspectives and highlight what new realisations/ discoveries that you have had from these conversations.	Offline

Commented [SB8]: A set of topics will have to be prepared e.g. Entertainment, Learning, Jewellery, Shoes, Health, Fitness, Environment, etc.

Topic 1-5: Exploring for Innovation

No.	Contents	Hrs
01	**Fundamentals of Exploring for Innovation** *Pedagogy: Interactive Presentation and Simulation* Understand the difference between research and exploration. Understand the different elements of an exploration exercise design viz. intent, guiding question, overall areas to explore for the exercise, sources, specific areas to explore with a particular source, any specific questions for each source. Understand how to design exploration exercise for different stages of the innovation journey i.e. identify, ideate, incubate, implement	1.5
02	**Sources for Exploration** *Pedagogy: Interactive Presentation and Simulation* **Trend Databases**: Know the available types of trend databases e.g. Technology, Consumer, Nature etc. Understand ways of leveraging these for different stages of innovation **People**: Know how to understand people at a deeper level to uncover the latent need/ intent depending upon the stage of the journey and the purpose of the engagement. **Lateral Sources**: How to identify sources (content or people) from other domains/ industries for our task-on-hand, understand different aspects of their solutions, extract principles and apply these to choses domain/ industry.	1.5
03	**Conduction of Exploration** *Pedagogy: Interactive Presentation and Simulation* **Through People as Sources**: Conducting exploration dialogues with people **Through Other Sources**: Conducting exploration from sources like internet, databases, literature etc.	1.5
04	**Synthesis of Exploration** *Pedagogy: Interactive Presentation and Simulation* **Types of Synthesis**: Understanding different types of synthesis and their purpose depending upon the stage of the innovation journey e.g. first-cut, interim, final. **Frameworks**: Designing frameworks suitable to the findings and the intent of exploration. Mapping the findings of the exploration into such frameworks such that it is easy to derive answers to the guiding question of the exploration. **Mapping** the findings of the exploration into such frameworks such that it is easy to derive answers to the guiding question of the exploration.	1.5
	Assignment: Design and Conduct explorations for at 3 different domains/ contexts and synthesise the findings to meet the intent.	Offline

Commented [SB9]: May be provided by facilitator or sponsor or identified by participants in consultation with the facilitator

Part 2: Driving Innovation Projects – I

Topic 2-1: Identifying Innovation Areas

No	Contents	Hrs
01	***Principles of choosing a domain and issues*** *Pedagogy: Interactive Presentation* What has triggered some of the innovators? What resonates with you?	1.5
	Assignment: Identify at least 3 different domains and conduct exploration to discover area to innovate in each.	Offline

Topic 2-2: Crafting & Prioritising Creative Challenges

No	Contents	Hrs
01	***Crafting Creative Challenges*** *Pedagogy: Interactive Presentation* Some examples of how the areas discovered through the dialogues are converted into creative challenge statements.	1.0
02	***Prioritising the Challenge to pursue*** *Pedagogy: Interactive Presentation* Principles for prioritising the challenge to pursue with discussion on how these apply to various challenges of the participants	0.5
	Assignment: Craft creative challenge(s) for each domain that was selected. Prioritise all the challenges crafted and select one to pursue further. Mention the thinking behind the selection.	Offline

Topic 2-3: Generation Innovative Ideas for a Challenge

No	Contents	Hrs
01	**Understanding different techniques of each methodology** *(1.0 hours per technique)* *Pedagogy: Interactive Presentation* to introduce to the method *Pedagogy: Simulation* Generate ideas for at least 3 simulated situations Current Methods and the number of techniques in each are: • OSI (3) – Frames, Assumptions, Cross-Fertilise • TRIZ (3) – 40 Principles, Contradictions, Function Oriented Search • Biomimetics (3) – B3.8 Functions, B3.8 Life Principles, BioTriz • Others (3) – SIT, Lateral, Other Trigger Based techniques	**12**
	Assignment: Pick at least 2 different problems each in Product and Process context of low level of complexity and generate ideas using at least 6 different techniques. Explain how the techniques was applied for each idea generated.	Offline

