



Department of Mechanical Engineering

Academic Year 2024-25



**7th and 8th Semester
Scheme & Syllabus**

BATCH: 2021-25

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NEW HORIZON COLLEGE OF ENGINEERING

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.
- To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.
- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

QUALITY POLICY

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level

VALUES

- Academic Freedom
- Integrity
- Inclusiveness
- Innovation
- Professionalism
- Social Responsibility

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To create competent mechanical engineers capable of working in diversified disciplines for transformative impact on societal progressive development in the field of mechanical engineering through creative research and lifelong learning

MISSION

- To impart excellent education by providing the state of art research facilities in the field of mechanical engineering.
- To develop alliances with industries and other organizations for excellence in teaching learning process, research and consultancy projects.
- To enhance the knowledge of students in intellectual, entrepreneurial and ethical challenges through active participation by critical thinking.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- **PEO 1:** The graduates will be able to apply the overall knowledge of Mechanical Engineering along with concepts of Mathematics, Science, Communication and Computing skills to understand specific problem areas and finding the optimal solutions for the same.
- **PEO 2:** The graduates will be able to implement ideas of Mechanical Engineering for the challenging tasks in the interdisciplinary areas like Electrical, Electronics, Computer Science, Civil, Bio-Technology and allied branches.
- **PEO 3:** The graduates will be widely talented in the fields of manufacturing, service and design industries, which will not only improve their employability but also aid in establishing the above said industries.
- **PEO 4:** The graduates will develop lifelong learning attitudes, ethics and values that will help their career employability and growth in engineering, academia, defence, state and central government sectors.

PEO TO MISSION STATEMENT MAPPING

Program Educational Objectives	M1	M2	M3
PEO 1	3	2	3
PEO 2	2	3	2
PEO 3	2	3	2
PEO 4	1	2	3

PROGRAM OUTCOMES (POs)

Graduate Attributes	PO #	Program Outcomes
Engineering knowledge	1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex mechanical engineering problems
Problem Analysis	2	Identify, formulate, review research literature, and analyze complex engineering problems in Mechanical Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
Design Development of Solutions	3	Design solutions for complex engineering problems and design system components or processes of Mechanical Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
Conduct Investigations of Complex Problems	4	Use research-based knowledge and research methods including design of experiments in Mechanical Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
Modern tool usage	5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities in Mechanical Engineering with an understanding of the limitations.
The Engineer and society	6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice in Mechanical Engineering.
Environment and Sustainability	7	Understand the impact of the professional engineering solutions of mechanical Engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
Ethics	8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
Individual & team work	9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
Communication	10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
Project management and finance	11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, manage projects and in multidisciplinary environments.
Lifelong learning	12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

After successful completion of mechanical Engineering Program, the graduates will be able to:

PSO1	Specify, fabricate, test and operate various machines along with essential documentations.
PSO2	Analyze, design, develop and implement the concepts of mechanical systems and processes towards product development

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Mechanical Engineering

VII Semester													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	PCC	21MEE71	Conventional and Non Conventional Energy Resources	ME	3	0	0	0	3	3	50	50	100
2	PCC	21MEE72	Mechanical Vibrations	ME	3	0	0	0	3	3	50	50	100
3	PROJ	21MEE73	Project Work	ME	0	0	12	0	12	0	100	100	200
4	AEC	21MEK74	Scientific Foundations of Health	ME	1	0	0	0	1	1	50	50	100
5	OEC	23NHOP7X X	Industrial Open Elective Course-II	Offering Dept.	3	0	0	0	3	3	50	50	100
Total									22	10	300	300	600

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, PEC: Professional Elective Course, OEC: Open Elective Course, PROJ: Project work, L: Lecture, T: Tutorial, P: Practical S: SDA: Self Study for Skill Development, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	<p>All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of V semester. The activities shall be carried out from (for 4 semesters) between V semester to VIII semester.</p> <p>SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree.</p> <p>The events shall to be reflected in the calendar prepared for the NSS, PE and Yoga activities.</p>
	21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director	
	21YOG84	Yoga	Yoga Teacher	

Industrial Open Elective Course (OEC): Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Project Work:

The objective of the Project work is

- (i) To encourage independent learning and the innovative attitude of the students.
- (ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- (iii) To impart flexibility and adaptability.
- (iv) To inspire team working.
- (v) To expand intellectual capacity, credibility, judgment and intuition.
- (vi) To adhere to punctuality, setting and meeting deadlines.
- (vii) To install responsibilities to oneself and others.
- (viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25.

Credit Definition:

1-hour Lecture (L) per week=1Credit
2-hours Tutorial(T) per week=1Credit
2-hours Practical / Drawing (P) per week=1Credit
2-hous Self Study for Skill Development (SDA) per week = 1 Credit

03-Credits courses are to be designed for 40 hours in Teaching-Learning Session
02- Credits courses are to be designed for 25 hours of Teaching-Learning Session
01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

**NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Mechanical Engineering**

VIII Semester													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	PEC	21MEE81X	Professional Elective Course-III	ME	3	0	0	0	3	3	50	50	100
2	SEM	21MEE82	Technical Seminar	ME	0	0	1	0	1	0	50	-	50
3	INT	21MEE83	Research Internship/ Industry Internship /Rural Internship	ME	0	0	12	0	12	0	100	100	200
4	NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator									
		21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director	0	0	0	0	0	0	50	50	100
		21YOG84	Yoga	Yoga Teacher									
Total									16	3	250	200	450

Professional Elective Course-III			
21MEE811	Additive Manufacturing	21MEE814	Emerging Automotive Technologies
21MEE812	Industrial Robotics	21MEE815	Hydraulics and Pneumatics
21MEE813	Refrigeration and Air Conditioning		

NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, SEM: Seminar, INT: Industry Internship / Research Internship / Rural Internship, L: Lecture, T: Tutorial, P: Practical S: SDA: Self Study for Skill Development, , CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

Elucidation:

Research/Industry Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent SEE examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.

TECHNICAL SEMINAR (21XXX82): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of specialization.

- (i) Carry out literature survey, systematically organize the content.
- (ii) Prepare the report with own sentences, avoiding a cut and paste act.
- (iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- (iv) Present the seminar topic through PowerPoint slides.
- (v) Answer the queries and involve in debate/discussion.
- (vi) Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report: 25marks

Presentation skill: 10 marks

Technical Paper Publication: 15 marks.

Non - credit mandatory courses (NMC):

National Service Scheme/ Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE, 35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.

(3) In case, any student fails to register for NSS, PE or Yoga / fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

VII Semester Syllabus

CONVENTIONAL AND NON CONVENTIONAL ENERGY RESOURCES														
Course Code	21MEE71								CIE Marks			50		
L:T:P:S	3:0:0:0								SEE Marks			50		
Hrs / Week	03								Total Marks			100		
Credits	03								Exam Hours			03		
Course outcomes:														
At the end of the course, the student will be able to:														
21MEE71.1	Understand the basic working principles of non-conventional power plants like Nuclear, Solar, Geo-thermal, Tidal and Ocean Thermal Energy power plant.													
21MEE71.2	Evaluate cycle efficiency and performance of Various Power Plants.													
21MEE71.3	Distinguish the various types of fuels used in power plants and estimate their Heating values.													
21MEE71.4	Analyze the applications of Bio Mass and Hydrogen energy.													
21MEE71.5	Investigate the ways to increase the thermal efficiency of power plant by the use of accessories.													
21MEE71.6	Discuss the working principle and basic components of Diesel and hydro electric power plants and the economic principles and safety precautions involved with it.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEE71.1	3	-	-	-	-	3	-	-	-	-	-	-	3	-
21MEE71.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE71.3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE71.4	3	-	-	-	-	3	-	-	-	-	-	-	3	-
21MEE71.5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE71.6	3	3	-	-	-	-	-	-	-	-	-	-	3	-
MODULE-1 Steam Power Plant														
										22MEE71.1			8 Hours	
										22MEE71.4				
										22MEE71.6				
Layout of steam power plant, Different Types of Fuels used for steam generation, Equipment for burning coal in lump form, stokers, different types, Advantages and Disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, unit system and bin system. Pulverized fuel furnaces, cyclone furnace.														
A Brief Account Of Benson, Velox, Schmidt Steam Generators, Chimneys: Natural, forced, induced and balanced draft. Cooling towers and Ponds. Accessories for the Steam generators such as Super heaters, De-super heater, control of super heaters, Economizers, Air pre heaters and re-heaters.														
Case Study					Case Studies on Performance different Boilers									
Text Book					Text Book 1: 1.1, 1.2, 1.3									
MODULE-2 Diesel Engine Power Plant														
										22MEE71.2			8 Hours	
Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, intake and exhaust system, Layout of diesel power plant.														

