MVJ COLLEGE OF ENGINEERING
Since 1982
Engineering A Better Tomorrow
An Autonomous Institution
Affiliated to VTU, Belagavi,
Approved by AICTE, New Delhi,
Recognized by UGC with 2(f) & 12 (B)

B.E., III Semester,

Semester: III			
Astronomy-Explore the Space (Level 1)			
Course Code:	MVJ22A3051	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hours

Course Objectives:

This course will give ability to:

- To enhance knowledge on Big Bang Theory, Galaxies, Stars, Electromagnetic Spectrum, Space Communication and Telescopes.
- To create workspaces that are suitable for young minds to learn innovative skills, develop ideas via hands-on activities, work and learn in a flexible environment.
- To empower students with skills of creativity, innovation, critical thinking, design thinking, social and cross-cultural collaboration and ethical leadership.
- To help build innovative solutions for unique problems, thereby supporting the nation's efforts to grow as a knowledge economy.

Module I	
Introduction to Astronomy Basics of Astronomy; Universe; Extra-terrestrial objects; Space communication; Basics to astronomical instrumentation.	**4 Hrs**
Module II	
Introduction to Planetary system Basics of planetary system; Formation and structure of solar system; Basic configuration of planets.	**4 Hrs**
Module III	
Introduction to Celestial mechanics Law's of gravitation; Gravitational force and field; Gravitational potential and potential energy; Escape velocity and orbital velocity; Kepler's laws, Hertzsprung–Russell (H-R) Diagram.	**4 Hrs**

Textbooks:

1. Forest Ray Moulton, "An Introduction to Astronomy Hardcover", The Macmillan Company, New and Revised Edition, 2018.
2. Sally R. Ball, "Astronomy for Beginners: The Introduction Guide to Space, Cosmos, Galaxies and Celestial Bodies", Blue source and Friends, 2020.

Reference Book:

1. Andrew Fraknoi, David Morrison, Sidney C. Wolff, "Astronomy: The OpenStax Introduction to the Solar System, Stars, Galaxies, and Cosmology", OpenStax, 2017.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand and describe the fundamental concepts of astronomy including the Big Bang Theory, galaxies, stars, and the electromagnetic spectrum.

CO2: Explain the formation, structure, and configuration of the solar system, and illustrate the role of space communication in astronomical studies.

CO3: Apply the laws of gravitation and Kepler's laws to analyze and predict celestial motion and planetary behavior.

CO4: Analyze the principles of astronomical instrumentation and compare the working of different telescopes for observing extra-terrestrial objects.

CO5: Evaluate stellar properties using the H–R Diagram and interpret observational data in relation to theoretical models.

Evaluation Method

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	20	Conducting Online test
Literature survey	20	Novelty identified from the literature survey
Club related activity	10	To be decided by the respective coordinators

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	30+10	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	2			2	2	1					2
CO3	3	3	2	2								2
CO4	2	2	2	2	3							2
CO5	3	3		3	2					1		2

High-3: Medium-2: Low-1

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B.E., IV Semester

Semester: IV			
Astronomy- Explore the Space (Level 2)			
Course Code:	MVJ22A4052	**CIE Marks:**	50
L: T:P:S	**1:0:2:0**	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- To introduce students to the foundational concepts of astronomy, including the origin and structure of the universe, galaxies, stars, and planetary systems.
- To develop understanding of astronomical instrumentation, such as optical and radio telescopes, and their theoretical working principles based on geometrical and electromagnetic optics.
- To explore the principles of space communication, including satellite systems, signal transmission, and the role of atmospheric effects in data propagation.

Module I	
Optical Telescope: Theoretical working principle of optical telescope. Elementary geometrical optics, image formation by reflection at a spherical boundary; concave and convex mirrors. Real and virtual images. Magnification. Image formation by refraction at a spherical boundary by converging and diverging lenses.	**4 Hrs**
Module II	
Radio Telescope: Elementary Electromagnetic theory; Image Formation by Reflection at a Parabolic Boundary; Antenna Systems and Signal Reception; Real and Reconstructed Images; Magnification and Resolution; Image Formation by Interferometry.	**4 Hrs**
Module III	
Satellite Communications: Elementary Electromagnetic Theory; Signal Transmission and Reception; Image and Data Formation; Reflection and Refraction Principles through atmosphere; Result analysis.	**4 Hrs**

Textbooks:

1. Johnson B. K, "Optics and Optical Instruments", Dover Publications, Inc. New York, 2001.
2. Whitlock LA, Pulliam K., "Laboratory exercises for introductory radio astronomy with a small radio telescope", iUniverse. 2008.
3. Piskunov N., Valenti J.A., Fischer D., "Stellar Spectral Synthesis: Modelling Techniques in Astronomy". Cambridge University Press, 2017.

Reference Book:

1. Maral G., Bousquet M., "Satellite Communications Systems: Systems, Techniques and Technology", 5th Edition. Wiley, 2009.
2. Rohlfs K., Wilson T.L., Hüttemeister S. "Tools of Radio Astronomy". 6th Edition. Springer, 2019.
3. Poggiani R. "Optical, Infrared and Radio Astronomy: From Techniques to Observation", Springer, 2017.

Course Outcomes:
At the end of the course, the student will be able to:

CO1: Explain the theoretical working principles of optical and radio telescopes using basic concepts of geometrical and electromagnetic optics.
CO2: Analyze image formation, magnification, and resolution in optical and radio telescopes through reflection, refraction, and interferometry principles.
CO3: Apply elementary electromagnetic theory to understand signal transmission, reception, and data formation in satellite communication.
CO4: Design and simulate basic telescope/antenna systems and astronomical models or satellite communication systems as part of project-based learning in groups.
CO5: Demonstrate teamwork, communication, and project management skills in executing intermediate-level astronomy projects progressing from Level-1.

Evaluation Method
Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	3	2	2								2
CO3	3	3	2	2	2							2
CO4	2	3	3	2	3						2	2
CO5			2					2	3	3	2	2

High-3: Medium-2: Low-1

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B.E., VI Semester

Semester: VI			
Astronomy- Explore the Space (Level 3)			
Course Code:	MVJ22A6053	**CIE Marks:**	50
L: T:P:S	**0:0:2:0**	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	**24 Hrs. Practical**	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will enable students;

- To apply interdisciplinary knowledge of optics, electromagnetism, and astronomy to design and develop functional models, instruments, or simulations.
- To demonstrate innovation and research orientation through project execution, publications, patents, or participation in technical competitions.
- To enhance teamwork, communication, and project management skills through structured reviews, presentations, viva voce, and final demonstrations.
- To promote life-long learning and problem-solving abilities by integrating engineering practices with creative exploration in astronomy and space science.

Module I

Product/Model Development Fabrication of small telescopes, sensors, space and astronomy exploring instruments; Simulation of astronomical and space models; Developing products and solutions to promote astronomy and space science. Final project output to be submitted with proper product/model demonstration.	**24 Hrs (Project)**

Textbooks:

1. Karttunen H., Kröger P., Oja H., Poutanen M., Donner K.J., "Fundamental Astronomy", 6th Edition. Springer, 2017.
2. Jenkins F.A., White H.E., "Fundamentals of Optics", 4th Edition. McGraw-Hill, 2001.
3. Poggiani R., "Optical, Infrared and Radio Astronomy: From Techniques to Observation". Springer, 2017.
4. Zeilik M., Gregory S., "Introductory Astronomy & Astrophysics". 4th Edition. Saunders College, 1998.

Reference Book:

1. Ingalls A.G. (Ed.)., "Amateur Telescope Making", (Vols. I–III). Dover Publications, 1996 (Reprint).
2. Berry R., Burnell J., "The Handbook of Astronomical Image Processing", Willmann-Bell, 2005.
3. Benz W. "Computational Astrophysics: An Introduction to Numerical Methods", CRC Press, 2012.
4. Whitlock L.A., Pulliam K. "Laboratory Exercises for Introductory Radio Astronomy with a Small Radio Telescope", iUniverse, 2008.
5. Pelton J.N., Madry S., Camacho-Lara S., "Handbook of Satellite Applications", 2nd Edition. Springer, 2017.
6. Clark R.N., "Visual Astronomy of the Deep Sky", Cambridge University Press, 1990.

Evaluation parameters:

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus -Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2		2					2
CO2	3	3	3	2	3	2	2	2	2			2
CO3	2	3	2	3	3		2					3
CO4			2						3	2	3	2
CO5							1		2	3	2	2

High-3: Medium-2: Low-1

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B.E, III Semester

Semester: III			
CNC Lab (Level 1)			
Course Code:	MVJ22A3111	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- Understand the working principle of the CNC machines.
- Understand the driving characteristics of the driving system, feedback devices, and the application of CNC Machines.

Module I	
Introduction to CNC Machine Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning center, machining center, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection.	**4 Hrs**
Module II	
Structure of CNC machine tool CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible	**4 Hrs**
Module III	
Activities and Project Work 1. To develop a program involving step turning and taper turning 2. Identify at least 2 different products in the market and prepare a report on requirements to manufacture /develop the product using Computer numerical control technology. 3. To start literature survey regarding the project identified.	**4 Hrs**

Textbooks:

1. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Mikell P. Groover, "Automation, Production Systems, and Computer Integrated Manufacturing", 4th Edition, Pearson, 2015.

Reference Book:

1. Koren Y, "Computer Control of Manufacturing systems", McGraw Hill, 1986.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the functioning of the components in a CNC machine.
CO2: Conduct the requirement analysis and execute the necessary calculations for component design in a CNC.
CO3: Develop the dimension system and structure of the CNC Part Program for parts.

Evaluation Methodology for Ability Enhancement Course (Level 1)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	20	Conducting Online test
Literature survey	20	Novelty identified from the literature survey
Club related activity	10	To be decided by the respective coordinators

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	30+10	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	3			2		2	2	3
CO2	2	1	2	2			2		2	2	2
CO3	3	2	1	2			1		2	1	2

High-3: Medium-2: Low-1

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B.E, IV Semester

Semester: IV

CNC Lab (Level 2)

Course Code:	MVJ22A4112	**CIE Marks:**	50
L: T:P:S	**1:0:2:0**	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	**12 Hrs. Theory+ 24 Hrs. Practical**	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- Understand the different drives and controllers in CNC.
- Understand the CNC Part Program terminologies

Module I

Drives and Controls — **4 Hrs**

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosysn, laser interferometer.

Module II

CNC Programming — **4 Hrs**

Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, manual part programming for machining center and turning center.

Module III

Activities and Project Work — **4 Hrs**

1. To develop a program for the project identified.
2. To develop the design and mechanism involved in the project and initiate the fabrication of the project.