Commented [SB10]: Some examples are:
- Problem experienced by Self/ Family/ Community/ World
- Leveraging Trends - current/ future, technology/ consumer
- Aspiration driven - Growth in existing/ adjacent/ new domains etc.
- Striving to make something better/ faster/ cheaper
- General interactions

Emotional connect is a must to ensure adequate commitment when the dealing with delays/ failures etc.

Commented [SB11]: Can be either the ones identified earlier OR provided by Facilitator from a bank of dummy challenges OR live challenge sponsored by any company.

Project – Part 1: Identify a Problem and Generate Ideas to solve it

- Participants to form teams of two to six people
- Apply the concepts learnt so far to identify problems at least 6 domains/ contexts, prioritise the top three to pursue and generate ideas to solve it.

Part 3: Driving Innovation Projects – II

Topic 3-1: Designing an Innovative Solution

Just ideas are not enough for an innovation to be successful. These ideas need to come together as a solution to a problem such that its benefits are clearly understood by the stakeholders including the end-beneficiaries.

No	Contents	Hrs
01	***Combining ideas into solutions*** *Pedagogy: Interactive Presentation and Simulations* Some examples of how the ideas generated are combined into solutions to the problems that were discovered. The benefits of the solution for the problem to be clearly emerging.	1.5
02	***Prioritising Solutions*** *Pedagogy: Interactive Presentation and Simulations* Some examples of how the solutions are prioritised. Evolve principles to prioritise solutions	1.5
	Assignment: Pick at least 3 different problems identified earlier and combine the ideas generated to form at least 3 different solutions for these.	Offline

Commented [SB12]: These can be either during the session or online assignments post the session

Commented [SB13]: Will have to be created

Commented [SB14]: These can be either during the session or online assignments post the session

Commented [SB15]: Will have to be created

Commented [SB16]: Can be either the ones identified earlier OR provided by Facilitator from a bank of dummy challenges OR live challenge sponsored by any company.

Topic 3-2: Conceptualising the operating model

No	Contents	Hrs
01	***Conceptualising the operating model*** *Pedagogy: Interactive Presentation and Simulations* Some examples of how the operating models are conceptualised – the essential and desirable components of it.	1.5
	Assignment: For the 3 different solutions evolved earlier conceptualise the operating models, identify at least 3 unknowns for each and map their dependencies with the knowns.	Offline
02	**Understanding eco-systems** *Pedagogy: Interactive Presentation and Simulations* Understanding entities, its type and role played by each in an ecosystem. Mapping value (tangible and intangible) exchanges between the entities. Defining & re-defining the parameters of values being exchanged.	1.5
	Assignment: Identify 6 eco-systems from different domains/ contexts and prepare a value exchange map for each. Not more than 2 of these could be internal eco-systems (i.e. within an organisation)	Offline

Commented [SB17]: These can be either during the session or online assignments post the session

Commented [SB18]: Will have to be created

Commented [SB19]: These can be either during the session or online assignments post the session

Topic 3-3: Crafting & Communicating the Value Propositions

No	Contents	Hrs
01	**Articulating the Core Value Proposition** *Pedagogy: Interactive Presentation and Simulations* Based on the problems discovered, and any new entities envisaged in the conceptual solution, identify the core value proposition for each stakeholder in the eco-system.	1.5
02	**Preparing a compelling story** *Pedagogy: Interactive Presentation and Simulations* For exciting and enrolling each stakeholder, their core value propositions need to be communicated in a highly compelling way.	1.5
	Assignment: From the eco-systems identified earlier, pick at least 2 from different domains/ contexts and prepare core value propositions for at least 3 entities in each. Not more than 1 of these could be internal eco-systems (i.e. within an organisation) and for at least 1 newly envisaged entity.	Offline

Commented [SB20]: These can be either during the session or online assignments post the session

Commented [SB21]: These can be either during the session or online assignments post the session

Topic 3-4: Evolving a Working Model

A Working Model is also known as a Prototype (Proto) or a Minimal Viable Product/ Proposition (MVP) etc.