Hydro-Electric Plants: Hydrographs, flow duration and mass curves, unit hydrograph and numerical. Storage and pondage, pumped storage plants, low, medium and high head plants, Penstock, water hammer, surge tanks, gates and valves. General layout of hydel power plants.				
Applications	Investigate the applications of Diesel power plant			
Text Book	Text Book 2: 3.1, 3.2, 3.3, 3.5			
MODULE-3	Solar Energy	22MEE71.3 22MEE71.4 22MEE71.6	8 Hours	
Solar extra terrestrial radiation and radiation at the earth surface, radiation-measuring instruments, working principles of solar flat plate collectors, solar pond and photovoltaic conversion (Numerical Examples). Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills.				
Applications	Analyze the Applications of Solar Energy			
Text Book	Text Book 1: 4.1, 4.2, 4.3, 4.4			
MODULE-4	Nuclear Power Plant	22MEE71.5 22MEE71.6	8 Hours	
Principles of release of nuclear energy; Fusion and fission reactions. Nuclear fuels used in the reactors. Elements of the nuclear reactor; moderator, control rod, fuel rods, coolants. Brief description of reactors of the following types- Pressurized water reactor, Boiling water reactor, Sodium graphite reactor and gas cooled reactor, Radiation hazards, Shieldings, Radio-active waste disposal. Hydrogen Energy: Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production, bio- chemical production.				
Case Study	Case study on Nuclear power and its waste disposal			
Text Book	Text Book 2: 5.1, 5.2, 5.3			
MODULE-5	Geothermal Energy Conversion	22MEE71.5 22MEE71.6	8 Hours	
Principle of working, types of geothermal station with schematic diagram, problems associated with geothermal conversion, scope of geothermal energy. Tidal Power: fundamental characteristics of tidal power, harnessing tidal energy, limitations. Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, problems associated with OTEC. Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, problems involved with bio-gas production.				
Applications	Investigate the applications of OTEC, Biomass			
Text Book	Text Book 3: 8.1, 8.2, 8.3, 8.4, Text Book 4: 10.1, 10.2, 10.3, 10.4			
CIE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks - Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:**Text Books:**

- 1) Non-Conventional Energy Sources by G.D Rai K, Khanna Publishers, 5th Ed, ISBN: 97881- 7409-073-8
- 2) Solar energy, by Subhas P Sukhatme- Tata McGraw Hill, 3rd Ed, ISBN: 9780070260641
- 3) Power Plant Engineering, P. K. Nag Tata McGraw Hill ,4th Ed, ISBN: 9789339204044
- 4) Power Plant Engineering, Domakundawar, Dhanpath Rai sons.

Reference Books:

- 1) Power Plant Engineering, R. K. Rajput, Laxmi publication, 5th Ed, ISBN: 9788131802557
- 2) Principles of Energy conversion, A. W. Culp Jr., McGraw Hill, 2nd Ed, ISBN-13: 978- 0070435599
- 3) Renewable Energy Sources and Conversion Technology by N.K.Bansal, Manfred Kleeman & Mechael Meliss, Tata McGraw Hill, 2001.

Web links and Video Lectures (e-Resources)

- <https://www.learnthermo.com/T1-tutorial/ch01/lesson-A/pg01.php>
- <http://www.freeonlinecoursesforall.com/2017/01/01/10-free-online-courses-on-thermodynamics/>
- <https://archive.nptel.ac.in/courses/112/105/112105123/>
- <http://www.digimat.in/nptel/courses/video/112105123/L13.html>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any Thermal power plant
- Demonstration of working of IC engine/refrigerator
- Video demonstration on Laws of thermodynamics
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare thermodynamics related Flowcharts and Handouts
 - Organizing Group wise discussions on issues

MECHANICAL VIBRATIONS															
Course Code	21MEE72								CIE Marks	50					
L:T:P:S	3:0:0:0								SEE Marks	50					
Hrs / Week	3								Total Marks	100					
Credits	03								Exam Hours	03					
Course outcomes:															
At the end of the course, the student will be able to:															
21MEE72.1	Apply the fundamental knowledge of physics and mechanics in understanding the theory behind free & forced vibrations, frequencies, damping, degrees of freedom and vibrations measuring instruments.														
21MEE72.2	Evaluate the methods for determining the frequencies in cases of free, forced, damped, un-damped, multiple DoF and continuous systems.														
21MEE72.3	Analyze the solutions through detailed process, investigations & vibrations of machines and shafts under distinctive loading conditions and evaluation of vibration of vibration measuring instruments.														
21MEE72.4	Apply adequate theory, formula, and analysis techniques to provide vibration solution for mechanical machine elements of specific functions.														
21MEE72.5	Develop feasible engineering components with thorough vibrations investigation & analysis so as to benefit the industry and environment.														
21MEE72.6	Analyze new products with the fundamental knowledge on vibrations by latest technological advancement in design of vibrating machine parts and components.														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02	
21MEE72.1	3	2	-	-	-	-	-	-	-	-	-	-	-	2	
21MEE72.2	3	3	2	-	-	-	-	-	-	-	-	-	-	2	
21MEE72.3	3	2	2	-	-	-	-	-	-	-	-	-	-	2	
21MEE72.4	3	3	3	2	-	-	-	-	-	-	-	-	-	2	
21MEE72.5	3	2	2	2	-	-	-	-	-	-	-	-	-	2	
21MEE72.6	3	2	2	-	-	-	-	-	-	-	-	-	-	2	
MODULE-1 Introduction to vibrations															
										21MEE72.1/ 21MEE72.2		8 Hours			
Basic concepts and definitions. Simple harmonic motions, addition by analytical and graphical methods. Types of vibrations, elements of vibrating system. Super position of waves, Beats. Representation of wave forms using Fourier series and work done by a wave (derivations and problems)															
Self-study / Case Study / Applications			Apply harmonic analysis methods to diverse engineering challenges such as IC Engines, Wind Turbines, and Industrial Plants.												
Text Book			Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16												
MODULE-2 Undamped and damped Free Vibrations															
										21MEE72.1/ 21MEE72.2		08 Hours			
Differential equation for undamped spring mass system using Newton's, Energy and Rayleigh's methods. Natural frequency of simple and compound pendulum, and spring mass system considering the mass of the spring. Determination of natural frequencies of pendulum systems and disc- suspended mass spring systems by newtons method.															

Types of damping systems, Differential equation for damped spring mass system with solution for under damped, critically damped and over damped systems. Log decrement. Problems on damped systems.				
Self-study / Case Study / Applications	Study the vibrations produced by an internal combustion engine, focusing on sources of vibrations, their frequencies, and methods for mitigation.			
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15			
MODULE-3	Forced Vibrations and Measuring Instruments	21MEE72.2/ 21MEE72.4	08 Hours	
Excitation sources, equation of motion for a forced spring mass damper system, rotating and reciprocating unbalanced system response. Absolute and relative motion. Vibrations isolations and transmissibility. Problems on forced vibrations. Vibrometer and accelerometer. Whirling of shafts with and without air damping. Critical speed of a shaft. Problems on a vibrometer and accelerometer. Problems on critical speed of shaft.				
Self-study / Case Study / Applications	Investigate the vibrations in turbines, compressors, and other rotating machinery in power plants, for Rotor dynamics, imbalance, misalignment, and vibration monitoring.			
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10			
MODULE-4	Multi Degree Freedom Systems	21MEE72.3/ 21MEE72.4	08 Hours	
Introduction, influence coefficients, Maxwell's reciprocal theorem, Determination of natural frequency using Rayleigh's method, Dunkerley's method, Holzer's method, Stodola method and Matrix iteration method.(spring mass systems and torsional systems)				
Self-study / Case Study / Applications	Analyze the MDOF vibrations in a vehicle's suspension system, rotating machinery such as turbines and compressors, focusing on rotor-stator interactions.			
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7			
MODULE-5	Continuous Systems and Signal condition with monitoring Techniques	21MEE72.5/ 21MEE72.6	8 Hours	
Introduction to continuous systems, vibrations of a string, longitudinal vibrations of rods, torsional vibrations of rods, Euler's equation of beams. Problems. Signal analysis and spectrum analyzers, band pass filter, dynamic testing of machines and structures, experimental modal analysis, machine condition monitoring techniques and diagnosis.				
Self-study / Case Study / Applications	Investigate vibrations in industrial machinery such as pumps, fans, and motors, for Condition monitoring, predictive maintenance, and fault diagnosis.			
Text Book	Text Book 2: 12.1 to 12.10			
CIE Assessment Pattern (50 Marks - Theory) -				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks - Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:**Text Books:**

- 1) Mechanical vibrations by V. P Singh, Dhanpat Rai & Co (P) Ltd, 5th edition 2015. ISBN-978-81-7700-031-3
- 2) Mechanical vibrations by S. S. Rao, Peason Prentice Hall, 6th edition 2016, ISBN-10-0134361307.

Reference Books:

- 1) Mechanical vibrations, S. Graham Kelly, Schaum outline series, McGraw-Hill Education, 2016, ISBN- 10: 007034041
- 2) Mechanical vibrations by Srinath.M.K, Sanguine Technical Publishers Bangalore, 2015. ISBN-978 9383506 48-4

Web links and Video Lectures (e-Resources):

- <https://ocw.mit.edu/courses/2-003sc-engineering-dynamics-fall-2011/pages/mechanical-vibration/>
- <https://www.coursera.org/learn/introduction-basic-vibrations>
- <https://www.youtube.com/playlist?list=PLAC668A0566953FB5>
- <https://www.isu.edu/media/libraries/college-of-science-and-engineering/mechanical-engineering-v2/robotics-research-lab/Mechanical-Vibration.pdf>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Allow students to build and analyze a spring-mass-damper system, recording the oscillations and comparing with theoretical predictions.
- Have students create simulations of vibrational systems and analyze the effects of varying parameters.
- Analyze the vibrational characteristics of a vehicle's suspension system and propose improvements.
- Use a simple pendulum setup or a vibrating table to demonstrate resonance and natural frequencies.
- Visit a plant where machinery vibration monitoring is essential for maintenance.