Textbooks:

1. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Mikell P. Groover, "Automation, Production Systems, and Computer Integrated Manufacturing", 4th Edition, Pearson, 2015.

Reference Book:

1. Koren Y, "Computer Control of Manufacturing systems", McGraw Hill 1986.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the fundamentals of CNC drivers and controllers.
CO2: Develop the part programs for various operations.
CO3: Evaluate the loops, sub routines and parametric programming languages in manual part programming.

Evaluation Methodology for Ability Enhancement Course (Level 2)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	3			2		2	2	3
CO2	2	3	2	2			2		2	2	2
CO3	3	2	2	2			3		2	3	2

High-3: Medium-2: Low-1

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B.E, VI Semester

Semester: VI

CNC Lab (Level 3)

Course Code:	MVJ22A6113	**CIE Marks:**	50
L: T:P:S	**0:0:2:0**	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	**24 Hrs. Practical**	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- Understand the dimension system and structure of the CNC Part Program.
- Understand the tool and working holding devices.

Module I	
Computer Aided CNC Part Programming Need for computer aided part programming, Tools for computer aided part programming, APT, CAD/CAM based part programming for well-known controllers such as Fanuc, Heidenhain, Sinumerik etc., and generation of CNC codes from CAM packages.	**8 Hrs**
Module II	
Tooling and Work Holding Devices Introduction to cutting tool materials, Carbides, Ceramics, CBN, PCD–inserts classification, qualified, semi qualified and pre-set tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, modular fixtures, economics of CNC, maintenance of CNC machines.	**8 Hrs**
Module III	
Activities and Project work 1. To develop a part program for the project identified and perform simulations. 2. To develop fabricate the model of the project and test the model.	**8 Hrs**

Textbooks:

1. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Mikell P. Groover, "Automation, Production Systems, and Computer Integrated Manufacturing", 4th Edition, Pearson, 2015.

Reference Book:

1. Koren Y, "Computer Control of Manufacturing systems", McGraw Hill 1986.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the fundamentals of CNC part Programing.
CO2: Develop part programs for tool handling.
CO3: Appreciate the significance of cutting tool materials in material removal process.

Evaluation Methodology for Ability Enhancement Course (Level 3)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus -Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	3			2		2	2	3
CO2	2	2	2	2			3		2	2	2
CO3	3	3	3	2			2		2	3	2

High-3: Medium-2: Low-1

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B.E, III Semester

Semester: III			
Idea Box (Level 1)			
Course Code:	MVJ22A3011	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory+ 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give the ability to:

- To develop conceptual thinking skills to generate ideas and content to solve problems or create opportunities.
- To develop a research and workspace practice through inquiry and iteration.
- To develop critical thinking skills that will allow them to analyze and position their work in a team or group actively and effectively

Module I	
Introduction to Innovation: Definition of Innovation, Importance of Innovations and Inventions, What to Innovate, Types of Innovations, Innovation and Design Thinking, Concepts in Design Thinking- concept of empathy, concept of ethnography, concept of divergent thinking, concept of convergent thinking, concept of visual thinking, concept of assumption testing and concept of prototyping within the context of innovation and design thinking.	**4 Hrs**
Module II	
Stages of thinking: The Design Process: Stage 1 – Define, Stage 2 – Research, Stage 3 – Ideate, Stage 4 – Prototype, Stage 5 – Select, Stage 6 – Implement, Stage 7 – Learn, Idea generation, Basic design directions, Themes of thinking, Inspiration and references, Brainstorming, Value, Inclusion, Sketching, Presenting ideas.	**4 Hrs**
Module III	
Activity on Perspective: Activity on Empathy (Where, who, and what), Identifying a market need, Targeting the right audience, carrying out competitor and SWOT analyses, Defining the problem statement, Perform Research. Activities on Idea Generation	**4 Hrs**

Textbooks:

1. Michael Michalko, "Cracking Creativity", Ten Speed Press, Revised edition ,13 April 2011
2. Austin Kleon, "Steal like an Artist", Workman Publishing, 1st edition, 15 April 2014.

Reference Book:

1. Sam Harrison, "Idea Spotting: How to Find Your Next Great Idea", Cincinnati, Ohio: HOW Books, 2006.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the need for innovations and aspects of innovations
CO2: Design an appropriate innovative solution.
CO3: Demonstrate practical idea generation and work effectively in a team.

Evaluation Methodology for Ability Enhancement Course (Level 1)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	**20**	Conducting Online test
Literature survey	**20**	Novelty identified from the literature survey
Club related activity	**10**	To be decided by the respective coordinators
Total	**50**	------

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	**30+10**	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	**10**	Report of Level - I
Total	**50**	------

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2							1	1	1
CO2	3	2							1	1	1
CO3	3	2							1	1	1
CO4											
CO5											

High-3: Medium-2: Low-1

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B.E, IV Semester

Semester: IV			
Idea Box (Level 2)			
Course Code:	MVJ2A4012	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory+ 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give the ability to:

- Develop an innovative mindset and understand levels of innovation, manufacturing, and Investments.
- Understand different types of prototypes and their benefits.
- Develop critical thinking skills by developing the prototypes and testing.

Module I	
Technology Readiness Levels of Innovation, Manufacturing Readiness Levels of Innovation, Investment Readiness Levels for Innovation	**4 Hrs**
Module II	
Prototyping and experimentation-Initial Design, Developing designs, Types of prototypes: Sketches and diagrams, 3D printing or rapid model, Physical model, Wireframe, Role-play through virtual or augmented reality, Feasibility, Working model, Video prototype, Horizontal, Vertical, Experimental Prototyping.	**4 Hrs**
Module III	
Activity on realization of the TRL, MRL, and IRL, to design and develop the proof of concepts for the ideas/problem statements defined in the 3rd semester, to develop strategies to make the project work flawlessly.	**4 Hrs**

Textbooks:

1. Michael Michalko, "Cracking Creativity", Ten Speed Press; Revised edition ,13 April 2011
2. Austin Kleon, "Steal like an Artist", Workman Publishing; 1st edition, 15 April 2014.

Reference Book:

1. Sam Harrison, "Idea Spotting: How to Find Your Next Great Idea", Cincinnati, Ohio: HOW Books, 2006.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the Concepts of TRL, MRL, and IRL
CO2: Design development Prototypes
CO3: Demonstrate practical aspects of design and development of the proposed idea.

Evaluation Methodology for Ability Enhancement Course (Level 2)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Total	**50**	------

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II
Total	**50**	------

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2							1	1	1
CO2	3	2							1	1	1
CO3	3	2							1	1	1
CO4											
CO5											

High-3: Medium-2: Low-1

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B.E, VI Semester

Semester: VI

Idea box (Level 3)

Course Code:	MVJXXA6011	**CIE Marks:**	50
L: T:P:S	**0:0:2:0**	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give the ability to:

- Understand the steps involved in developing MVP.
- Understand different types of prototypes and their benefits.
- Develop critical thinking skills by developing the prototypes and testing.

Module I	
Minimum Viable Product: Introduction to MVP, difference between proof of concept (PoC) and MVP, Types of MVPs, Steps to building an MVP, Minimum marketable product, minimum lovable product, fully fledged product.	**8 Hrs**
Module II	
Creating a business canvas model for the idea, pitching the business model, and the startup, and the essential requirements for starting a startup. Unicorn start-ups and their journey: a case study of two Indian start-ups, Swiggy and Paytm, Various Schemes by the Indian Government to nurture Startups, and Various Schemes from the Government of Karnataka.	**8 Hrs**
Module III	
To develop a Minimum Viable Product for the problem statement identified, Develop Business Model and Pitch, Apply to various Funding agencies.	**8 Hrs**

Textbooks:

1. Michael Michalko, "Cracking Creativity", Ten Speed Press; Revised edition ,13 April 2011
2. Austin Kleon, "Steal like an Artist", Workman Publishing; 1st edition, 15 April 2014.

Reference Book:

1. Sam Harrison, "Idea Spotting: How to Find Your Next Great Idea", Cincinnati, Ohio: HOW Books, 2006.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the Concepts of MVP
CO2: Develop a business model and understand the types of startups.
CO3: Develop MVP, Business canvas mode.

Evaluation Methodology for Ability Enhancement Course (Level 3)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	**30**	Presentation, Progress and Viva Voce.
Project Demonstration	**10**	Evaluation of methodology and planning.
1.Paper Publications (Scopus -Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	**10**	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks
Total	**50**	------

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Final Project Demonstration + Viva Voce	**25 + 10**	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	**15**	Final report including abstract, design, implementation, results, and conclusion.
Total	**50**	------

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2							1	1	1
CO2	3	2							1	1	1
CO3	3	2							1	1	1
CO4											
CO5											

High-3: Medium-2: Low-1

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B.E., III Semester

Semester: III			
IOT (Level 1)			
Course Code:	MVJ22A3071	**CIE Marks:**	50
L:T:P:S	1:0:2:0 (AEC)	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 HOURS THEORY + 24 Hours Practical	**SEE Duration:**	2 Hrs

Course Objectives:

This course will enable students to:

- Gain knowledge on IoT ecosystem and Arduino board.
- To understand the different layers of IOT.
- Interface IR, Temperature, humidity sensors to Arduino board.
- Implementation of theory in practical applications.

Module I - Introduction to IoT	
Introduction to IoT: Genesis, Digitization, Impact- Connected Roadways, Buildings, IOT Challenges, Network Architecture and Design- Drivers Behind New Network Architectures, Security, Constrained Devices and Networks Comparing IOT Architectures, M2M architecture, IOT world forum standard, IOT Reference Model, Simplified IOT Architecture. **Experiments:** 1. Familiarization with Arduino and perform necessary software installation. 2. To interface LED with Arduino and write a program to turn ON LED for 1 sec after every 2 seconds	**6 Hrs**
Module II - IoT Layers and functionality	
IOT Network Architecture and Design Core IOT Functional Stack, Layer1(Sensors and Actuators), Layer 2(Communications Sublayer), Access network sublayer, Gateways and backhaul sublayer, Network transport sublayer, IOT Network management. Layer 3(Applications and Analytics) – Analytics vs Control, Data vs Network Analytics. **Experiments:** 1. To interface Digital sensor (IR) with Arduino and write a program to turn ON LED when the push button is pressed or a sensor detection. 2. To interface the DHT11 sensor with Arduino and write a program to print temperature and humidity readings.	**6 Hrs**

Project Implementation (Activity Based Learning-Level I)

1. Demonstration of sensor-based real-time application.
2. Development of prototype related to integrated sensors and wired communication (Arduino uno).