Sr. No	Contents	Hrs
01	**Innovation Experiments**: *Pedagogy: Interactive Presentation* **Differentiators:** Understand the difference between experiment to prove/disprove and to evolve. **Type of Models**: Understand the different types of models e.g. sketch, strawman, functional, working etc., pros & cons of each and how to leverage each in the evolution of a concept. **Type of Settings** Understanding different settings like the simulated, ideal, real etc. and ways of leveraging each to evolve a new concept.	1.5
02	***Identifying the knowns, unknowns and their dependencies*** *Pedagogy: Interactive Presentation and Simulations* Some examples of how the knowns and unknowns are identified, classified as constants and variables, and establishing their interdependencies.	1.5
	Assignment: From the solutions conceptualised earlier, pick at least 3 from different domains/ contexts, identify its knowns/ unknowns, constants/variables and their interdependencies.	Offline
03	**Design & Conduct experiments** *Pedagogy: Interactive Presentation* To resolve each of the technical and non-technical unknowns of the new solutions and evolve the solution.	1.5
	Assignment: From the unknowns identified earlier, pick at least 5 from different domains/ contexts, prepare and conduct experiments to resolve these. These should consist of at least 2 technical and 2 non-technical unknowns.	Offline
04	**Learning from Successes & Failures:** *Pedagogy: Interactive Presentation and Simulations* Many things will, and many will not work as expected during an innovation experiment. Decoding the reasons for successes and failures is essential for the evolution of any new concept.	1.5
	Assignment: From the experiments conducted earlier, prepare the learnings and design for the next round of experiments.	Offline

Commented [SB22]: Innovation experiments are to be primarily designed to evolve the concept not prove it right or wrong.

Commented [SB23]: These can be either during the session or online assignments post the session

Commented [SB24]: Will have to be created

Commented [SB25]: These can be either during the session or online assignments post the session

Topic 3-5: Scaling-up a Working Model

A solution that worked in one context may not work in another. Adapting a model that is working in context into another while scaling-up is the key to the success of any solution

Sr. No	Contents	Hrs
01	**Understanding the differences between** 'horizontal-deployment' / 'cookie-cutter' approach and scaling-up of innovative solutions. **Understanding the stages** of deploying a working model in a new context i.e. uncover the differences in contexts, pre-align stakeholders, contextualise the solution, evolve it in the new context. **Engaging teams** especially the operational team at different stages of the scale-up journey	1.5
	Assignment: Explore various innovations, uncover the challenges faced during their scale-up stage, how did they overcome it, synthesise the learnings and suggest some other ways in which they could have scaled-up by either avoiding the challenges or dealing with the challenges differently	Offline

Project – Part 2: Evolving a Working Solution

- Participants to continue working in teams formed for Part 1.
- Apply the concepts learnt in Part 2 and evolve a working model of at least one innovative solution.

Part 4: Managing Innovation Ecosystems

Pedagogy of this part would be research on few topics by the participants before the session and discussions on this during the session.

Topic 4-1: Innovation Strategy

No.	Contents	Hrs
	Why Innovation Strategy? What does it entail? What are its elements? How to evolve, manage and track it?	3.0

Topic 4-2: Internal Innovation Ecosystem

An enabling environment nurtures and accelerates innovation journeys. While an organisation as an internal ecosystem there could be external ecosystems at an industry, sector or region level which intends to establish such an environment.