PROJECT WORK

Course Code	21MEE73	CIE Marks	100
L:T:P:S	0:0:12:0	SEE Marks	100
Hrs / Week	--	Total Marks	200
Credits	12	Exam Hours	03

Course outcomes:

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

21MEE73.1	Identify the specified societal needs and categorize them into multi-disciplinary areas in engineering.
21MEE73.2	Conduct detailed review of industrial and societal needs to reach sustainable conclusions.
21MEE73.3	Integrate significant techniques and modern tools to solve complex real-world problems.
21MEE73.4	Evaluate the identified methodologies and select based on specific criteria.
21MEE73.5	Interpret the progress and outputs of the project through professional engineering reports and present it to a community or industry.
21MEE73.6	Role effectively as an individual and as a team.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
21MEE73.1	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21MEE73.2	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21MEE73.3	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21MEE73.4	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21MEE73.5	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21MEE73.6	3	3	3	2	3	2	1	1	2	1	2	2	2	2

Project is an experimental learning course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. The student shall be capable of recognizing a problem with appropriate consideration about societal needs in multiple areas and solve it using latest tools and technologies. Based on the ability/abilities of the student(s) and recommendations of the guide, multidisciplinary project can be assigned to a group having not more than 4 students. The project work will be reviewed by a panel of experts throughout the semester. The CIE marks awarded for the project work shall be based on the work accomplishment, project presentation skill, and question and answer session. The plagiarized projects will automatically result an F grade and the student will be liable for further disciplinary action. At the completion of a project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CONTENTS	COs
Perform a literature search to review current knowledge and developments in the chosen technical area. Review and finalization of the Approach to the Problem relating to the chosen topic/title. Preparation of work schedule with a team.	21MEE73.1, 21MEE73.2
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as required for the chosen field.	21MEE73.2, 21MEE73.3
Development of product/process, testing, results, conclusions and future directions.	21MEE73.4
Present the work in a forum involving poster presentations and demonstrations of operational hardware and software.	21MEE73.5
Preparation of a project report in the standard format for being evaluated by the guide and the department with plagiarism certificate and present it as a team to the evaluators.	21MEE73.5, 21MEE73.6

CIE Assessment Pattern (50 Marks - Theory) -

RBT Levels		Marks Distribution	
		Review 1 (25 Marks)	Review 2 (25 Marks)
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	5	5

SEE Assessment Pattern (50 Marks - Theory)

RBT Levels		Exam Marks Distribution (100)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

SCIENTIFIC FOUNDATIONS OF HEALTH												
Course Code	21MEK74						CIE Marks			50		
L:T:P:S	1:0:0:0						SEE Marks			50		
Hrs / Week	1						Total Marks			100		
Credits	1						Exam Hours			2		
Course outcomes:												
At the end of the course, the student will be able to:												
21MEK74.1	Understand the concepts of Health and wellness and the importance of achieving balanced good health											
21MEK74.2	Implement healthy lifestyle habits effectively to enhance overall well-being											
21MEK74.3	Adopt the innovative & positive methods to avoid risks from harmful habits in their campus & outside the campus											
21MEK74.4	Create the formulate strategies to fight against harmful diseases for good health through positive mindset											
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:												
21MEK74.1	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MEK74.2	-	-	-	-	-	1	-	-	-	-	-	-
21MEK74.3	-	-	-	-	-	2	-	-	-	-	-	-
21MEK74.4	-	-	-	-	-	3	-	-	-	-	-	-
MODULE-1	GOOD HEALTH AND IT'S BALANCE FOR POSITIVE MINDSET							21MEK74.1			3 Hours	
Health -Importance of Health, Influencing factors of Health, Health beliefs, Advantages of good health, Health & Behavior, Health & Society, Health & family, Health & Personality, Psychological disorders-Methods to improve good psychological health, Changing health habits for good health.												
Case Study				Factors Affecting Health and Mindset								
Text Book				Text Book 1: Ch. 1								
MODULE-2	BUILDING OF HEALTHY LIFESTYLES FOR BETTER FUTURE							21MEK74.2			3 Hours	
Developing healthy diet for good health, Food & health, Nutritional guidelines for good health, Obesity & overweight disorders and its management, Eating disorders, Fitness components for health, Wellness and physical function, How to avoid exercise injuries.												
Self-study		Benefits of mindfulness practices for stress reduction and mental clarity.										
Text Book		Text Book 1: Ch. 2, Text Book 3: Ch. 7										
MODULE-3	CREATION OF HEALTHY AND CARING RELATIONSHIPS							21MEK74.1, 21MEK74.2			3 Hours	
Building communication skills (Listening and speaking), Friends and friendship - education, the value of relationships and communication, Relationships for Better or worsening of life, understanding of basic instincts of life (more than a biology), Changing health behaviours through social engineering,												
Case Study		Guidance and support to colleagues facing challenges or seeking career advancement.										
Text Book		Text Book 1: Ch. 3										
MODULE-4	AVOIDING RISKS AND HARMFUL HABITS							21MEK74.3			3 Hours	
Characteristics of health compromising behaviors, Recognizing and avoiding of addictions, How addiction develops and addictive behaviors, Types of addictions, influencing factors for addictions, Differences between addictive people and non-addictive people and their behavior with society, Effects and health hazards from addictions, how to recovery from addictions												

Self-study	Study the impact of excessive sugar, salt, and saturated fats on cardiovascular health, obesity, and chronic diseases.			
Text Book	Text Book 1: Ch. 4, Text Book 3: Ch. 5,6			
MODULE-5	PREVENTING AND FIGHTING AGAINST DISEASES FOR GOOD HEALTH	21MEK74.4	3 Hours	
Process of infections and reasons for it, Management of chronic illness for Quality of life, Health and Wellness of youth , Measuring of health & wealth status.				
Self-study	Explore diagnostic tests and their role in detecting health conditions before symptoms appear.			
Text Book	Text Book 1: Ch. 5, Text Book 2: Ch. 5			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	Quiz
		25	15	10
L1	Remember	5	5	5
L2	Understand	5	5	5
L3	Apply	15	5	-
L4	Analyze	-	-	-
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	30		
L3	Apply	10		
L4	Analyze	-		
L5	Evaluate	-		
L6	Create	-		
Suggested Learning Resources:				
Textbook:				
1. "Scientific Foundations of Health" – Study Material Prepared by Dr. L Thimmesh, Published in VTU - University Website.				
2. "Scientific Foundations of Health", (ISBN-978-81-955465-6-5) published by Infinite Learning Solutions, Bangalore – 2022.				
3. Health Psychology - A Textbook, FOURTH EDITION by Jane Ogden McGraw Hill Education (India) Private Limited - Open University Press. ISBN 9780335222636.				
Reference Books:				
1. Health Psychology (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O'Connor – Published by Routledge 711 Third Avenue, New York, NY 10017.				
2. HEALTH PSYCHOLOGY (Ninth Edition) by SHELLEY E. TAYLOR - University of California, Los Angeles, McGraw Hill Education (India) Private Limited - Open University Press.				
Web links and Video Lectures (e-Resources):				
<ul style="list-style-type: none"> • https://archive.nptel.ac.in/courses/109/103/109103182/ • https://www.youtube.com/watch?v=BYmQbtyNfCo • https://www.youtube.com/watch?v=u9TFeiBc SE 				

- <https://archive.nptel.ac.in/courses/109/101/109101007/>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Activities to improve health, fitness, mindfulness etc.
- Case studies on healthy habits, impact of good lifestyle

VIII Semester Syllabus

ADDITIVE MANUFACTURING														
Course Code	21MEE811							CIE Marks	50					
L:T:P:S	3:0:0:0							SEE Marks	50					
Hrs / Week	03							Total Marks	100					
Credits	03							Exam Hours	03					
Course outcomes:														
At the end of the course, the student will be able to:														
21MEE811.1	Understand the fundamentals and process parameters of AM processes.													
21MEE811.2	Explore the suitability of AM process for various applications													
21MEE811.3	Apply the suitable process for fabricating a given product considering different real-life case studies.													
21MEE811.4	Understand the different tooling and its methods for AM													
21MEE811.5	Develop the optimal modelling of AM components for product.													
21MEE811.6	Design and develop a product for AM process.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEE811.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE811.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE811.3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE811.4	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE811.5	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21MEE811.6	3	3	-	-	-	-	-	-	-	-	-	-	3	-
MODULE-1 Introduction														
										21MEE811.1		8 Hours		
										21MEE811.2				
Introduction: Overview of Additive Manufacturing (AM); AM history; Classification of AM; Merits/de-merits and applications of AM process; Outline on AM software's. Brief information on different materials used for AM.														
Case Study/Applications		New product Development												
Text Book		Text book 1, 2, 3 and 4, at respective sections												
MODULE-2 CAD Data Processing for AM:														
										21MEE811.1		8 Hours		
										21MEE811.2				
										21MEE811.3				
CAD model development; Overview on Data requirements, Data formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP), Data interfacing, Part orientation and support generation; Design of support structure for AM; Overview on slicing methods; Tool path generation for AM.														
Case Study/Applications		New product Development												
Text Book		Text book 1, 2, 3 and 4, at respective sections												
MODULE-3 Liquid, Solid & Powder Based AM Technologies:														
										21MEE811.1		8 Hours		
										21MEE811.2				
										21MEE811.3				
										21MEE811.5				
										21MEE811.6				
Stereolithography; FDM; LOM; Multijet Modeling, SLS, Direct Metal Laser Sintering, 3-Dimensional Printing; Working Principles, products, materials, merits, drawbacks and applications –Case studies.														