Reference Books:

1. Cisco, IOT Fundamentals – Networking Technologies, Protocols, Use Cases for IOT, Pearson Education; First edition (16 August 2017).
2. Raj Kamal," Internet of Things-Architecture and design principles", McGraw Hill Education.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands-on Approach", Orient Blackswan Private

Limited - New Delhi; First edition (2015).

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Analyze different IOT Architecture and select them for a particular application.

CO2: Evaluate the sensor data generated and map it to IOT protocol stack.

CO3: Implement and execute programs using development tools.

Evaluation Method

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	20	Conducting Online test
Literature survey	20	Novelty identified from the literature survey
Club related activity	10	To be decided by the respective coordinators

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	30+10	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	2			2	2	1					2
CO3	3	3	2	2								2
CO4	2	2	2	2	3							2
CO5	3	3		3	2					1		2

High-3: Medium-2: Low-1

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B.E., IV Semester

Semester: IV			
IOT (Level II)			
Course Code:	MVJ22A4072	**CIE Marks:**	50
L:T:P:S	1:0:2:0 (AEC)	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 HOURS THEORY + 24 Hours Practical	**SEE Duration:**	3 Hrs

Course Objectives:

This course will enable students to:

- Gain knowledge on storage and cloud computing.
- To understand the software design concepts of IOT.
- To develop skills required to build real-life IoT based projects.

Module I - Cloud Platform	
Data Collection, Storage and Computing using a Cloud Platform: Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud - based data collection, storage and computing services using Nimbits, The Hierarchy of Edge, Fog, and Cloud. **Experiment:** To interface Bluetooth with Arduino and write a program to send sensor data to smartphone using Bluetooth.	**6 Hrs**
Module II - Prototyping and Designing	
Prototyping and Designing Software for IoT Applications: Introduction, Prototyping Embedded device software, Programming Embedded Device, Arduino Platform using IDE, Reading data from sensors and devices, Devices, Gateways, Internet and Web/Cloud services software development. **Experiment:** Write a program on Arduino to publish temperature data to MQTT broker	**6 Hrs**

Project Implementation (Activity Based Learning-Level II)

1. Identifying a real-life application area such as smart city, smart parking, smart agriculture, smart health care, Medical IOT, smart environment monitoring.
2. Usage of Arduino board suitability for prototype RFIDs at the customer and company ends.
3. Development of prototype to obtain and control the real-time data with cloud integration in the above selected application.

Reference Books:

1. Cisco, IOT Fundamentals – Networking Technologies, Protocols, Use Cases for IOT, Pearson Education; First edition (16 August 2017).
2. Raj Kamal, "Internet of Things-Architecture and design principles", McGraw Hill Education.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things – A Hands-on Approach", Orient Blackswan Private Limited - New Delhi; First edition (2015).

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Develop an energy efficient system for WSN.
CO2: Create a real-life application involving Wireless Sensor Networks using IoT concepts.
CO3: Remotely monitor data and control device.

Evaluation Method
Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	3	2	2								2
CO3	3	3	2	2	2							2
CO4	2	3	3	2	3						2	2
CO5			2					2	3	3	2	2

High-3: Medium-2: Low-1

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B.E., VI Semester

Semester: VI

IOT (Level III)

Course Code:	MVJ22A6073	**CIE Marks:**	50
L: T:P:S	0:0:2:0 (AEC)	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	24 HOURS PRACTICAL	**SEE Duration:**	2 Hrs

Course Objectives:

This course will enable students to:

- Gain knowledge on Web of Things and Cloud of Things.
- To apply the theoretical concepts in designing web/cloud based IOT applications.
- Applying the concepts in industrial sector to enhance the existing technologies.

Module I–Case Studies	
Web of Things: Web of Things versus Internet of Things-Architecture Standardization for WoT - Platform Middleware for WoT- WoT Portals and Business Intelligence-Cloud of Things: Grid/SOA and Cloud Computing-Cloud Standards –Cloud of Things Architecture, Open-Source e-Health sensor platform.	**12 Hrs**
Module II - Prototyping and Designing	
Case Study and IoT Application Development: IoT applications in home- infrastructures security Industries- IoT electronic equipment's. Use of Big Data and Visualization in IoT Industry 4.0 concepts.	**12 Hrs**

Project Implementation (Activity Based Learning-Level III)

1. Design and Development of prototype device and Deployment of M2M, IoT, IIoT applications and services.
2. Design of smart applications and services using all four architectural layers: (i) sensor and device networks, (ii) data adaptation and gateway, (iii) cloud platform, which includes data store and analytics, and (iv) applications and services.
3. Validation and Testing of the prototype with respect to the existing devices and its performance analysis.

Reference Books:

1. Cisco, IOT Fundamentals – Networking Technologies, Protocols, Use Cases for IOT, Pearson Education; First edition (16 August 2017).
2. Raj Kamal, "Internet of Things-Architecture and design principles", McGraw Hill Education.
3. Arshdeep Bahga and Vijay Madisetti, 'Internet of Things – A Hands-on Approach', Orient Blackswan Private Limited - New Delhi; First edition (2015).
4. Introduction to Industry 4.0 and Industrial Internet of Things - Course (nptel.ac.in)

Course Outcomes:

At the end of the course, the student will be able to:

CO1: To study the basics of Industrial IOT.
CO2: Develop real-life IIOT based projects
CO3: To control the data remotely using apps and web.

Evaluation parameters:

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus -Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2		2					2
CO2	3	3	3	2	3	2	2	2	2			2
CO3	2	3	2	3	3		2					3
CO4			2						3	2	3	2
CO5							1		2	3	2	2

High-3: Medium-2: Low-1

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B.E, III Semester,

Semester: III			
LabVIEW – Graphical Programming (Level 1)			
Course Code:	MVJ22A3101	**CIE Marks:**	50
L: T:P:S	1:0:2:0 (AEC)	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 HOURS THEORY + 24 Hours Practical	**SEE Duration:**	2 Hrs

Course Objectives:

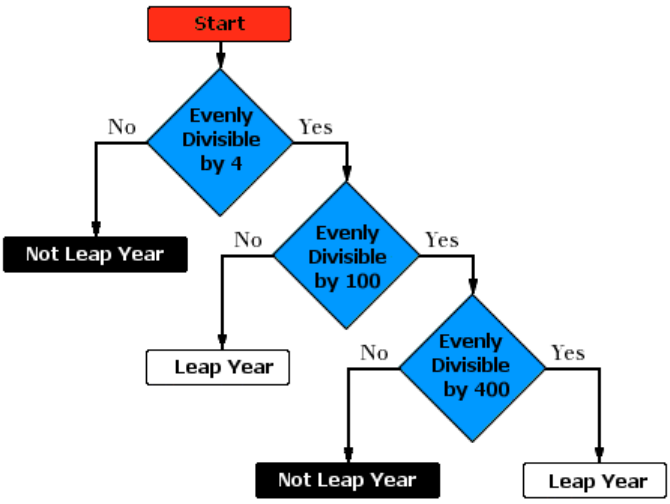
This course will enable students to:

- Introduce the basics of LabVIEW environment and the basic concept of Data Flow programming.
- Familiarize the common LabVIEW functions with the different palettes.
- Understand the graphical programming and the debugging methods.

Module I	
Introduction to Virtual Instrumentation - LabVIEW Programming and its advantages - Components of LabVIEW – Creating and saving a VI - Creating and saving a project – Front panel and block diagram Tool bar – Palettes – Front panel and block diagram objects – Data types – Data flow programming: Wires, automatically wiring objects, manually wiring objects **Debugging tools:** Fixing broken Vis, finding causes for broken Vis, common causes of broken Vis, fixing incorrect behaviour, block diagram toolbar, probe tool	**6 Hrs**
Module II	
Modular Programming: Formula nodes -Expression Nodes - Structures – Case structure – Sequence structures – Timed structures - Data Structure: Numeric, Boolean, Dynamic, Enum and Ring. **Execution structures**: Loops-While, For, Infinite and Various Tunneling Modes **Passing data between loop iterations:** Shift registers, initializing shift registers and stacked Shift registers, Local and global variables	**6 Hrs**

Programming Tasks

1. Build a VI to perform the operation of Half adder and Full adder.
2. Build a VI to find the roots of a equation using formula node. (EX: A=1, B=4, C=3-→ X1=-1 & X2=3).
3. Build a VI to compute the following equations using Formula Nodes: Y1= X3+X2+5;Y2=M*X + B; (X=2.5, M=-0.6, B=6.7 -------→ Y1=26.87, Y2=5.20)
4. Build a VI to develop code converters like binary to gray, gray to binary, BCD to Excess 3.
5. Develop a VI to demonstrate the 4X1 Multiplexer and 1X4 Demultiplexer.
6. Find the equivalent gray code for the binary input and the binary code for the Gray input.
7. Convert a 4bit binary number to decimal number and vice versa.
8. Build a VI to simulate the username and password to enter into a PC.
9. Build a VI to find whether the given input year is a leap year or not.



10. Build a VI to simulate traffic light control.
11. Build a VI to perform the operation of calculator using ENUM and RING.(Minimum of 4 operations).
12. Build a VI to simulate Motor Speed control which limits the speed to 80.
13. Build a VI for Tank level measurement. (Single tank level filling and then draining, Two tank with one filling and other draining after first tank filling, two tanks simultaneously One filling and other draining)
14. Build a VI to add 'n' Natural numbers according to the input of the user.(Using feedback node and shift register)
15. Build a VI to find the factorial of a given number.
16. Build a VI to find the Fibonacci series according to the given input of the user.
17. Build a VI to display only the odd numbers using conditional tunnel modes.
18. Build a VI to demonstrate the difference of tunnelling modes(Concatenating, conditional, last value)
19. Create a VI to find the sum of first n natural numbers using A WHILE LOOP with a feedback node.
20. Create a VI to find the factorial of a given number using While loop.

Textbooks:

1. Jeffrey Travis and Jim Kring," LabVIEW for Everyone: Graphical programming Made Easy and Fun Hardcover", Prentice Hall, 3rd Edition, 2006.
2. Jovitha Jerome," Virtual Instrumentation using LabVIEW", "Prentice Hall of India, reprint, 2018.

Reference Books:

1. Essick John, "Hands-On Introduction to LabVIEW for Scientists and Engineers, "Oxford University Press, 2018.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the basic tools for developing the Virtual Instruments environment.

CO2: Analyze data structures of different data types of Numeric, Boolean in LabVIEW and Identify and use various loop structures in LabVIEW environment.