No.	Contents	Hrs
	What are the different roles and competencies for innovation team? What are the various Processes, Practices and Platforms to: - inspire, equip, enable, and multiply people - identify, drive, and accelerate projects What are the different metrics used for measuring Innovation - outcomes at each stage of the journey - capabilities of people for performing different roles	3.0

Topic 4-3: External Innovation Ecosystem

An enabling environment nurtures and accelerates innovation journeys. While an organisation as an internal ecosystem there could be external ecosystems at an industry, sector or region level which intends to establish such an environment.

No.	Contents	Hrs
	What are the various approaches being used for: - Open Innovation - Scouting Innovations including Start-ups - Collaborative Networks - Spin-outs What are the pros and cons of each? When and how could each be leveraged?	3.0

Assessments

For Assignments

Assessment consists of a variety of elements viz.:

1) Engagement during the sessions – assessed by the Facilitators
2) Engagement on the online platform www.MyInnovationJourneyS.com - assessed by peers and *MijS* Team
3) Assignments for each topic/ sub-topic to assessed jointly Facilitator and Sponsor, if any.
4) To widen the horizon of engagement, discussions on assignments to happen within team, class, within institute, with other institutes, with industry professionals, where arranged.
5) Levels of Complexity and Diversity to increase:
    a. For Academic Programs: from under-graduate to post-graduate to doctorate levels of programs.
    b. For Open Programe: for individuals seeking higher level of certification.
    c. For Corporate/ Sponsored Programs: This is to be aligned with the Stakeholders/ Sponsors

For Project Work

1) Project Work submitted and presented to a panel of jurors comprising of – Facilitators, Sponsors and Special invitees, if any.
2) Viva Voce conducted after the presentation of the Project Work

Reference Materials

For Driving Innovation Projects

1) Breaking the Silos of Innovation Methods, Shreyas Bakshi, International Journal of Systematic Innovation, Pg 36, Vol. 2 Sep 2020.
2) Orbit-shifting innovation: Dynamics of Ideas that Create History, Rajiv Narang & Devika Devaiah
3) Making Breakthrough Innovations Happen – How 11 Indians Pulled-off the Impossible, Porus Munshi
4) Hands-on Systematic Innovation (Technical), Darrell Mann
5) Innovation Inspired by Nature, Janine Benyus
6) Engineered Biomimicry, Akhlesh Lakhtakia and Raúl J. Martín-Palma
7) Inventions Inspired by Nature. Dora Lee, Margot Thompson
8) Inventor's Manual, Nikolay Bogatyrev, Olga Bogatyrev
9) Inside the Box: A Proven System of Creativity for Breakthrough Results, by Drew Boyd, Jacob Goldenberg
10) Change by Design, Tim Brown
11) Business Model Innovation Strategy: Transformational Concepts and Tools for Entrepreneurial Leaders, Raphael Amit, Christoph Zott
12) Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, Alexander Osterwalder, Yves Pigneur
13) Value Proposition Design: How to Create Products and Services Customers Want, Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith, Trish Papadakos
14) Experimentation Works: The Surprising Power of Business Experiments, Stefan Thomke

For Managing Innovation Ecosystems

1) Dealing with the Mirage: Institutionalising Innovation, Shreyas Bakshi
2) Innovation Capability Maturity Model – An Introduction, Darrell Mann
3) The Hero's (Start-Up) Journey, Darrell Mann
4) ISO 56002:2019, Innovation management system — Guidance

Acknowledgements

The following people have contributed in evolving this curriculum. The same is being acknowledged with sincere thanks to each. The names are in alphabetical order.