Applications	New product Development		
Text Book	Text book 1, 2, 3 and 4, at respective sections		
MODULE-4	Direct Energy Deposition AM Process:	21MEE811.1 21MEE811.2 21MEE811.3 21MEE811.5 21MEE811.6	8 Hours
Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam based metal deposition: working principles, products, benefits and drawbacks, applications. Overview on new & Hybrid AM technologies.			
Case Study/Applications	New product Development		
Text Book	Text book 1, 2, 3 and 4, at respective sections		
MODULE-5	Post Processing of AM Parts and Rapid Tooling	21MEE811.1 21MEE811.2 21MEE811.4	8 Hours
Overview on support material removal, Surface quality and aesthetic improvement. Applications of AM. Overview on construction of basic AM machines. Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.			
Applications	New product Development		
Text Book	Text book 5, section 1 to 4		
CIE Assessment Pattern (50 Marks - Theory)			
RBT Levels		Marks Distribution	
		Test (s)	NPTEL
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	-
L6	Create	-	-
SEE Assessment Pattern (50 Marks - Theory)			
RBT Levels		Exam Marks Distribution (50)	
L1	Remember	10	
L2	Understand	10	
L3	Apply	10	
L4	Analyze	10	
L5	Evaluate	10	
L6	Create	--	

Suggested Learning Resources:**Text Books:**

- 1) Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003, ISBN 9789812383181
- 2) Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Ian Gibson, David W Rosen, Brent Stucker, 2nd Edition, Springer, 2015 , ISBN 9781493921126
- 3) Rapid Prototyping: Laser-based and Other Technologies, Patri K. Venuvinod and Weiyin Ma, Springer, 2004.
- 4) 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, Chee Kai Chua, Kah Fai Leong, World Scientific Publishers, 2014
- 5) Rapid Tooling: Technologies and Industrial Applications, Peter Dhillon, Hilton/Jacobs, Paul Jacobs, CRC press, 2000

Reference Books:

- 1) Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, D.T. Pham, S.S. Dimov, Springer 2001. ISBN 9781852333058
- 2) Rapid Prototyping and Engineering applications: A tool box for prototype development, Lieu W. Liou, Frank W. Liou, CRC Press, 2007.
- 3) Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr, Springer, 2006
- 4) Rapid Prototyping: Principles and Applications in Manufacturing, Rafiq Noorani, John Wiley & Sons, 2006
- 5) Laser Metal Deposition Process of Metals, Alloys, and Composite Materials, Engineering Materials and Processes, Mahamood R.M., Springer International Publishing AG 2018

Web links and Video Lectures (e-Resources)

- https://onlinecourses.nptel.ac.in/noc22_me74/preview
- https://onlinecourses.nptel.ac.in/noc24_me115/preview
- https://home.iitk.ac.in/~nsinha/Additive_Manufacturing%20I.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any 3D printing labs
- Demonstration of working of AM process
- Polymer printing Activities in COE at NHCE
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare a CAD model
 - Organizing Group wise discussions on AM techniques
 - Seminars on NPD and innovative design

INDUSTRIAL ROBOTICS														
Course Code	21MEE812					CIE Marks					50			
L:T:P:S	3:0:0:0					SEE Marks					50			
Hrs / Week	3					Total Marks					100			
Credits	03					Exam Hours					03			
Course outcomes:														
At the end of the course, the student will be able to:														
21MEE812.1	Understand the significance, social impact and future prospects of robotics.													
21MEE812.2	Use the suitable drives and sensors used in robots.													
21MEE812.3	Analyze the different motions of robotics system.													
21MEE812.4	Know about various path planning techniques and analyze different motions of robotics system.													
21MEE812.5	Use the Forward Kinematics and Reverse Kinematics for a different DOF													
21MEE812.6	Apply robotics concept to automate the monotonous and hazardous tasks and categorize various types of robots based on the design and applications in real world scenarios.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEE812.1	3	2	-	-	-	2	-	2	-	-	-	2	3	3
21MEE812.2	3	2	2	-	-	-	-	-	-	-	-	2	3	3
21MEE812.3	3	2	2	-	-	-	-	-	-	-	-	-	3	3
21MEE812.4	3	2	2	-	-	-	-	-	-	-	-	-	3	3
21MEE812.5	3	2	2	-	-	-	-	-	-	-	-	-	3	3
21MEE812.6	3	2	2	-	-	-	-	-	-	-	-	-	3	3
MODULE-1 INTRODUCTION TO ROBOTICS 21MEE812.1 8 Hours														
Introduction to Robotics and Automation, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, safety measures in robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots.														
Self-study		Understand the Introduction to Robotics and Automation with respect to human system and social impact.												
Text Book		Text Book 1: 1.1 to 1.12.												
MODULE-2 Control systems and components 21MEE812.2 8 Hours														
Basic control systems and components: Basic control systems concepts and models, Controllers, control system analysis, Robot sensors : Position & Velocity Sensors, Actuators: Pneumatic & Hydraulic Actuators, Electric Motors, Stepper Motors & AC Servomotors														
Case Study		Basic control systems concepts and models, Controllers, control system analysis, Robot sensors :Position & Velocity Sensors												
Text Book		Text Book 1: 2.2, 2.3, 2.4 to 2.15												
MODULE-3 PATH PLANNING 21MEE812.3, 21MEE812.4 8 Hours														
1 DoF, 2 DoF, multiple degrees of freedom robot hand, tools as end effectors, Robot control types: limited sequence control, point-to-point control, playback with continuous path control, and intelligent control.														

Path Planning: Definition-Joint space technique, Use of P-degree polynomial-Cubic,polynomial- Cartesian space technique, parametric descriptions, straight line and circular paths, position and orientation planning.			
Self-study / Case Study /	Investigate the path planning and cubic polynomial.		
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	FORWORDN KINEMATICS	21MEE812.5	8 Hours
Forward Kinematics; Inverse Kinematics and Differences. Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems. Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming. Motion Commands; Sensor Commands; End effector commands; and Simple programs.			
Self-study	Know the kinematics robotics techniques and simple program.		
Text Book	Text Book 1: 2.1 to 2.7. Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	APPLICATIONS OF ROBOT	21MEE812.6	8 Hours
Application of Robot: aerial robots helicopters, Multi rotor UAV, Flapping wing/Bio inspired UAV, wheeled mobile robots, swarm robots, Legged robots, medical/healthcare robots , Rehabilitation robot, hospital robot, space robots, service robots, Underwater and floating robots, Military Robots, unmanned vehicles: ground, robotic for computer integrated manufacturing, Industrial robots, Humanoids, Autonomous robots			
Case Study / Applications	Applications and case studies aerial robots helicopters, Multi rotor UAV, Flapping wing/Bio inspired UAV		
Text Book	Text Book 1: 10.1 to 10.8 Text Book 2: 10.1, 10.3, 10.5, 10.7		
CIE Assessment Pattern (50 Marks - Theory)			
RBT Levels		Marks Distribution	
		Test (s)	NPTEL
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	-
L6	Create	-	-
SEE Assessment Pattern (50 Marks - Theory)			
RBT Levels		Exam Marks Distribution (50)	
L1	Remember	10	
L2	Understand	10	
L3	Apply	10	
L4	Analyze	10	
L5	Evaluate	10	
L6	Create	--	
Suggested Learning Resources:			
TEXT BOOKS:			
1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education, 2009.ISBN 978-0070707085.			
2. Mikell P. Groover et. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Edition, (2012). ISBN 978-0070249898			
3. Ganesh S Hegde, "A textbook on Industrial Robotics", University science press, 3rd edition, 2017.			

REFERENCE BOOKS:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill.

Web links and Video Lectures (e-Resources):

- <https://roboticscasual.com/ros-tutorial-pick-and-place-task-with-the-moveit-c-interface/>
- <https://roboticscasual.com/ros-tutorial-simulate-ur5-robot-in-gazebo-urdf-explained/>
- <https://roboticscasual.com/the-best-degrees-to-work-in-robotics/>
- <https://roboticscasual.com/robotics-tutorials/>
- <https://www.ieee-ras.org/educational-resources-outreach/educational-material-in-robotics-and-automation>
- [https://www.academia.edu/20361073/Web Based Control and Robotics Education pdf](https://www.academia.edu/20361073/Web_Based_Control_and_Robotics_Education_pdf)
- <https://github.com/Developer-Y/cs-video-courses> <https://www.isa.org/>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in Industrial Robotics
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare Flowcharts and Handouts
 - Organizing Group wise discussions on issues
 - Seminars