Evaluation Method

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description

Basic Concept Learning	20	Conducting Online test
Programming Skill	20	Innovative methods to solve programmes
Club related activity	10	To be decided by the respective coordinators

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	30+10	Programmes executed with their results, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2			3	2	2	2	2	2
CO2	3	3	2			3	2	2	2	2	2
CO3			3	3		2	2	2	2	2	2
CO4		2	2	3	2	2	3	2	2	2	2
CO5			2	2		1	1	1	2	2	2

1 – Low, 2 – Medium, 3 - High

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B.E, IV Semester

Semester: IV			
LabVIEW – Graphical Programming (Level 2)			
Course Code:	MVJ22A4102	**CIE Marks:**	50
L: T:P:S	1:0:2:0 (AEC)	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 HOURS THEORY + 24 Hours Practical	**SEE Duration:**	2 Hrs

Course Objectives:

This course will enable students to:

- Understand the advanced operations of LabVIEW programming in developing stand-alone applications.
- Understand the modularity in different data types and modularity in different operations of LabVIEW.

Module I	
Modular Programming: Data Structure: Arrays and its operations - Custers and its functions- Customizing Front Panel. **Controls:** Typedef - Strict Typedef - Modularity: SubVI's - Terminal Setting - Icon Design **Polymorphism** - Arrays and Clusters. **Handling errors:** Automatic error handling. Manual error handling, error clusters.	**6 Hrs**
Module II	
Graphs and Charts: Waveform graphs and charts, XY graphs, Intensity graphs and charts, Digital waveform graphs, Mixed signal graphs, 2D graphs, 3D graphs. **Data Structure:** Strings and its functions, File I/O VIs and Functions.	**6 Hrs**

Programming Tasks

1. Create a 1D numeric array from loops (For and While) using random numbers and obtain the reverse of the array.
2. Create a 2D numeric array (5*5) containing random numbers and find its transpose.
3. Create two 2D numeric arrays and add them. Change the Number of rows and number of columns of each array and see the result.
4. Build a VI that generates a 1D array. Multiply the array elements by a scaling factor and find the resultant array.
5. Build a VI that generates 1D array and then multiplies pairs of elements together and outputs the resulting array. For Example, the input array with values 1, 23, 10, 5, 7, 11 will result in the output array 23, 50, 77.
6. Build a VI to find the sum and product of array elements.
7. Create a 1D numeric array and check whether the array elements are odd or even. In the output array display 0s and 1s for ODD numbers and EVEN numbers respectively.
8. Create a VI to generate random numbers between 0-50, 50-100, 0-100 and put them into separate arrays.
9. Build a VI that generates a 1D array of random numbers and sort the array in ascending and descending order and find the maximum and minimum value of the array elements and also find the size of the array.
10. Build a VI that generates a 1D array of any integer values and replace the negative numbers with 0. Then build

from the same VI to remove the negative numbers and sort the arrays. (Example: Input array : 1,-3, 4, 9, 21, -89; Output array1: 1, 0, 4, 9, 21, 0 , Output array 2: 1, 4, 9, 21(Sorted))

11. Build a VI to generate 1D Boolean array Running LED.
12. Create a VI to check whether the cluster elements are in range or not. Specify the Upper and Lower limits. Display the coerced output and a cluster of LEDs to indicate whether a particular element is in range or not.
13. Create a VI to compare clusters and Switch ON an LED in the output cluster if the nth Element of cluster 1 is greater than the nth element of the Cluster2.
14. Create a VI to add a value with every element of an available cluster. (Adding a numeric to a cluster result in the addition of the numeric to each element in the cluster).
15. Create a VI to select between two input clusters using a toggle switch and display in an output cluster.
16. Build an array of cluster controls in which each cluster consists of numeric control and 1D numeric array (With 5 Elements). This forms a database of marks of students. The numeric control indicates the roll number, and the array indicates the test marks of five subjects. Build logic to modify the mark in a particular subject of a particular student. Input the roll number, Subject in which mark to be changed and the new marks. Display the changed database on a separate array indicator.
17. Build a VI that generates 50 random numbers and plot it on a waveform chart using For and While loops. Accumulate the random numbers into an array and display it on waveform graph.
18. Build a VI which gets a string input. Replace a particular word in the input string by a new word. Use the Replace substring function for this.
19. Build a VI to check whether the given string is palindrome or not.
20. Create a VI to find the nCr and nPr values using subVI.
21. Create a VI to compute full adder logic using half adder logic as subVI.
22. Create a VI to find the Grey code equivalent of a BCD number using subVIs.

Textbooks:

1. Jeffrey Travis and Jim Kring," LabVIEW for Everyone: Graphical programming Made Easy and Fun Hardcover", Prentice Hall, 3rd Edition, 2006.
2. Jovitha Jerome," Virtual Instrumentation using LabVIEW", "Prentice Hall of India, reprint, 2018.

Reference Books:

1. Essick John, "Hands-On Introduction to LabVIEW for Scientists and Engineers, "Oxford University Press, 2018.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the different operational functions for arrays and clusters to develop different tasks.

CO2: Examine Digital waveform graphs and Charts and Implement error handling techniques in LabVIEW.

Evaluation Method

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2			3	2	2	2	2	2
CO2	3	3	2			3	2	2	2	2	2
CO3			3	3		2	2	2	2	2	2
CO4		2	2	3	2	2	3	2	2	2	2
CO5			2	2		1	1	1	2	2	2

1 – Low, 2 – Medium, 3 - High

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B.E, VI Semester

Semester: VI			
LabVIEW – Graphical Programming (Level 3)			
Course Code:	MVJ22A6103	**CIE Marks:**	50
L:T:P:S	0:0:2:0 (AEC)	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	24 Hours Practical	**SEE Duration:**	3 Hrs

Course Objectives:

This course will enable students to:

- Apply the various architectural coding patterns using LabVIEW.
- Analyze the acquisition of different signals from various sensors using NI hardware's.

Module I	
Event Structure: User Interface, Notify and Filter Events - Simple VI - General VI - State Machine Architecture - Master Slave Architecture - Producer Consumer - Property Nodes and Invoke Nodes. Creating and saving an Express VI – Creating a stand-alone application	**12 Hrs**
Module II	
Concepts of data acquisition and signals - types - Signal conditioning and grounding – Hardware and software configuration – Analog and digital I/O – Timers and counters – DAQ assistant and DAQmx – Selecting and configuring a data acquisition device	**12 Hrs**

Programming Tasks

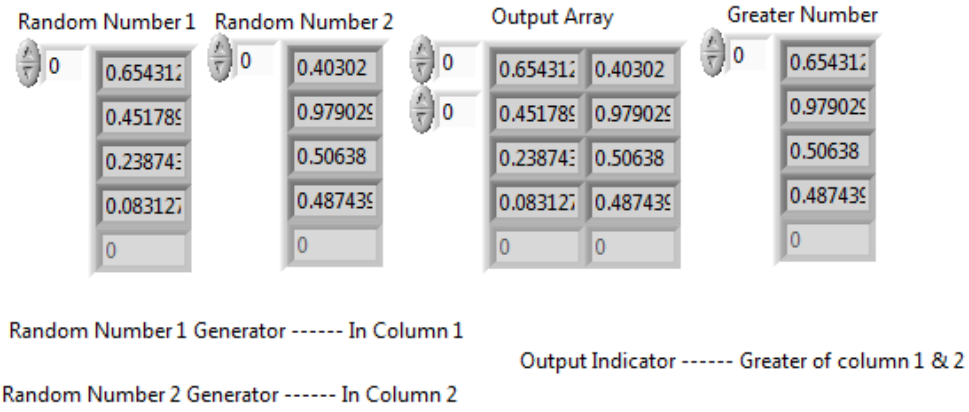
1. Write a VI to remove all duplicate entries in the input array and output results as the output array. Also output the indices of the removed element of the removed element in the indices array. EX: Input Array:1,2,3,1,2Output array: 1,2,3. Removed element indices: 3, 4
2. Remove items from the array that are greater than the average values of all the numbers in the array.Ex: Input array: 1,2,3,4. Avg value: 2.5, Output array: 1, 2
3. Write a VI to find the number of vowels in the input string. Vowels are a , e, i, o, u. Both upper and lower case must be counted.
4. Write a program that outputs a random number between lower limit and upper limit each time it is run. The program should always output -1 if the lower limit is greater than upper limit. If both limits are equal the output should be that number.
5. Find the difference between the consecutive elements of an array. y(i) = x(i) – x(i-1), y(0)=x(0). EX : Input array: 99, 5, 67, 66, Output array: 99, 94, -62, 1
6. Find whether the input number is prime or not. If prime display YES in prime indicator and output an empty array in factors array. If not prime display NO in prime indicator and output all factors (Including 1 and number itself) in factors array. Assume input to be positive integer greater than or equal to 2.
7. Write a VI to Count the number of # in the input string. Ex: This is a #String #. Ans : 2

8.Find the non negative integral power of 2 closest to the input. If input is equidistant from 2 consecutive powers of 2 output the higher power. Assume input to be greater than 0.

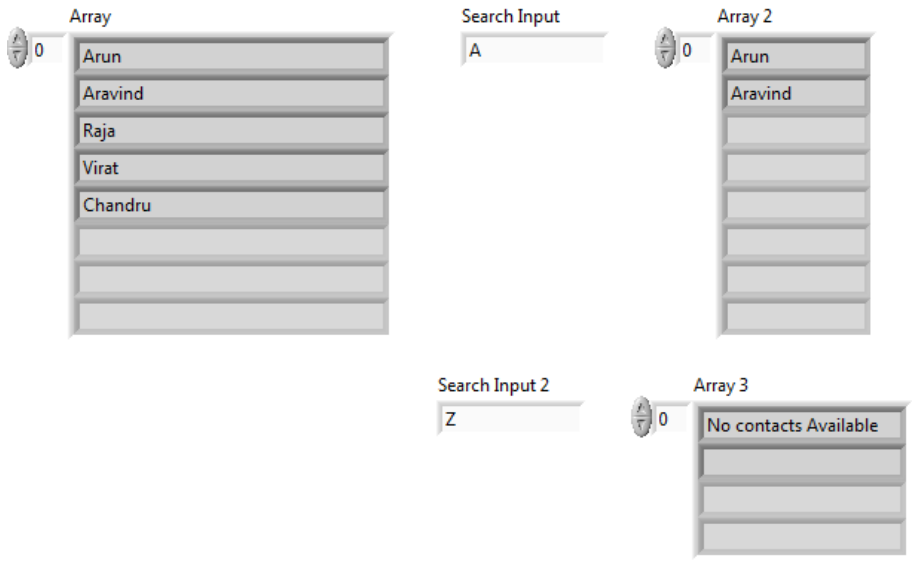
9.Example: 1. Input: 9, Output: 8

10. Ex 2. Input: 3, Output: 4

11. Find the sum and product of all digits in a number. Delete all the elements that are after the decimal point. Ex: Input: 136.99, Output: Sum=1+3+6 =10, Product = 1*3*6=18Another ex: 123456 output sum=1+2+3+4+5+6=21, again sum=2+1=3
12. Write a program to generate the number of elements in an array such that display FIZZ for multiples of 3 and display BUZZ for multiples of 5 and display FIZZBUZZ multiples of 3&5.Ex: For input 10: Output should be(1,2,FIZZ,4,BUZZ,FIZZ,7,8,FIZZ,BUZZ)
13. Write a program to display a camel string. Ex: Input: This is a string --------Output: ThisIsAString (No blank spaces and all letters of beginning word should be caps)
14. Roll of a Dice. Write a VI to count the number of occurrence's in the multiple roll of the dice.
15. Write a VI to find the berth spot (Side lower/middle/ upper, etc) of the given seat number.(Ex: 1-LB , 2-MB, 3-UB, 4-LB,5-MB, 6-UB, 7-SL, 8-SU)
16. Write a VI to develop the following task:



17. Write a VI to generate a names database as in mobile and then list out the names that match when a single input is given as shown in example.