1) Dr (Ms) Prasanna Nambiar, Principal – Don Bosco Institute of Technology, Mumbai
2) Dr Victor Gambhir, President/ Vice-Chancellor – JECRC University, Jaipur
3) Rajiv Narang, Founder – Erehwon Innovation Group of Companies.
4) Gokul Ranganathan, Founder – GarageX Consulting

Annexure

Guiding Framework for Project Selection

Levels of Complexities

Complexity level	Impact on Efficacies/ Efficiencies*	Impact on Offerings	Examples/ Description
1	Upto 50%	Improve the existing	Play-it-right Eliminate Losses/ Inefficiencies Never-before for an individual/ team
2	50% to 100%	New Features within same offerings	Play-the-game-better. Become more efficient/ profitable Never-before within a function/ business unit
3	100% to 300%	New Offerings within same category incl. ways of selling	Play-in-some-unique-ways. Gain competitive advantage Never-before within the organisation
4	300% to 500%	New Category of Offerings within the same industry	Change-the-game in the industry Transform the industry operates Never-before in the industry
5	More than 500%	New offerings across the industries	Change-the-game across industries Transform the way consumers meet their needs Never-before across the industries

Product Context

Discipline	Low	Medium	High
Mechanical, Electrical/ Electronics/ Civil	Less than 10 components	10 t0 50 components	More than 50 components
Software	Less than 1000 lines of code	1000 to 50,000 lines of code	More than 50,000 lines of code

e.g. 10 to 50 components product like assistive device for specially abled, playing/ learning device for kids, teaching/ training aids, kitchen appliance etc like an automobile or aircraft etc. (10 to 50 components to be developed or changed)

Process Context

Discipline	Low	Medium	High
Manufacturing	Improving Productivity, Quality, Safety on a manufacturing/ processing cell/station or transportation	Improving Productivity, Quality, Safety on a manufacturing/ processing/ assembly/ packaging line/ layout or transportation	Improving/ Establishing a new plant/ unit OR reducing the manufacturing footprint etc.

Engagement Context

Discipline	Low	Medium	High
All	Within Project Team of same discipline, Sponsors, Few Beneficiaries	With Project Team across disciplines, Sponsors, wide range of beneficiaries	With people across domains/ industries, Sponsors, wide range of beneficiaries

Alternate Content

No	Contents	Hrs
01	***Principles of choosing a domain and issues*** *Pedagogy: Interactive Presentation* What has triggered some of the innovators? What resonates with you?	1.5
02	**Leveraging Trends for Innovation**	**1.5**
	What are the different types of trends? *Pedagogy: Interactive Presentation* Understanding the different types of trends e.g. Consumer, Technology, Nature, etc.	0.5
	How to pick-up trends? *Pedagogy: Interactive Presentation* Leveraging Databases and General observations	0.5
	How to leverage trends to identify innovation areas? *Pedagogy: Interactive Presentation* Mapping the current state on trends and identifying opportunity areas	0.5
	Assignment: Map trends in at least two Consumer and two Technology spaces and identify opportunity areas in these	Offline
03	**Uncovering areas through dialogues**	**1.5**
	Principles of conducting a Problem Discovery Dialogue *Pedagogy: Interactive Presentation* Intent of conducting problem discovery dialogue. Some examples of dialogues and how to note the findings.	0.5
	Conducting a Problem Discovery Dialogue *Pedagogy: Simulated Exercise with debriefing* Conducting dialogues on variety of topics and noting the findings by the participants. Facilitator to debrief on what was done right and what could have been done better on these topics	1.5
	Assignment: Conduct at least 5 dialogues per team member and the team to cover at least 3 different domains. Synthesise the findings into Problems Discovered.	Offline

Commented [SB26]: Some examples are:
- Problem experienced by Self/ Family/ Community/ World
- Leveraging Trends - current/ future, technology/ consumer
- Aspiration driven - Growth in existing/ adjacent/ new domains etc.
- Striving to make something better/ faster/ cheaper
- General interactions

Emotional connect is a must to ensure adequate commitment when the dealing with delays/ failures etc.

Commented [SB27]: May have to prepare some pattern identification exercises

Commented [SB28]: This will include things like S-curve, EVPot, Pattern Recognition etc.

Commented [SB29]: These can be selected by the teams, provided by facilitator or Sponsored