REFRIGERATION AND AIR CONDITIONING														
Course Code	21MEE813								CIE Marks			50		
L:T:P:S	3:0:0:0								SEE Marks			50		
Hrs / Week	3								Total Marks			100		
Credits	03								Exam Hours			03		
Course outcomes:														
At the end of the course, the student will be able to:														
21MEE813.1	Understand Basics of Refrigeration and AC (HVAC & R) thermodynamic cycles													
21MEE813.2	Explain working of VCRS (various configurations) & VARS as used in industry													
21MEE813.3	Describe selection criteria of refrigerant w.r.t. eco-friendly operations													
21MEE813.4	Analyze various indoor and outdoor HVAC design conditions based on human comfort condition requirements and an overview of Data Centre cooling													
21MEE813.5	Understand Concepts and working of various types of industrial/commercial ACs and Refrigeration systems along with basic idea of cooling load calculation													
21MEE813.6	Classify various types ducting design of industrial ACs and Refrigeration systems based on applications													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEE813.1	2	2	-	-	-	-	-	-	-	-	-	-	-	3
21MEE813.2	2	1	-	-	-	-	-	-	-	-	-	-	-	3
21MEE813.3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
21MEE813.4	2	3	2	-	-	-	-	-	-	-	-	-	-	3
21MEE813.5	2	2	-	-	-	-	-	-	-	-	-	-	-	3
21MEE813.6	2	1	3	-	-	-	-	-	-	-	-	-	-	3
MODULE-1 INTRODUCTION														
										21MEE813.1			8 Hours	
Introduction about Refrigeration – Definitions of various terms. Methods of refrigeration. Air refrigeration system. Bell – Coleman cycle. Introduction about Air craft Air-Conditioning. Simple numerical on the same. RAC Data Handbook / Tables / Charts to be allowed in CIE / SEE														
Text Book				Text Book 1: 1.1, 1.2										
MODULE-2 VCRS & VARS SYSTEMS														
										21MEE813.2			8 Hours	
Analysis of Vapour compression cycle, Modifications to basic cycle. Multi pressure systems. Multi evaporator system and Cascade systems. Vapour Absorption Refrigeration System. Applications of VCRS & VARS. Simple numerical on VCRS & VARS. RAC Data Handbook / Tables / Charts to be allowed in CIE / SEE														
Text Book				Text Book 1: 2.1, 2.2, 2.3										
MODULE-3 REFRIGERANTS														
										21MEE813.3			8 Hours	
Pollution by refrigerants. Various Refrigerants selection and properties - overview. Use of solar energy, low grade energy to run the refrigeration system. Methods of refrigeration in Dry ice manufacturing, Ejector refrigeration system, Evaporative Coolers. Desiccant cooling system – overview (No Numerical)														
Text Book				Text Book 1:3.1, 3.2										
MODULE-4 PSYCHROMETRY														
										21MEE813.4			8 Hours	

Psychrometry – Definitions for properties. Introduction to AC cooling load calculations. Comfort conditions. Data Center Cooling. Effective temperature and humidity (ADP) concept. Idea of cooling load calculation Freeware’s. Simple numerical (with & without using psychrometric chart) – RAC Data Handbook / Tables / Charts to be allowed in CIE / SEE

Text Book | Text Book 1:4.1, 4.2

MODULE-5	APPLICATIONS OF AIR CONDITIONING & REFRIGERATION SYSTEMS	21MEE813.5 21MEE813.6	8 Hours
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Air-conditioning systems – discussion about the central plant with direct evaporator and chiller applications, Ice plant, refrigerators. Duct sizing methods. Simple numerical. Idea of Duct Sizing Freeware’s. Food preservation, IQF technique and freeze drying etc. Cold storage and thermal insulation. Simple numerical. RAC Data Handbook / Tables / Charts to be allowed in CIE / SEE

Text Book | Text Book -1: 5.1, 5.2

CIE Assessment Pattern (50 Marks – Theory) -

RBT Levels		Marks Distribution	
		Test (s)	NPTEL
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

- 1) C.P. Arora, Refrigeration and Air Conditioning, Publisher - TMH, 4th Edition, 2021, ISBN-10 9390385849, ISBN-13 978-9390385843
- 2) R.C. Arora, Refrigeration and Air Conditioning, Publisher – 2010 PHI, ISBN-10 9788120339156, ISBN-13 978-8120339156

Reference Books:

- 1) ASHRAE Handbook - Fundamentals, Publisher – ASHRAE, ISBN-10 1947192892, ISBN-13 978-1947192898
- 2) ASHRAE Handbook – Refrigeration, Publisher – ASHRAE, ISBN-10 1931862869, ISBN-13 978-1931862868

Web links and Video Lectures (e-Resources):

- [Refrigeration and Air-conditioning - Course \(nptel.ac.in\)](#)
- [NPTEL :: Mechanical Engineering - Refrigeration and Air Conditioning](#)

EMERGING AUTOMOTIVE TECHNOLOGIES

Course Code	21MEE814	CIE Marks	50
L:T:P:S	3:0:0:0	SEE Marks	50
Hrs / Week	03	Total Marks	100
Credits	03	Exam Hours	03

Course outcomes:

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

21MEE814.1	Understand the functions of IC engine components and fuel supply systems.
21MEE814.2	Investigation of the Super and Turbo Chargers for enhancing the power output.
21MEE814.3	Study of the different ignition systems used in IC engines.
21MEE814.4	Design and Development of various transmission system, braking and safety Mechanisms
21MEE814.5	Analyze the concept of Electric Vehicles, Energy Storage and Automotive Emission Control System.
21MEE814.6	Implement the Automotive Applications for Modern Technology.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEE814.1	2	-	-	-	-	-	-	-	-	-	-	-	2	3
21MEE814.2	3	3	-	-	-	-	-	-	-	-	-	-	3	3
21MEE814.3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
21MEE814.4	3	2	3	-	-	-	-	-	-	-	-	3	3	3
21MEE814.5	3	3	2	-	-	-	2	-	-	-	-	3	-	3
21MEE814.6	3	-	-	-	2	-	-	-	-	-	-	3	2	3

MODULE-1	ENGINE COMPONENTS, MODERN FUEL SUPPLY SYSTEMS	21MEE814.1 21MEE814.6	8 Hours
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Engine Components and Modern Fuel Supply Systems: cylinder – arrangements and their relatives merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, Combustion chamber Design in SI and CI engines.

Modern Fuel Supply Systems Electronic Fuel CV Injection (EFI) system, merits and demerits of EFI system, multi-point fuel injection system, D-MPFI system, L-MPFI system, Common rail injection system, i-V TECH, VVT.

Applications	List the applications of different suspension systems in vehicles.
Text Book	Text Book 2: 12.145, 13.181, 17.229

MODULE-2	IGNITION SYSTEMS, SUPERCHARGERS AND TURBOCHARGERS	21MEE814.2 21MEE814.3 21MEE814.5	8 Hours
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Ignition Systems: Battery Ignition systems, magneto Ignition system, Transistor assist contacts. Electronic Ignition, Automatic Ignition advance systems.

Superchargers And Turbochargers: Naturally aspirated engines, Forced Induction, Types of superchargers, Turbocharger construction and operation, Intercooler, Turbocharger lag.

Applications	List the Ignition system applications for different automobiles.
Text Book	Text Book 2: 1.3, : 2.15, 28.378, 29.399

MODULE-3	POWER TRAINS, DRIVE TO WHEELS	21MEE814.4	8 Hours
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Power Trains: Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, fluid flywheel, torque converter

Drive To Wheels: Propeller shaft and universal joints, differential, steering geometry, camber, king pin

inclination, included angle, castor, toe in & toe out, condition for exact steering, steering gears, power steering, general arrangements of links and stub axle, over steer, under steer and neutral steer.			
Self-study	Self-study on advanced steering systems		
Text Book	Text Book 2: 3.32, 11.123, 28.378		
MODULE-4	BRAKES AND AUTOMOTIVE EMISSION CONTROL SYSTEMS	21MEE814.4 21MEE814.5	8 Hours
<p>Brakes: Types of brakes, mechanical compressed air, vacuum and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, Antilock – Braking systems.</p> <p>Automotive Emission Control Systems:Controlling crankcase emissions, Controlling evaporative emissions, Exhaust gas recirculation, Catalytic converter, Treating the exhaust gas, Air- injection system, Air-aspirator system, Emission Standards : BS-I,BS-II, BS-III, BS-IV,BS-VI</p>			
Case Study	Case study on emission control Systems.		
Text Book	Text Book 2: 7.68, 8.89, Text Book 1: 35.448		
MODULE-5	HYBRID VEHICLES AND AUTONOMOUS VEHICLES	21MEE814.4 21MEE814.6	8 Hours
<p>Hybrid Electric Vehicles (HEVs): History of electric and hybrid vehicles. Need of electric and hybrid vehicles – comparative study of diesel, petrol, electric and hybrid vehicles. Limitations of electric vehicles. Specification of different electric and hybrid vehicles</p> <p>Autonomous Vehicles: levels of autonomy from Level 0 (no automation) to Level 5 (full automation), focusing on sensor technologies (radar, lidar, cameras), artificial intelligence algorithms for decision-making and regulatory challenges, Electronic Stability program</p>			
Applications	Hybrid Vehicles applications and case studies on Electric Vehicles.		
Text Book	Text Book 2: 26.345,27.362		
CIE Assessment Pattern (50 Marks – Theory) -			
RBT Levels		Marks Distribution	
		Test (s)	NPTEL
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	-
L6	Create	-	-
SEE Assessment Pattern (50 Marks – Theory)			
RBT Levels		Exam Marks Distribution (50)	
L1	Remember	10	
L2	Understand	10	
L3	Apply	10	
L4	Analyze	10	
L5	Evaluate	10	
L6	Create	--	

Suggested Learning Resources:**Text Books:**

- 1) Automotive mechanics, William H Crouse & Donald L Anglin, 10th Edition Tata McGraw Hill Publishing Company Ltd., 2007, ISBN 978-0070634350
- 2) Automotive Mechanics Srinivasan, 2nd Ed., Tata McGraw Hill 2003, ISBN 978-0070494916