18. Develop a VI to find whether a given number is a disarium number. (A disarium number is a number in which the sum of the digits to the power of their respective position is equal to the number itself (position is counted from left to right starting from 1). Hence,175 is a disarium number.) Example: 175=(1^1)+(7^2)+(5^3) = 175 = Disarium Number
19. Develop a VI for SGPA calculation.

Textbooks:

1. Jeffrey Travis and Jim Kring," LabVIEW for Everyone: Graphical programming Made Easy and Fun Hardcover", Prentice Hall, 3rd Edition, 2006.
2. Jovitha Jerome," Virtual Instrumentation using LabVIEW", "Prentice Hall of India, reprint, 2018.

Reference Books:

1. Essick John, "Hands-On Introduction to LabVIEW for Scientists and Engineers, "Oxford University Press, 2018.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the different operational functions for arrays and clusters to develop different tasks.

CO2: Examine Digital waveform graphs and Charts and Implement error handling techniques in LabVIEW.

Evaluation parameters:

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus -Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2			3	2	2	2	3	3
CO2	3	3	2			3	2	2	2	3	3
CO3			3	3		2	2	2	2	3	3
CO4		2	2	3	2	2	3	2	2	3	3
CO5			2	2		1	1	1	2	3	3

1 – Low, 2 – Medium, 3 - High

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B.E, III Semester

Semester: III			
National Cadet Corps (Level 1)			
Course Code:	MVJ22A3121	**CIE Marks:**	50
L: T:P:S	**0:0:4:0**	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	**24 hours Practicals**	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- Develop qualities of character and Courage.
- Develop qualities of leadership, communication, secular outlook, spirit of adventure and sportsmanship
- Manage time, emotion and stress effectively in critical situations.

Module I	
Introduction: Aims, Objectives of NCC, Threats to National Security, NCC Certificates. Life Skills: Effective Communication , Empathy, Critical Thinking, Coping with Emotions.	**8 Hrs**
Module II	
Personality development: Group Discussion Ability: Skills and techniques, Group Discussion activities- Think-Pair-Share, Inner/Outer Circles, and Jigsaw activities for interactive learning.	**8 Hrs**
Module III	
Emotional intelligence: Importance, Emotional quotient (EQ), EQ activity **Goal Setting**: Types, Activity	**8 Hrs**

Textbooks:

1. S Guar, “National Cadet Corps (SW& SD)”, AKG Publishing House,2021.

Reference Book:

1. R Gupta, “NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations”, Ramesh Publishing House” 2020.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the history of NCC and its role in nation building.
CO2: Apply group discussion techniques in diverse settings.
CO3: Analyse the importance of emotional management in various situations.
CO5: Compare the different types of goals in their career.

Evaluation Method
Continuous Internal Evaluation (CIE):50 Marks
Final CIE Mark =A+B+C+D

1. Group Discussion Ability(A)- 20Marks
2. Emotional intelligence activity(B) -10 Marks

3. Goal Setting Activity(C) - 10 Marks
4. Reward for excellence(D) - 10Marks

Semester End Examination (SEE):50Marks

Group Discussion Ability: Students will be divided into groups and assigned specific topics (on spot) for the group discussion activity. Their performance will be evaluated based on the predefined assessment parameters.

1) Content & Knowledge – 10Marks
2) Communication Skills – 10Marks
3) Team Interaction – 10Marks
4) Confidence & Body Language – 10Marks
5) Time Management & Relevance- 10Marks

TOTAL MARKS= (CIE for 50 + SEE for 50)

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											1
CO2								3			3
CO3											3
CO4											2

High-3: Medium-2: Low-1

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B.E, IV Semester

Semester: IV			
National Cadet Corps (Level 2)			
Course Code:	MVJ22A4122	**CIE Marks:**	50
L: T:P:S	0:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	24Hours	**SEE Duration:**	3 Hrs.

Course Objectives:

This course will give ability to:

- Develop qualities of character and Courage.
- Develop qualities of leadership, communication, secular outlook, spirit of adventure and sportsmanship
- Manage time, emotion and stress effectively in critical situations.

Module I	
Public Speaking Skill: Types, Key Skills and Qualities, Strategies for improvement, Benefits, Public Speaking Activity	**8 Hrs**
Module II	
Non-Verbal Communication: conveying and interpreting messages through body language, facial expressions, gestures, eye contact, posture, tone of voice, personal space, and appearance, without using spoken words. Public Speaking Activity with Non-Verbal Communication.	**8 Hrs**
Module III	
On-the-Spot Public speaking topic: Activity	**8 Hrs**

Textbooks:

1. S Guar, "National Cadet Corps (SW& SD)", AKG Publishing House,2021.

Reference Book:

1. R Gupta, "NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations, Ramesh Publishing House", 2020.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the need for and importance of public speaking.
CO2: Apply various techniques to adopt public speaking skills.
CO3: Analyse the importance of non-verbal communication

Evaluation Method

Continuous Internal Evaluation (CIE):50 Marks

1. Public Speaking Topic Presentation: 15 Marks
2. On spot topic Presentation: 15 Marks
3. Report Submission: 10 Marks
4. Reward for excellence: 10 Marks

Semester End Examination (SEE): 50 Marks

On-the-spot public speaking topic: 40 Marks
Each student will be given an on-the-spot public speaking topic. They are required to speak in front of the Examiners on the given topic showcasing their public speaking skills.

Viva-Voce:10 Marks
They are required to speak in front of the Examiners and respond to questions during the Q&A session.
TOTAL MARKS= (CIE for 50 + SEE for 50)

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1								3			3
CO2								3			3
CO3								3			3

High-3: Medium-2: Low-1

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B.E, VI Semester

Semester: VI			
National Cadet Corps (Level 3)			
Course Code:	MVJ22A6123	**CIE Marks:**	50
L: T:P:S	0:0:2:0	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	24 Hours	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- Develop qualities of character and Courage.
- Develop qualities of leadership, communication, secular outlook, spirit of adventure and sportsmanship
- Manage time, emotion and stress effectively in critical situations.

Module I

Community service-based and NCC related projects **24 Hours**

Textbooks:

1. S Guar, "National Cadet Corps (SW& SD)", AKG Publishing House,2021.

Reference Book:

1. R Gupta, "NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations, Ramesh Publishing House" 2020.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Understand the importance of civic responsibility.
CO2: Use communication skills to effectively coordinate volunteers for a community event.
CO3: Develop the capability to take decisions in various critical situations.
CO4: Analyse the root causes of a specific local problem and provide solution.

Evaluation Method

Continuous Internal Evaluation (CIE): 50Marks

1. Review I, II and III- 30Marks
2. Reward for excellence: 10 Marks
3. Project Report- 10 Marks

Semester End Examination (SEE): 50 Marks

1. Project Presentation and Communication:30 Marks
2. Project Impact and Outcome:10 Marks
3. Viva Voce- 10 Marks
4.

TOTAL MARKS= (CIE for 50 + SEE for 50)

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1								2			3
CO2								3			3
CO3											
CO4								2			2

High-3: Medium-2: Low-1

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B.E, III Semester

Semester: III			
Robotics And Industrial Automation (Level 1)			
Course Code:	MVJ22A3061	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- To understand the history, concept, development and key components of robotics technologies.
- To understand various CAD and EDA tools for robotic design.

Module I	
Introduction: Introduction to Robotics, Microcontrollers, Drives for robots: Electric, hydraulic, and pneumatic. Sensors: Internal-External, Contact non-contact, position, velocity, force, torque, proximity, and range, Actuators, Robot configurations, Robot wrist Mechanism, Precision and accuracy of Robot	**4 Hrs**
Module II	
Modelling and interface: Microcontroller interface with IDE and sensors, interfacing with actuators, chassis design and modelling, interfacing circuit design using EDA tools, Circuit design for interface of components, Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D.	**4 Hrs**
Module III	
Design and Implementation of Basic Robot design and assembly.	**4 Hrs**

Textbooks:

1. Patranabis D, "Sensors and Transducers", Prentice Hall India Learning Private Limited, 2nd Edition, 1-January-2003.
2. Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, "Industrial Robotics Technology, Programming and Applications", Tata –McGraw Hill Pub. Co., 2008.

Reference Book:

1. Deb. S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Publishing Company Limited, 2010.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: List and Explain the Basic Elements of Industrial Robots
CO2: Classify The Various Sensors Used in Robots for Better Performance

Evaluation Methodology for Ability Enhancement Course (Level 1)

Total Marks: 100

- **CIE: 50 Marks**

- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	**20**	Conducting Online test
Literature survey	**20**	Novelty identified from the literature survey
Club related activity	**10**	To be decided by the respective coordinators
Total	**50**	------

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	**30+10**	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	**10**	Report of Level - I
Total	**50**	-------

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	1					1	1
CO2	2	2	2	2	1					1	1

High-3: Medium-2: Low-1

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B.E, IV Semester

Semester: IV			
Robotics And Industrial Automation (Level 2)			
Course Code:	MVJ22A4062	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory+ 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- To understand the design model for Robot Chassis.
- To obtain hands-on experience in PCB design and manufacture of basic robots.

Module I	
Introduction to Printed circuit board: fundamentals of electronic components, basic electronic circuits, Basics of printed circuit board designing: Layout planning, general rules and parameters, ground conductor considerations, thermal issues, check and inspection of artwork. Design rules for PCB: Design rules for Digital circuit PCBs, Analog circuit PCBs, high frequency and fast pulse applications, Power electronic applications, Microwave applications.	**4 Hrs**
Module II	
3D modelling for Robot chassis, Additive manufacturing, The CAD Environment, Common CAD File Types, Design for 3D Print, Sketching, Extruding, Collaborating on Files, Process Flow, Optimizing for Print, Print De-Bugging.	**4 Hrs**
Module III	
3D Printed Design for Robot Chassis and its model, printed circuit design using Eagle CAD/ any PCB design tool.	**4 Hrs**

Textbooks:

1. Roger Hu, "PCB Design and Layout Fundamentals for EMC", Independently published, 2019.
2. Clyde F. Coombs, Jr, Happy T. Holden "Printed Circuits Handbook", Sixth Edition, , Publisher: McGraw-Hill Education Year: 2016.

Reference Book:

1. Walter C. Bosshart," Printed circuit Board Design and technology".
2. Ian Gibson, David Rosen, and Brent Stucker," Additive Manufacturing Technologies – 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing ", Second Edition, Springer, New York.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Develop multidisciplinary robotics projects with multi layered Printed Circuit Board.

CO2: Design the circuit with the Printed Circuit Board Design Software.

Evaluation Methodology for Ability Enhancement Course (Level 2)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	**20**	Evaluation of methodology and planning.
Review (I/II/III)	**30**	Presentation, Progress and Viva Voce.
Total	**50**	

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	**30 + 10**	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	**10**	Report of Level - II
Total	**50**	

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	2					1	1
CO2	2	2	2	2	2					1	1

High-3: Medium-2: Low-1

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B.E, VI Semester

Semester: VI			
Robotics And Industrial Automation (Level 3)			
Course Code:	MVJ22A6063	**CIE Marks:**	50
L: T:P:S	0:0:2:0	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- To introduce the functional elements of Robotic operating system.
- To educate on various path planning techniques

Module I	
ROS Essentials. Introduction to ROS Topics, Services, Actions and Nodes. Simple interaction with the course simulation environment.	**8 Hrs**
Module II	
Build your own robot environment. Software representation of a Robot using Unified Robot Description Format (URDF), ROS parameter server and adding real-world object representations to the simulation environment. Autonomous Navigation. Map creation with G Mapping package, autonomously navigate a known map with ROS navigation.	**8 Hrs**
Module III	
Designing Mobile autonomous Robots for various industrial applications.	**8 Hrs**

Textbooks:

1. B. K. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998
2. Ashitava Ghoshal, "Robotics-Fundamental Concepts and Analysis", Oxford University Press, Sixth impression, 2010.

Reference Book:

1. R. D. Klafter, T. A. Chimielewski and M. Negin, "Robotic Engineering–An Integrated Approach", Prentice Hall of India, New Delhi, 1994.
2. Edwin Wise, "Applied Robotics", Cengage Learning, 2003.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: To know about the differential motion in robotics

CO2: To know about the various path planning techniques.

Evaluation Methodology for Ability Enhancement Course (Level 3)

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	**30**	Presentation, Progress and Viva Voce.
Project Demonstration	**10**	Evaluation of methodology and planning.
1.Paper Publications (Scopus - Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	**10**	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks
Total	**50**	

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Final Project Demonstration + Viva Voce	**25 + 10**	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	**15**	Final report including abstract, design, implementation, results, and conclusion.
Total	**50**	

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	2	2					1	1
CO2	2	2	2	2	2					1	1

High-3: Medium-2: Low-1

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B.E., III Semester

Semester: III			
Software Development Club (Level 1)			
Course Code:	MVJ21A3091	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hours

Course Objectives:

This course will give ability to:

- To formulate the ideas for the real-time problems.
- To depict their ideas using design tools.
- To Identify the problem-solving techniques.
- To understand the role of programming within the overall software development process.
- To develop the capability for self-learning.
- To work as an individual or as a team.

Module I	
Software Development Process and tools Introduction to Software Development Process and roles in the IT industry, Different software development tools installation and working, Fundamental Protocols, Working, Python data types, Python files, Python Classes, methods. Activity: To install the different tools and to check their working.	**6 Hrs**
Module II	
Front-end technologies Introduction to front-end technologies-Introduction to Web Technologies -Basics of HTML5, CSS3. Introduction to Bootstrap 5, Designing a Front-End of a Web Application. Activity: To develop theme of a web page for a real time problem.	**6 Hrs**

Textbooks:

1. Ian Sommerville, "Software Engineering", Pearson Education, 10th Edition, 2015.
2. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Prentice Hall, 2007.
3. Jon Duckett, "HTML & CSS: Design and Build Websites", Wiley, 2011.
4. David Flanagan, "JavaScript: The Definitive Guide", O'Reilly Media, 7th Edition, 2020.
5. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, 7th Edition, 2015.
6. Erich Gamma, Richard Helm, Ralph Johnson, John Vlassises, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, 1994.

Reference Book:

1. Danny Goodman, "Dynamic HTML: The Definitive Reference", O'Reilly Media, 2006.
2. Addy Osmani, "Learning JavaScript Design Patterns", O'Reilly Media, 2017.
3. Rajkumar Buya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2011.

Course Outcomes:
At the end of the course, the student will be able to:

CO1: Understand the SDLC phases and processes in IT Industry.
CO2: Learn back-end basics and its connectivity to the web

Evaluation Method
Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	20	Conducting Online test
Literature survey	20	Novelty identified from the literature survey
Club related activity	10	To be decided by the respective coordinators

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	30+10	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1			2				1			1
CO2	2	1		1	2							

High-3: Medium-2: Low-1

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B.E., IV Semester

Semester: IV			
Software Development Club (Level 2)			
Course Code:	MVJ21A4092	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- To formulate the ideas for the real-time problems.
- To depict their ideas using design tools.
- To Identify the problem-solving techniques.
- To understand the role of programming within the overall software development process.
- To develop the capability for self-learning.
- To work as an individual or as a team.

Module I	
Back-end Technologies Bootstrap- Bootstrap grid, bootstrap components. Introduction to Java Script -JavaScript, DOM operations, JS AJAX, JS JSON, JS HTML. Activity: To develop a website to a real-world problem	**6 Hrs**
Module II	
Database Connectivity Introduction to Back-end -Basics of PHP & SQL, G-Mail SMPT Server, Basics of UI/UX, Database connectivity and MongoDB, Node.js, Data Exchange and its protocols. Activity: To connect the web page developed to required data base.	**6 Hrs**

Textbooks:

1. Jon Duckett, "HTML & CSS: Design and Build Websites", Wiley, 2011.
2. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Prentice Hall, 2007.
3. Jon Duckett, "HTML & CSS: Design and Build Websites", Wiley, 2011.
4. David Flanagan, "JavaScript: The Definitive Guide", O'Reilly Media, 7th Edition, 2020.
5. Database Systems: Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, 7th Edition, 2015.
6. Software Design Patterns: Erich Gamma, Richard Helm, Ralph Johnson, John Vlassises, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, 1994.

Reference Book:

1. Jakob Nielsen, "Designing Web Usability: The Practice of Simplicity", New Riders Publishing, 1999.
2. Rohlfs K., Wilson T.L., Hüttemeister S. “Tools of Radio Astronomy”. 6th Edition. Springer, 2019.
3. Poggiani R. “Optical, Infrared and Radio Astronomy: From Techniques to Observation”, Springer, 2017.

Course Outcomes:
At the end of the course, the student will be able to:

CO1: Understand the SDLC phases and processes in IT Industry.
CO2: Learn back-end basics and its connectivity to the web

Evaluation Method
Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										2
CO2	3	3	2	2								2

High-3: Medium-2: Low-1

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B.E., VI Semester

Semester: VI			
Software Development Club (Level 3)			
Course Code:	MVJ22A6093	**CIE Marks:**	50
L: T:P:S	0:0:2:0	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will enable students:

- To formulate the ideas for the real-time problems.
- To depict their ideas using design tools.
- To Identify the problem-solving techniques.
- To understand the role of programming within the overall software development process.
- To develop the capability for self-learning.
- To work as an individual or as a team.

Module I

Machine learning Introduction to various Machine learning algorithms (NLP, DIP, etc), Designing and implementing various ML/DL algorithms in a range of real-world applications. Activity: To design a ML Algorithm for real world application **Python Modules and datasets** Python modules and libraries, Data sets- Creation, importing and working. Activity: To create, import and work on datasets created by using real time data	**24 Hrs (Project)**

Textbooks:

1. Ian Sommerville, "Software Engineering", Pearson Education, 10th Edition, 2015.
2. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Prentice Hall, 2007.
3. Jon Duckett, "HTML & CSS: Design and Build Websites", Wiley, 2011.
4. David Flanagan, "JavaScript: The Definitive Guide", O'Reilly Media, 7th Edition, 2020.
5. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, 7th Edition, 2015.
6. Erich Gamma, Richard Helm, Ralph Johnson, John Vlassises, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, 1994.

Reference Book:

1. Don Norman, "The Design of Everyday Things", Basic Books, Revised Edition, 2013.
2. Danny Goodman, "Dynamic HTML: The Definitive Reference", O'Reilly Media, 2006.

Evaluation parameters:

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus -Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks

Semester End Evaluation (SEE) – 50 Marks

Component	**Marks**	**Description**
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3		2		2					2
CO2	3	3	3	2	3	2	2	2	2			2

High-3: Medium-2: Low-1

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B.E., III Semester

Semester: III			
Tinkering Lab - Experiment and Conceptualize (Level 1)			
Course Code:	MVJ22A3031	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	02	**Total:**	100
Hours:	12 Hrs Theory+24Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:
The course will give ability to:

- To create workspaces that are suitable for young minds to learn innovation skills, develop ideas via hands-on activities, work and learn in a flexible environment.

Module I	
Introduction to Tinkering Lab: Importance of Innovation in Engineering: Role of creativity and experimentation in solving real-world problems. Safety Guidelines and Lab Protocols: Lab usage rules, PPE, emergency procedures, and responsible handling of tools.	**4 Hrs**
Module II	
Hands-on Tool Training: Exposure to tools from Mechanical, Electrical, Electronics, and Civil departments, Basic operations: Cutting, Drilling, Soldering, Measuring, etc., Introduction to prototyping materials: Clay, Thermocol, Cardboard	**4 Hrs**
Module III	
Innovation Fundamentals: Literature Survey Techniques, Problem Identification and Analysis, Defining Objectives and Scope, Team Formation and Idea Pitching	**4 Hrs**

Reference Books:

1. R. Subramanian, "Professional Ethics", Oxford University Press, 2nd Edition, 2017.
2. Benjamin O. Alli, "Fundamental Principles of Occupational Health and Safety", International Labour Office, Geneva, 1st Edition, 2008.

Course Outcomes:
At the end of the course, the student will be able to:
CO1: Demonstrate understanding of innovation, creativity, and safety in engineering practice.
CO2: Apply interdisciplinary tool skills and prototyping techniques to build basic models.
CO3: Identify real-world problems and develop innovative solutions through collaborative research and design.