Reference Books:

- 1) Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
- 2) Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd.
- 3) Automobile Engineering, R. B. Gupta, SatyaPrakashan, 4th edn. 1984.
- 4) Automobile engineering, Kirpal Singh. Vol I and II 2002.
- 5) Internal combustion engines, V Ganesan

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=ZQvfHyfgBtA>
- <https://www.youtube.com/watch?v=SzyswSQD1Sc>
- <https://www.youtube.com/watch?v=SyD0xtXrRIo&t=109s>
- <https://www.youtube.com/watch?v=665YfCieiH8>
- <https://www.youtube.com/watch?v=RCbZjPHC1gg>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any Automotive industry
- Video demonstration of latest trends in Automotive technologies
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to collect Automotive parts
 - Organizing Group wise discussions on issues in Automotive technologies
 - Seminars

HYDRAULICS AND PNEUMATICS

Course Code	21MEE815	CIE Marks	50
L:T:P:S	3:0:0:0	SEE Marks	50
Hrs / Week	03	Total Marks	100
Credits	03	Exam Hours	03

Course outcomes:

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

21MEE815.1	Understand the working of hydraulic systems and pumps.
21MEE815.2	Evaluate the need of valves for hydraulic systems.
21MEE815.3	Investigate the need and functioning of hydraulic circuits.
21MEE815.4	Apply the role of pneumatic systems in the industry.
21MEE815.5	Analyze the working of multi-cylinder applications.
21MEE815.6	Evaluate the working of electro-pneumatic control systems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEE815.1	3	2	-	-	-	-	-	-	-	-	-	-	-	2
21MEE815.2	3	2	2	-	-	-	-	-	-	-	-	-	-	2
21MEE815.3	3	3	2	-	-	-	-	-	-	-	-	-	-	2
21MEE815.4	3	2	1	-	-	-	-	-	-	-	-	-	-	2
21MEE815.5	3	2	2	-	-	-	-	-	-	-	-	-	-	2
21MEE815.6	3	3	2	-	-	-	-	-	-	-	-	-	-	2

MODULE-1 INTRODUCTION TO HYDRAULIC POWER 21MEE815.1 8 Hours

Definition of Hydraulic System, Pascal's Law, Advantages, Limitations, Applications, Pumps, Classification, Positive Displacement Pumps, Selection of Pumps, Hydraulic Actuators.

Applications Real time applications of Pascal's Law.

Text Book Text Book 1: 1.1,1.3,1.4,3.3,3.4,3.7,5.2,5.3

MODULE-2 CONTROL COMPONENTS IN HYDRAULIC SYSTEMS. 21MEE815.2 8 Hours

Directional Control Valves, Symbolic Representation, Pressure Control Valves, Flow Control Valves, Hydraulic Oils, Types, Desirable Properties.

Self-study Types of valves used in various industries.

Text Book Text Book 1: 8.2,8.3,8.4,

MODULE-3 HYDRAULIC CIRCUIT DESIGN AND ANALYSIS 21MEE815.3 8 Hours

Control of Single and Double – acting Hydraulic cylinder, Regenerative Circuit, Pump Unloading Circuit, Double Pump Hydraulic system, Counter Balance Valve application, Hydraulic Cylinder Sequencing Circuits. Locked Cylinder using Pilot Check Valve, Cylinder Synchronizing Circuits, Speed Control of Hydraulic Cylinder, Speed Control of Hydraulic Motors, Accumulators and Accumulator Circuits.

Case Study Real time applications of hydraulic systems in industry.

Text Book Text Book 1: 9.2,9.3,9.4,9.5,9.6,9.7,9.8,9.10,9.11,9.13,9.14

MODULE-4 PNEUMATIC CONTROL 21MEE815.4 8 Hours

Choice of working medium, characteristics of compressed air, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout. Pneumatic Actuators: Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals. Rod – less cylinders – types, working advantages, Rotary cylinder-types, construction.

Directional Control Valves: Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve.

Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders. Flow control valves and speed control of cylinders supply air throttling and exhaust air throttling use of quick exhaust valve.

Self-study Comparing efficiency of pneumatic and hydraulic systems.

Text Book Text Book 1: 13.2,13.4

MODULE-5	MULTI-CYLINDER APPLICATIONS	21MEE815.5 21MEE815.6	8 Hours
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Multi-cylinder Applications: Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. Cascading method – principle. Practical application examples (up to two cylinders) using cascading method using reversing valves.

Electro-Pneumatic control: Principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications.

Case Study Control and monitoring of electro-pneumatic systems.

Text Book Text Book 1: 15.6,15.7

CIE Assessment Pattern (50 Marks - Theory)

RBT Levels		Marks Distribution	
		Test (s)	NPTEL
		25	25
L1	Remember	5	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

- 1) "Fluid Power with Applications" Anthony Esposito, Seventh edition, Pearson New International Edition, 7th edition 2013, ISBN-13: 9781292023878
- 2) Hydraulics and Pneumatics, A Technician's and Engineer's Guide, Andrew Parr, 3rd Edition 2011, Butterworth-Heinemann 2011 publication, ISBN:9780080966748

Reference Books:

- 1) Oil Hydraulic systems', Principles and Maintenance S. R. Majumdar, Tata McGraw Hill Publishing Company Ltd. – 2001, ISBN-13: 978-0074637487
- 2) Principles of Hydraulic Systems Design, Peter Chapple, 2nd Edition ((Dec 31 2014),Momentum Press publishing, ISBN: 9781606504529
- 3) Fluid Power: Hydraulics and Pneumatics, James R Daines2nd Edition (Aug 30, 2012),Goodheartwillcox Publication, ISBN: 9781605259369
- 4) Pneumatic Systems', S. R. Majumdar, McGraw-Hill Professional; 2004 Publication, ISBN 13: 9780074602317
- 5) Hydraulics and Pneumatics, 1/e Jagadeesha T, I K International publishers (2015), ISBN- 13: 97893845889

Web links and Video Lectures (e-Resources):

- <https://elearn.nptel.ac.in/shop/nptel/oil-hydraulics-and-pneumatics/?v=c86ee0d9d7ed>
- <https://uk.rs-online.com/web/content/discovery/ideas-and-advice/pneumatics-hydraulics-overview>
- <https://www.udemy.com/course/introduction-of-hydraulics-and-pneumatics/>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in hydraulics and pneumatics
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare flowcharts
 - Organizing Group wise discussions on issues in maintenance of hydraulic and pneumatic systems
 - Seminars

TECHNICAL SEMINAR

Course Code	21MEE82	CIE Marks	50
L:T:P:S	0:0:1:0	SEE Marks	--
Hrs / Week	--	Total Marks	50
Credits	01	Exam Hours	--

Course outcomes:

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

21MEE82.1	Analyze quickly evolving field in multidisciplinary areas through independent study.
21MEE82.2	Identify the advancements in the technology pertinent to the chosen area.
21MEE82.3	Demonstrate the identified technology and analyze its effects on the environment, society, and domain.
21MEE82.4	Compile the study report and provide it to the audience while abiding by ethical guidelines.
21MEE82.5	Develop interpersonal skills and presentation skills.
21MEE82.6	Use their developed skills in real life situations.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
21MEE82.1	3	3	3	2	3	2	-	1	3	2	2	-	-	2
21MEE82.2	3	3	3	2	3	2	-	1	3	2	2	-	-	2
21MEE82.3	3	3	3	2	3	2	-	1	3	2	2	-	-	2
21MEE82.4	3	3	3	2	3	2	-	1	3	2	2	-	-	2
21MEE82.5	-	-	-	-	-	2		1	3	2	2	-	-	2
21MEE82.6	-	-	-	-	-	2	-	1	3	2	2	-	-	2

It is crucial to stay current with the practical and communicative aspects of recent technologies. Technical seminar course is designed in such a way the preparation for presentations and models would foster practical creativity as well as the general personality of students. Based on the ability of the students, each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of specialization. The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman. At the completion of the semester the student will submit a seminar report, which will be evaluated by internal panel of experts.

CIE Assessment Pattern (50 Marks)

RBT Levels		Marks Distribution		
		Review 1 (15 Marks)	Review 2 (15 Marks)	Seminar Report (20 Marks)
		15	15	20
L1	Remember	-	-	-
L2	Understand	5	5	5
L3	Apply	-	-	-
L4	Analyze	5	5	5
L5	Evaluate	5	5	10
L6	Create	-	-	-

RESEARCH INTERNSHIP/ INDUSTRY INTERNSHIP /RURAL INTERNSHIP

Course Code	21MEE83	CIE Marks	100
L:T:P:S	0:0:12:0	SEE Marks	100
Hrs / Week	0	Total Marks	200
Credits	12	Exam Hours	03

Course outcomes:

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

21MEE83.1	Apply and test the basic theoretical knowledge learnt during the study on to projects in industry/Startup/CoE/Study Centre etc.
21MEE83.2	Cater to the recent industrial demands by analyzing and designing complex engineering solutions.
21MEE83.3	Work in real-life scenarios.
21MEE83.4	Perform either as an individual or as a team to communicate the complex engineering activities with the community and with the society and comprehend the work through articles/reports.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEE83.1	3	3	3	-	3	-	-	-	-	-	-	3	-	3
21MEE83.2	3	3	3	-	3	-	-	-	-	-	-	3	-	3
21MEE83.3	3	3	3	-	3	-	-	-	-	-	-	3	-	3
21MEE83.4	3	3	3	-	3	-	-	-	-	-	-	3	-	3

At the beginning of IV years of the program i.e., after VI semester, VII semester class work and VIII semester Research Internship /Industrial Internship / Rural Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship.

In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree.

Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.

University shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization.

CIE Assessment Pattern (50 Marks - Theory)

RBT Levels		Marks Distribution	
		Review 1 (25 Marks)	Review 2 (25 Marks)
		25	25
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	5	5

SEE Assessment Pattern (50 Marks - Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

NATIONAL SERVICE SCHEME (NSS)												
Course Code	21NSS84						CIE Marks	50				
L:T:P:S	0:0:0:0						SEE Marks	50				
Hrs / Week	2						Total Marks	100				
Credits	00						Exam Hours	2				
Course outcomes:												
At the end of the course, the student will be able to:												
21NSS84.1	Understand the importance of his / her responsibilities towards society											
21NSS84.2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.											
21NSS84.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.											
21NSS84.4	Implement government or self-driven projects effectively in the field.											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21NSS84.1	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.2	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.3	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.4	-	-	-	-	-	3	1	1	3	2	2	1
Semester												
CONTENT												
HOURS												
5 th to 8 th	<p style="text-align: center;">PART A</p> <p>ONENSS-CAMP @College/University/State or Central Govt Level/ NGO's/General Social Camps</p> <p style="text-align: center;">PART B</p> <ol style="list-style-type: none"> Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing Waste management-Public, Private and Govt organization, 5R's. Setting of the information imparting club for women leading to contribution in social and economic issues. Water conservation techniques-Role of different stakeholders-Implementation. Preparing an actionable business proposal for enhancing the village income and approach for implementation. Helping local schools to achieve good results and enhance their enrolment in Higher/technical/vocational education. Developing Sustainable Water management system for rural areas and implementation approaches. Contribution to any national level initiative of Government of India. For. eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. Spreading public awareness under rural outreach programs. (minimum 5 programs). Organize National integration and social harmony events/workshops / Seminars. (Minimum 02 programs). Govt. school Rejuvenation and helping them to achieve good infrastructure. 											<p style="text-align: center;">Total 32 Hrs/ Semester</p> <p style="text-align: center;">2 Hrs/week</p>

CIE Assessment Pattern (50 Marks – Practical) –

1. **PART A:** Compulsorily students have to attend one camp.
2. **PART B:** Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.
3. CIE will be evaluated based on their presentation, approach and implementation strategies.

CIE Components	Marks
Presentation1-Selection of topic-(phase1)	10
Experiential Learning Presentation 2 (phase2)	10
Case Study-based Teaching-Learning	10
Sector-wise study & consolidation	10
Video based seminar (4-5 minutes per student)	10
Total	50

SEE Assessment Pattern (50 Marks – Practical)

- Implementation strategies of the project with report duly signed by the Dept’s Coordinator, HoD and Principal.
- At last it should be evaluated by the NSS Coordinator.
- Finally consolidated report should be sent to the University.

Suggested Learning Resources:**Reference Books:**

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)												
Course Code	21PES84						CIE Marks	50				
L:T:P:S	0:0:0:0						SEE Marks	50				
Hrs / Week	2						Total Marks	100				
Credits	00						Exam Hours	02				
Course outcomes:												
At the end of the course, the student will be able to:												
21PES84.1	Demonstrate the starting and finishing positions of different track and jump events.											
21PES84.2	Demonstrate the holding and releasing stances in various throwing events, and takeoff and landing position in various jumping events of Athletics.											
21PES84.3	Demonstrate the specific skills and techniques of the selected game/event.											
21PES84.4	Demonstrate and describe the rules and regulations of specific games.											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21PES84.1	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.2	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.3	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.4	-	-	-	-	-	-	-	1	2	-	-	1
Semester	CONTENT										HOURS	
5th	<p>Fitness Components: Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips.</p> <p>Practical Components: Speed, Strength, Endurance, Flexibility, and Agility</p> <p>Athletics:</p> <ol style="list-style-type: none"> Track -Sprints: <ul style="list-style-type: none"> Starting Techniques: Standing start and Crouch start(its variations)use of Starting Block. Acceleration with proper running techniques. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) <p style="text-align: center;">Kabaddi OR Kho-Kho</p> <p>Kabaddi:</p> <p>A. Fundamental skills</p> <ol style="list-style-type: none"> Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. Game practice with application of Rules and Regulations. 										Total 32 Hrs/ Semester	
											2 Hrs/week	

	<p>B. Rules and their interpretations and duties of the officials.</p> <p>Kho-Kho: A Fundamental skills 1. Skills in Chasing: Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul. 2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play. 3. Game practice with application of Rules and Regulations.</p> <p>B. Rules and their interpretations and duties of the officials.</p>	
6th	<p>Athletics: 1. Track - 110 Mtrs and 400 Mtrs: <ul style="list-style-type: none"> • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).</p> <p style="text-align: center;">Volleyball OR Throw Ball</p> <p>Volleyball: A. Fundamental skills 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over-head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations</p> <p>B. Rules and their interpretation and duties of officials.</p> <p>Throw Ball: A. Fundamental skills: Over hand service, Side arm service, two hand catching, one hand over head return, side arm return. B. Rules and their interpretations and duties of officials</p> <p style="text-align: center;">Football OR Hockey</p> <p>Football: A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition.</p>	

	<p>5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations.</p> <p>C. Rules and their interpretation and duties of officials.</p> <p>Hockey: A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.</p>	
7th	<p>Athletics: 1. Track -Relay Race: <ul style="list-style-type: none"> • Starting, Baton Holding/Carrying, Baton Exchange in between zone, and Finishing • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- Triple Jump: Approach Run, Take-off, Flight in the Hop, Step, Jump and Landing 3. Throws- Javelin Throw: Grip, Carry, and Recovery (3/5 Impulse stride). Release</p> <p style="text-align: center;">Cricket OR Baseball</p> <p>Cricket: A. Fundamental skills 1. Batting- Forward Defense Stroke, Backward Defense Stroke, OffDrive, On Drive, Straight Drive, Cover Drive, Square Cut. 2. Bowling-Out-swing, In-swing Off Break, Leg Break and Googly. 3. Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw, Throwing on the Turn. 4. Wicket Keeping B. Rules and their interpretation and duties of officials.</p> <p>Baseball: A. Fundamental skills: 1. Player Stances – walking, extending walking, L stance, cat stance Grip – standard grip, choke grip 2. Batting – swing and bunt. 3. Pitching 4. Baseball: slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball B. Rules and their interpretations and duties of officials</p>	

	<p style="text-align: center;">Basketball OR Net Ball</p> <p>Basketball:</p> <p>A. Fundamental Skills</p> <ol style="list-style-type: none"> 1. Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass. 2. Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running. 3. Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble. 4. Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw. 5. Rebounding: Defensive rebound and Offensive rebound. 6. Individual Defence: Guarding the player with the ball and without the ball, Pivoting. 7. Game practice with application of Rules and Regulations. <p>Netball:</p> <p>A. Fundamental Skills</p> <ol style="list-style-type: none"> 1. Catching: one handed, two handed, with feet grounded and in flight. 2. Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce). 3. Footwork: Landing on one foot, landing on two feet, Pivot, Running pass. 4. Shooting: One hand, forward step shot, and backward step shot. 5. Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed. 6. Defending: Marking the player, marking the ball, blocking, inside the circle, outside the circle. Defending the circle edge against the passing. 7. Intercepting: Pass and shot. 8. Game practice with application of Rules and Regulations. <p>B. Rules and their interpretation and duties of officials.</p>	
8th	<p>Athletics:</p> <p>A. Track -Combined Events:</p> <ol style="list-style-type: none"> a. Heptathlon all the 7 events b. Decathlon: All 10 Events <p>B. Jumps- Pole Vault: Approach Run, Planting the Pole, Take-off, Bar Clearance and Landing.</p> <p>C. Throws- Hammer Throw: Holding the Hammer, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).</p> <p style="text-align: center;">Shuttle Badminton OR Table Tennis</p> <p>Shuttle Badminton:</p> <p>A. Fundamental skills</p> <p>D. Basic Knowledge: Various parts of the Racket and Grip.</p> <p>E. Service: Short service, Long service, Long-high service.</p> <p>F. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash.</p> <p>G. Game practice with application of Rules and Regulations.</p> <p>B. Rules and their interpretation and duties of officials.</p> <p>Table Tennis:</p> <p>A. Fundamental skills:</p> <ol style="list-style-type: none"> 1. Basic Knowledge: Various parts of the Racket and Grip(Shake Hand & 	

- PenHold Grip).
 - 2. Stance: Alternate & Parallel.
 - 3. Push and Service: Backhand & Forehand.
 - 4. Chop: Backhand & Forehand.
 - 5. Receive: Push and Chop with both Backhand & Forehand.
 - 6. Game practice with application of Rules and Regulations.
- B. Rules and their interpretations and duties of officials

Handball OR Ball Badminton

Handball:

- A. Fundamental Skills
 - 1. Catching, Throwing and Ball control,
 - 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot.
 - 3. Dribbling: High and low.
 - 4. Attack and counter attack, simple counter attack, counter attack from two wings and center.
 - 5. Blocking, Goal Keeping and Defensive skills.
 - 6. Game practice with application of Rules and Regulations.
- B. Rules and their interpretations and duties of officials

Ball badminton:

- A. Fundamental Skills
 - 1. Basic Knowledge: Various parts of the Racket and Grip.
 - 2. Service: Short service, Long service, Long-high service.
 - 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash.
 - 4. Game practice with application of Rules and Regulations.
- B. Rules and their interpretation and duties of officials.