Evaluation Method
Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	20	Conducting Online test
Literature survey	20	Novelty identified from the literature survey

Club related activity	10	To be decided by the respective coordinators

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	30+10	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3								3		
CO2		3						2	2		
CO3		3.	3	3					2		

High-3: Medium-2: Low-1

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B.E., IV Semester

Semester: IV

Tinkering Lab - Experiment and Conceptualize (Level 2)

Course Code:	MVJ22A4032	**CIE Marks:**	50
L:T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

The course will give ability to:

- To empower students with skills of creativity, innovation, critical thinking, design thinking, social and cross-cultural collaboration and ethical leadership.

Module I	
Introduction to Modelling and Analysis: An overview of modelling and analysis software, explaining the principles of orthographic projection, different planes, various views of engineering drawings, and the significance of analysis tools in project work.	**4 Hrs**
Module II	
Hands-on Experience on Modelling and Analysis Tool: Practical training on modelling tools such as Solid Edge for 3D modelling and Ansys software for engineering analysis.	**4 Hrs**
Module III	
Project Work: Application of CAD modelling skills to real-world ideas, Integration of design and analysis tools for product development, Documentation and presentation of project outcomes**.**	**4 Hrs**

Reference Books:

1. Goutam Rohit & Goutham Ghosh, "Machine Drawing with AutoCAD", Pearson Education, 1st Indian Print, 2005.
2. S S Bhavikatti, "Finite Element Analysis", Pearson Publication, 4th Edition, 2016.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Explain the principles of engineering drawing, modelling, and analysis tools used in design.
CO2: Develop 2D and 3D models using CAD tools and perform basic engineering analysis.
CO3: Apply modelling and analysis skills to solve real-world problems through collaborative project.

Evaluation Method

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									3
CO2			3			3		2			
CO3			3			3		2		2	

High-3: Medium-2: Low-1

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B.E., VI Semester

Semester: VI			
Tinkering Lab - Experiment and Conceptualize (Level 3)			
Course Code:	MVJ22A6033	**CIE Marks:**	50
L: T:P:S	0:0:2:0	**SEE Marks:**	50
Credits:	01	**Total:**	100
Hours:	24Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:
The course will give ability to:

- To help build innovative solutions for unique problems, thereby supporting the nation's efforts to grow as a knowledge economy.

Module I	
Introduction to Manufacturing and Mechanics of Materials: Overview of manufacturing processes, Introduction to mechanics of materials, Material selection criteria for different types of projects, Factors influencing material choice: mechanical properties, cost, availability, sustainability	**8 Hrs**
Module II	
Material Requirement and Estimation: Introduction to Bill of Materials (BOM), Estimation techniques for material quantity and cost, Material planning for project execution, Inventory and procurement basics	**8 Hrs**
Module III	
Project Work: Construction of working models based on CAD designs, Integration of selected materials and estimated resources, Testing and refinement of prototypes, Final presentation and documentation	**8 Hrs**

Reference Books:

1. R.C. Hibbeler, "Mechanics of Materials", Prentice Hall, Pearson Education, 1st Edition, 2005.
2. Serope Kalpakjian & Steuen R. Schmid, "Manufacturing Technology", Pearson Education Asia, 5th Edition, 2006.

Course Outcomes:
At the end of the course, the student will be able to:

CO1: Explain the fundamentals of manufacturing processes and mechanics of materials, including material selection criteria.
CO2: Estimate material requirements and plan resources effectively for engineering projects.
CO2: Apply manufacturing and material knowledge to construct, test, and present engineering prototypes.

Evaluation parameters:
Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description

Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus -Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks

Semester End Evaluation (SEE) – 50 Marks

Component	**Marks**	**Description**
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2									3
CO2			3			3		2			
CO3			3			3		2		2	

High-3: Medium-2: Low-1

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B.E, III Semester

Semester: III

Tomorrow's Engineers – Engineering Solution to Societal Problems (Level 1)

Course Code:	MVJ22A3021	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability to:

- To take up Engineering as a team sport.
- To get involved with fellow students and give solutions for community defined problems.
- To think out of the box and discover new areas of interest.
- To network with industry professionals.
- To make students highly successful inside and outside the classroom.

Module I

Engineering: Engineering - Attributes of an Engineer - Marvels of Engineering - Creativity techniques - Synectic's - Creativity in Science and Engineering. **Thinking out of the box:** Introduction to Creative Strategy - Thinking out of the box - Introduction to the R.E.A.L.I.S.E Model - Case study on R.E.A.L.I.S.E Model - Open ended problems - Engineering design process loop.	**6 Hrs**

Module II

Chakku 7C's (Cause, Context, Comprehension, Check, Conception, Crafting, Connection) - Collaborative Model for Innovation - Pitfalls in the Innovation process - Innovation by Design – Case study on Innovation by Design.	**6 Hrs**

Textbooks:

1. John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
2. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons, Second Edition, 2013.

Reference Book:

1. Jeanne Liedtka, Andrew King, Kevin Bennett, "Book - Solving Problems with Design Thinking - Ten Stories of What Works" (Columbia Business School Publishing) Hardcover, 2nd Edition, Sep 2013

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply appropriate problem-solving framework methodology.
CO2: Predict and conduct constructive brainstorming and ideation sessions with interdisciplinary team members for new ideas and solutions.
CO3: Develop a user-centric mindset while designing, innovating, developing, and testing solutions for new products, services, and systems.

CO4: Predict solutions individually and in teams and create and present prototypes.
CO5: Develop the capability to empathise with potential users to develop meaningful products and services.

Evaluation Methodology for Ability Enhancement Course (Level 1)

Total Marks: 100

- **CIE:** 50 Marks
- **SEE:** 50 Marks

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Basic Concept Learning	20	Conducting Online test
Literature survey	20	Novelty identified from the literature survey
Club related activity	10	To be decided by the respective coordinators
Total	**50**	----

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Presentation	30+10	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I
Total	**50**	----

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2			3	2	2	2	2	2
CO2	3	3	2			3	2	2	2	2	2
CO3			3	3		2	2	2	2	2	2
CO4		2	2	3	2	2	3	2	2	2	2
CO5			2	2		1	1	1	2	2	2

High-3: Medium-2: Low-1

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B.E, IV Semester

Semester: IV			
Tomorrow's Engineers – Engineering Solution to Societal Problems (Level 2)			
Course Code:	MVJ22A4022	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability:

- To take up Engineering as a team sport.
- To get involved with fellow students and give solutions for community defined problems.
- To think out of the box and discover new areas of interest.
- To network with industry professionals.
- To make students highly successful inside and outside the classroom.

Module I	
Problem-Solving in Engineering: Introduction – Problem Statement – Problem solving process – Tools for problem solving – Pareto principle for problem solving – Brainstorming process for problem solving – Root Cause analysis for problem solving - SWOT analysis for problem solving – Case Studies	**6 Hrs**
Module II	
Innovation With TRIZ: Overview of TRIZ - The Tools of TRIZ: Physical Contradiction - Technical Contradiction - Ideal Final Result (IFR) - S-Field Model for Harmful Effect Elimination - Function and Attribute Analysis and Trimming of components - Removal of Psychological Inertia by STC method & SLP method - Solution Planning - Solution Implementation – Solution Feasibility.	**6 Hrs**

Textbooks:

1. John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
2. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons, Second Edition 2013.

Reference Book:

1. Jeanne Liedtka, Andrew King, Kevin Bennett, "Book - Solving Problems with Design Thinking - Ten Stories of What Works", (Columbia Business School Publishing) Hardcover, 2nd Edition, Sep 2013

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply appropriate problem-solving framework methodology.
CO2: Predict and conduct constructive brainstorming and ideation sessions with interdisciplinary team members for new ideas and solutions.
CO3: Develop a user-centric mindset while designing, innovating, developing, and testing solutions for new products, services, and systems.
CO4: Predict solutions individually and in teams and create and present prototypes.
CO5: Develop the capability to empathise with potential users to develop meaningful products and services.

Evaluation Methodology for Ability Enhancement Course (Level 2)

Total Marks: 100

- **CIE:** 50 Marks
- **SEE:** 50 Marks

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2			3	2	2	2	2	2
CO2	3	3	2			3	2	2	2	2	2
CO3			3	3		2	2	2	2	2	2
CO4		2	2	3	2	2	3	2	2	2	2
CO5			2	2		1	1	1	2	2	2

High-3: Medium-2: Low-1

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B.E, VI Semester

Semester: VI

Tomorrow's Engineers – Engineering Solution to Societal Problems (Level 3)

Course Code:	MVJ22A6023	**CIE Marks:**	50
L: T:P:S	0:0:2:0	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will give ability:

- To take up Engineering as a team sport.
- To get involved with fellow students and give solutions for community defined problems.
- To think out of the box and discover new areas of interest.
- To network with industry professionals.
- To make students highly successful inside and outside the classroom.

Module I

Stake holders in Problem Solving: Stakeholder - Stakeholder Analysis - Role of stake holders in problem solving- Identification of Stakeholders - Developing a Stakeholder Communication Plan - The Stakeholder Analysis Worksheet	**12 Hrs**

Module II

Idea to Prototype: Product Development Lifecycle - Product architecture & prototyping - Planning and Product Horizons - Project Management to Product Management - Product Innovation with Case Studies	**12 Hrs**

Textbooks:

1. John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
2. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons, Second Edition 2013.

Reference Book:

1. Jeanne Liedtka, Andrew King, Kevin Bennett, "Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover, 2nd Edition, Sep 2013

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Apply appropriate problem-solving framework methodology.
CO2: Predict and conduct constructive brainstorming and ideation sessions with interdisciplinary team members for new ideas and solutions.
CO3: Develop a user-centric mindset while designing, innovating, developing, and testing solutions for new products, services, and systems.
CO4: Predict solutions individually and in teams and create and present prototypes.
CO5: Develop the capability to empathise with potential users to develop meaningful products and services.

Evaluation Methodology for Ability Enhancement Course (Level 3)

Total Marks: 100

- **CIE:** 50 Marks
- **SEE:** 50 Marks

Continuous Internal Evaluation (CIE) - 50 marks

Component	Marks	Description
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus - Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2			3	2	2	2	2	2
CO2	3	3	2			3	2	2	2	2	2
CO3			3	3		2	2	2	2	2	2
CO4		2	2	3	2	2	3	2	2	2	2
CO5			2	2		1	1	1	2	2	2

High-3: Medium-2: Low-1

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B.E, III Semester

Semester: III			
Unmanned Aerial Vehicle-Develop Drones (Level 1)			
Course Code:	MVJ22A3041	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory + 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will enable students to:

- Understand foundational UAV concepts, including types, components, functionalities, and control systems.
- Apply basic flight mechanics principles to analyze UAV performance and stability.
- Perform basic UAV mission planning, airframe selection, and mini project work to gain hands-on experience.