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
5 th Semester	10
6 th Semester	10
7 th Semester	15
8 th Semester	15
Total	50

SEE Assessment Pattern (50 Marks – Practical)

SEE	Marks
Athletics	20
Kabaddi OR Kho-Kho	05
Volleyball / Throw ball	05
Football/Hockey	05
Netball/Basketball	05
Shuttle Badminton / Table Tennis	05
Handball/ Badminton	05
Total	50

Suggested Learning Resources:

Reference Books:

- 1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.

2. Bandopadhyay,K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, etal. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma,P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, NewDelhi.
5. Jain,R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket ,Khel Sahitya Kendra, NewDelhi.
7. Saha,A.K.Sarir Siksher Ritiniti,RanaPublishingHouse,Kalyani.
8. Bandopadhyay,K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, NewDelhi.
10. Dubey,H.C. Basketball, Discovery Publishing House, NewDelhi.
11. RachanaJain, Teach Yourself Basketball, Sports Publication.
12. JackNagle,Power Pattern Offences for Winning basketball,ParkerPublishingCo.,NewYork.
13. RenuJain, Play and Learn Basketball, Khel Sahitya Kendra,NewDelhi.
14. SallyKus, Coaching Volleyball Successfully, HumanKinetics.
15. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
16. Bandopadhyay, K.Sarir Siksha Parichay, Classic Publishers, Kolkata

YOGA												
Course Code	21YOG84						CIE Marks	50				
L:T:P:S	0:0:0:0						SEE Marks	50				
Hrs / Week	2						Total Marks	100				
Credits	00						Exam Hours	02				
Course outcomes:												
At the end of the course, the student will be able to:												
21YOG84.1	Use Yogasana practices in an effective manner											
21YOG84.2	Become familiar with an authentic foundation of Yogic practices											
21YOG84.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas											
21YOG84.4	Use the teachings of Patanjali in daily life.											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21YOG84.1	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.2	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.3	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.4	-	-	-	-	-	3	-	-	2	-	-	1
Semester	CONTENT										HOURS	
5th	<p>Introduction of Yoga: Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer</p> <p>Brief introduction of yogic practices for common man: Yogic practices for common man to promote positive health</p> <p>Rules and regulations: Rules to be followed during yogic practices by practitioner</p> <p>Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices.</p> <p>Suryanamaskara:</p> <ol style="list-style-type: none"> Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar. Suryanamaskar 12 count, 2 rounds <p>Kapalabhati: Meaning, importance and benefits of Kapalabhati - 40 strokes/min 3 rounds</p> <p>Different types of Asanas:</p> <ol style="list-style-type: none"> Sitting: Padmasana, Vajrasana, Sukhasana Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana Prone line: Bhujangasana, Shalabhasana Supine line: Utthitadvipadasana, Ardhalasana, Halasana <p>Patanjali's Ashtanga Yoga: Yama, Niyama</p> <p>Pranayama: Suryanuloma - Viloma, Chandranuloma - Viloma</p>										Total 32 Hrs/ Semester 2 Hrs/week	
6th	<p>Suryanamaskara: Suryanamaskar 12 count, 4 rounds</p> <p>Kapalabhati: Revision of Kapalabhati - 60 strokes/min 3 rounds</p> <p>Different types of Asanas:</p> <ol style="list-style-type: none"> Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana Prone line: Dhanurasana 											

	<p>4. Supine line: Karna Peedasana, Sarvangasana, Chakrasana Patanjali's Ashtanga Yoga: Asana, Pranayama Pranayama: Chandra Bhedana, Nadishodhana, Surya Bhedana</p>	
7th	<p>Suryanamaskara: Suryanamaskar 12 count, 8 rounds Kapalabhati: Revision of Kapalabhati - 80 strokes/min 3 rounds Different types of Asanas:</p> <ol style="list-style-type: none"> 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana <p>Patanjali's Ashtanga Yoga: Pratyahara, Dharana Pranayama: Ujjayi, Sheetal, Sheektari</p>	
8th	<p>Suryanamaskara: Suryanamaskar 12 count, 12 rounds Kapalabhati: Revision of Kapalabhati - 100 strokes/min 3 rounds Different types of Asanas:</p> <ol style="list-style-type: none"> 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Mayurasana 4. Supine line: Setubandhasana, Shavasana (Relaxation posture) 5. Balancing: Sheershasana <p>Patanjali's Ashtanga Yoga: Dhyana (Meditation), Samadhi Pranayama: Bhastrika, Bhramari, Ujjai Shat Kriyas: Jalaneti and sutraneti, Sheetkarma Kapalabhati</p>	

CIE Assessment Pattern (50 Marks - Practical) -

CIE to be evaluated every semester end based on practical demonstration of Yogasana learnt in the semester.

CIE	Marks
5 th Semester	10
6 th Semester	10
7 th Semester	15
8 th Semester	15
Total	50

SEE Assessment Pattern (50 Marks - Practical)

SEE	Marks
Suryanamaskara	10
Kapalabhati	10
Asanas	10
Patanjali's Ashtanga Yoga	10
Pranayama / Shat Kriyas	10
Total	50

Suggested Learning Resources:

Reference Books:

1. Swami Kuvulyananda: Asma (Kavalayadhama, Lonavala)
2. Tiwari, O P: Asana Why and How
3. Ajitkumar: Yoga Pravesha (Kannada)
4. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)

5. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
6. Nagendra H R: The art and science of Pranayama
7. Tiruka: Shatkriyegalu (Kannada)
8. Iyengar B K S: Yoga Pradipika (Kannada)
9. Iyengar B K S: Light on Yoga (English)

Appendix A: List of Assessment Patterns

S.NO	Pattern of Assessments
1	Assignments
2	Group Discussions
3	Case Study / Caselets
4	Practical-Orientation on Design Thinking
5	Participatory & Industry-Integrated Learning
6	Practical Activities / Problem Solving Exercises
7	Class Presentations
8	Analysis of Industry / Technical / Business Reports
9	Reports on Industrial Visit
10	Industrial / Social / Rural Projects
11	Participation in external seminars / Workshops
12	Any Other Academic Activity
13	Online / Offline Quizzes

APPENDIX B: Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

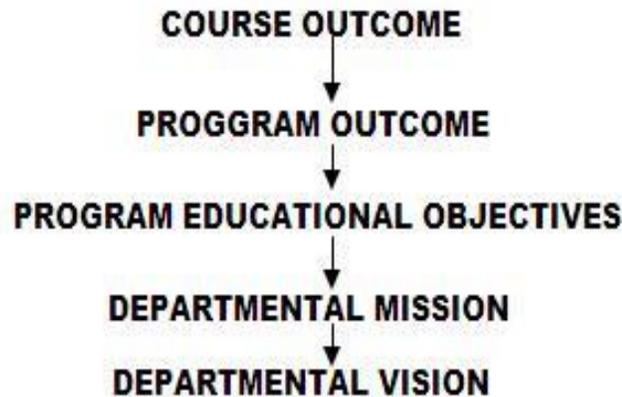
There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX C: The Graduate Attributes of NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

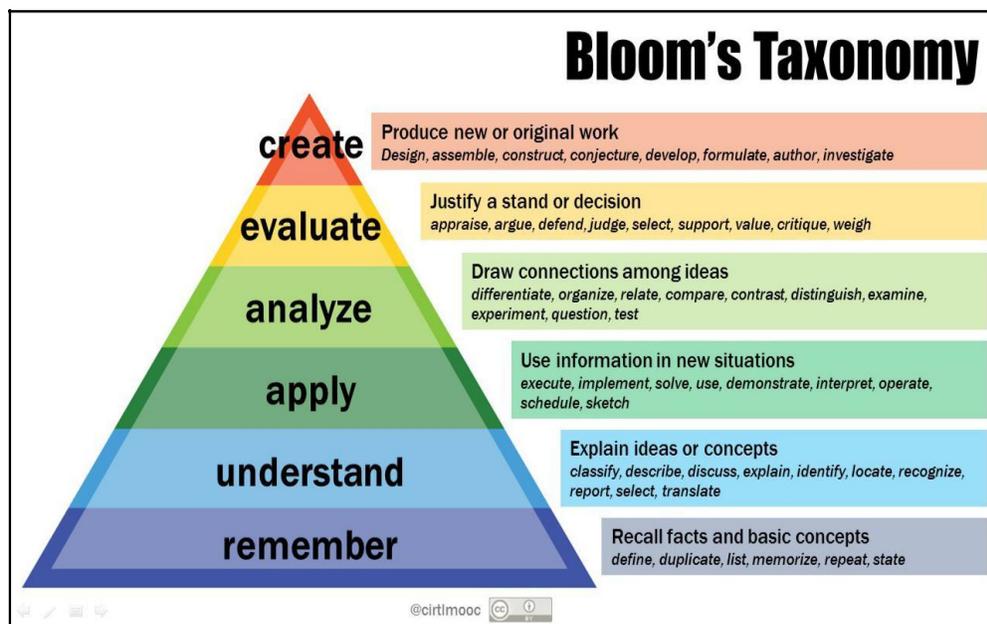
Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDIX D: BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.





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