Module I	
Introduction to UAV and Basic Flight Mechanics: Introduction to UAV types, functioning, system components, and ground & airborne control systems; Basic flight mechanics covering forces, moments, stability, centre of gravity, and basic UAV manoeuvring; Overview of UAV regulations including DGCA Drone Rules 2021 and CEMILAC guidelines, safety protocols, and operational limits; Practical activities include flight demos, video simulations, simple force & moment calculations, and a quiz or case study on regulatory compliance.	**5 Hrs (T) + 6 Hrs (P)**
Module II	
Mission Planning and Airframe Selection Airframe selection criteria, propulsion, motor and propeller selection, system integration and calibration, basic aerodynamic and performance calculations (simplified for multidisciplinary students); Integration of regulatory considerations during mission planning including altitude limits, payload restrictions, and operational safety guidelines; Practical exercises include guided calculations for small UAV models and simulation of simple mission planning in MATLAB/Simulink or other generalized platforms.	**4 Hrs (T) + 10 Hrs (P)**
Module III	
Literature Survey and Club Activities Conduct literature survey on UAV types, applications, and current technological trends; Identify novel ideas and innovations from the literature; Include regulatory awareness and compliance considerations in survey reports; Participate in club-related activities such as online quizzes, discussions, and presentations; Practical sessions include preparation and presentation of survey reports, identification of UAV novelty, and optional demonstrations or simulations.	**3 Hrs (T) + 8 Hrs (P)**

Textbooks:

1. Reg Austin, "Unmanned Air Systems: UAV Design, Development and Deployment", Wiley Publishing, 1st Edition, 2010.
2. Kimon P. Valavanis & George J. Vachtsevanos (Eds.), "Handbook of Unmanned Aerial Vehicles", Springer, 1st Edition, 2015.

Reference Books:

1. John D. Anderson, "Introduction to Flight", McGraw-Hill, 8th Edition, 2016.
2. David R. Pack, "Introduction to Unmanned Aircraft Systems", CRC Press, 1st Edition, 2013.

3. Jay Gundlach, "Introduction to UAV Systems", American Institute of Aeronautics and Astronautics (AIAA), 3rd Edition, 2012.
4. Government of India, DGCA Drone Rules 2021 / CEMILAC UAV Guidelines, 1st Edition, 2021.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Explain foundational UAV concepts and control system components.
CO2: Apply basic flight mechanics and performance principles to UAV analysis.
CO3: Conduct a literature survey, identify novel ideas, and participate in UAV club-related activities.

Evaluation Method: -

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE):

Component	Marks	Description
Basic Concept Learning	20	Conducting Online test
Literature survey	20	Novelty identified from the literature survey
Club related activity	10	To be decided by the respective coordinators
Total	**50**	---

Semester End Examination (SEE):

Component	Marks	Description
Presentation	30+10	Literature Survey, Problem Identification, Objective+ Viva Voce
Report	10	Report of Level - I
Total	**50**	---

The Final mark for the course is sum of the CIE and SEE Marks (50+50=100) Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2	-	2	-	-	-	2	-	2
CO2	3	3	2	-	2	-	-	-	2	-	2
CO3	2	2	1	-	1	1	-	3	3	-	3

High-3: Medium-2: Low-1

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B.E, IV Semester

Semester: IV			
Unmanned Aerial Vehicle-Develop Drones (Level 2)			
Course Code:	MVJ22A4042	**CIE Marks:**	50
L: T:P:S	1:0:2:0	**SEE Marks:**	50
Credits:	2	**Total:**	100
Hours:	12 Hrs. Theory+ 24 Hrs. Practical	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will enable students to:

- Develop conceptual designs of UAVs by understanding mission requirements, airframe configurations, and subsystem selection, emphasizing trade-offs and system integration.
- Apply mathematical modelling and simulation tools (e.g., MATLAB/Simulink) to analyze UAV performance, control systems, and mission feasibility.
- Integrate hardware specifications and IoT elements into the UAV conceptual model, preparing for practical implementation and future project development.

Module I	
UAV Mathematical Modelling & Flight Mechanics: Mathematical model of UAV dynamics (equations of motion, stability axes); Flight mechanics concepts for conceptual design (range, endurance, payload, mission trade-offs); Simulation experimentation: modelling UAV responses, basic autopilot logic.	**4 Hrs (T) + 8 Hrs (P)**
Module II	
UAV Conceptual Design Framework: Mission requirement analysis and trade-off studies; Airframe configuration and subsystem selection (propulsion, power, payload); Hardware specifications and IoT integration in design phase; System integration planning & simulation validation.	**4 Hrs (T) + 8 Hrs (P)**
Module III	
UAV Conceptual Design Project: Defining UAV mission profile and design objectives; Conceptual design execution: subsystem sizing, control system modelling in Simulation environment, mission simulation; Report preparation & Presentation-design document and innovation aspects.	**4 Hrs (T) + 8 Hrs (P)**

Textbooks:

1. Reg Austin, "Unmanned Aircraft Systems: UAV Design, Development and Deployment", Wiley Publishing, 1st Edition, 2010.
2. Kimon P. Valavanis & George J. Vachtsevanos, "Handbook of Unmanned Aerial Vehicles", Springer, 1st Edition, 2015.

Reference Books:

1. Randal W. Beard, Timothy W. McLain, "Small Unmanned Aircraft: Theory and Practice", Princeton University Press, 2nd Edition, 2012.
2. Government of India, "DGCA Drone Rules 2021 / CEMILAC UAV Guidelines", 1st Edition, 2021.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Formulate mission requirements and trade-off studies for UAV conceptual design.

CO2: Develop mathematical models and simulate UAV performance/control using Simulink.

CO3: Design and justify a conceptual UAV solution integrating subsystems and innovation elements.

Evaluation Method: -

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) – 50 Marks

Component	Marks	Description
Project Strategy	20	Evaluation of methodology and planning.
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Total	**50**	---

Semester End Evaluation (SEE) – 50 Marks

Component	Marks	Description
Project Progress Presentation and Final Viva Voce	30 + 10	Presentation on Problem statement, Objective, Scope, proposed solution/ methodology, Innovation, Uniqueness, Expected outcomes, Timeline.
Report	10	Report of Level - II
Total	**50**	---

The Final mark for the course is sum of the CIE and SEE Marks.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	-	2	2	-	2	2	-	2
CO2	3	2	3	-	3	-	-	-	2	-	2
CO3	3	2	3	-	2	3	-	3	3	-	3

High-3: Medium-2: Low-1

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B.E, VI Semester

Semester: VI

Unmanned Aerial Vehicles-Develop Drones (Level 3)

Course Code:	MVJ22A6043	**CIE Marks:**	50
L: T:P:S	**0:0:2:0**	**SEE Marks:**	50
Credits:	1	**Total:**	100
Hours:	**24 Hrs. Practical**	**SEE Duration:**	2 Hrs.

Course Objectives:

This course will enable students to:

- Integrate UAV subsystems and payloads, including sensors, communication, and control systems, to develop a functional UAV model.
- Conduct flight testing and data analysis to validate UAV performance, troubleshoot issues, and optimize mission execution.
- Prepare and present a comprehensive project report, including design, implementation, results, regulatory compliance, and innovation.

Module I

Payload Selection and Sensor Integration:
Integration of sensors with flight controllers, testing of sensor outputs, validation of communication with UAV systems, and awareness of compliance with aviation regulatory guidelines.

8 Hrs

Module II

Flight Testing and Data Analysis:
Execution of UAV flight testing, acquisition and handling of flight data, analysis of performance parameters, identification of gaps and unsolved issues, and awareness of national regulatory norms related to UAV operations.

8 Hrs

Module III

UAV Project Work – Construction and Validation:
Construction of a UAV working model, subsystem integration, ground and flight validation of the UAV, and preparation of project documentation highlighting design, results, innovation, and regulatory awareness. Submission of final project report.

8 Hrs

Textbooks:

1. Reg Austin, "Unmanned Aircraft Systems: UAV Design, Development and Deployment", Wiley Publishing, 1st Edition, 2010.
2. Paul G. Fahlstrom and Thomas J. Gleason, "Introduction to UAV Systems", Wiley, 4th Edition, 2012.

Reference Book:

1. Kimon P. Valavanis and George J. Vachtsevanos, "Handbook of Unmanned Aerial Vehicles", Springer, 1st Edition, 2015.
2. Doug Marshall, Richard Barnhart, Eric Shappee, Michael H. T. Holdsworth, "Introduction to Unmanned Aircraft Systems", CRC Press, 2nd Edition, 2016.
3. DGCA, Drone Rules 2021 – Guidelines for Civil Use of Remotely Piloted Aircraft Systems (RPAS) in India.

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Integrate UAV subsystems and payloads with flight controllers and validate sensor outputs.

CO2: Conduct UAV flight testing, acquire and analyze flight data, and identify performance gaps.

CO3: Demonstrate a complete UAV working model and prepare a comprehensive project report including design, results, and regulatory awareness.

Evaluation Method: -

Total Marks: 100

- **CIE: 50 Marks**
- **SEE: 50 Marks**

Continuous Internal Evaluation (CIE) - 50 marks (A)

Component	Marks	Description
Review (I/II/III)	30	Presentation, Progress and Viva Voce.
Project Demonstration	10	Evaluation of methodology and planning.
1.Paper Publications (Scopus - Indexed) (or) 2.Filing Patent (Apply through College) (or) 3.Participation in Hackathons/Technical Competitions.	10	1.Acceptance of Paper/Published Paper – 10 Marks (or) 2.Filing of Patent (Provisional /Complete) – 10 Marks (or) 3.a) Participation in Technical Competitions / Hackathon – 5 Marks b) Winning in Technical Competitions / Hackathon – 5 Marks
Total	**50**	---

Semester End Evaluation (SEE) – 50 Marks (B)

Component	Marks	Description
Final Project Demonstration + Viva Voce	25 + 10	Complete working model /Software with full functionality and user interface (if applicable)
Final Report Evaluation	15	Final report including abstract, design, implementation, results, and conclusion.
Total	**50**	---

The Final mark for the course is sum of the CIE and SEE Marks (A+B=100 Marks).

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	2	2	3	-	-	2	1	-	1
CO2	-	-	2	3	3	-	-	1	2	-	2
CO3	-	-	3	2	2	-	-	3	3	-	3

High-3: Medium-2: Low-1