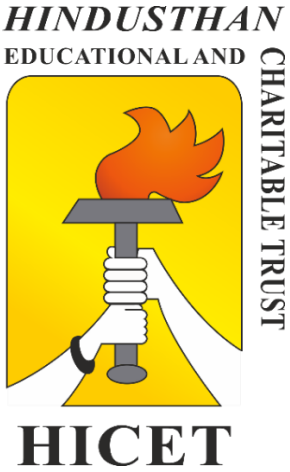
HINDUSTHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai)

(Approved by AICTE, New Delhi, Accredited by NAAC with 'A' Grade)

Coimbatore - 641 032.

B E. MECHANICAL ENGINEERING



CHOICE BASED CREDIT SYSTEM

Curriculum and Syllabus

Academic year 2023-24

VISION OF THE INSTITUTE

To become a premier institution by producing professionals with strong technical knowledge, innovative research skills and high ethical values.

MISSION OF THE INSTITUTE

- To provide academic excellence in technical education through novel teaching methods.
- To empower students with creative skills and leadership qualities.
- To produce dedicated professionals with social responsibility

VISION OF THE DEPARTMENT

To provide quality technical education in Mechanical Engineering and build holistic professionals who can excel in the engineering establishments and serve for the country with ethical values.

MISSION OF THE DEPARTMENT

M1: To prepare graduates with good technical skills and knowledge.

M2: To prepare graduates with life-long learning skills to meet the requirements in the higher education and in society.

M3: To prepare graduates as successful entrepreneur with employment skills, ethics and human values.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Exhibit their sound theoretical, practical skills and knowledge for successful employments, higher studies, research and entrepreneurial assignments.

PEO 2: Lifelong learning skills, professional ethics and good communication capabilities along with entrepreneur skills and leadership, so that they can succeed in their life.

PEO 3: Become leaders and innovators by devising engineering solutions for social issues and problems, thus caring for the society.

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

PROGRAMME OUTCOMES

Engineering graduates will able to

PO1. Engineering Knowledge: Apply the knowledge of Mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. 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.

PO4. Conduct investigations of complex problems: use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. 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.

PO7. 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.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

PO11. 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.

PO12. Lifelong 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.

PROGRAMME SPECIFIC OUTCOMES

PSO1. Ability to become a successful entrepreneur caring for the society with ethical approach.

PSO2. Ability to pursue higher education in the field of engineering and management.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH *
Chairman

Dean – Academics
Dean (Academics)
HiCET

CURRICULUM
R2022

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS
CBCS PATTERN
UNDERGRADUATE PROGRAMMES
B.E. MECHANICAL ENGINEERING REGULATION-2022
(For the students admitted during the academic year 2022-2023 and onwards)

Programme: Mechanical Engineering **Branch: Mechanical**

SEMESTER I											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22MA1101	Matrices and Calculus	BSC	3	1	0	4	4	40	60	100
THEORY WITH LAB COMPONENT											
2	22HE1151	English for Engineers	HSC	2	0	2	3	4	40	60	100
3	22PH1151	Physics for Non Circuit Engineering	BSC	2	0	2	3	4	50	50	100
4	22IT1151	Python Programming and practices	ESC	2	0	2	3	4	50	50	100
5	22ME1101	Engineering Drawing	ESC	1	4	0	3	5	50	50	100
EEC COURSES (SE/AE)											
6	22HE1071	Universal Human Values –II	AEC	2	0	0	2	2	40	60	100
7	22HE1072	Entrepreneurship & Innovation	AEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
8	22MC1091/ 22MC1092	தமிழரும்தொழில்நுட்பமும்/ Indian Constitution (Common to all branches)	MC	2	0	0	0	2	0	0	0
		TOTAL		**15**	**1**	**10**	**19**	**26**			

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

SEMESTER II											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22MA2101	Differential Equations and Complex Analysis.	BSC	3	1	0	4	4	40	60	100
2	22CY2101	Environmental Studies	ESC	2	0	0	2	2	40	60	100
3	22PH2101	Basics of Material Science	BSC	2	0	0	2	2	40	60	100
4	22ME2101	Engineering Mechanics	ESC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
4	22HE2151	Effective Technical Communication	HSC	2	0	2	3	4	50	50	100
5	22CY2152	Applied Chemistry	BSC	2	0	2	3	4	50	50	100
PRACTICAL											
6	22ME2001	Engineering Practices	ESC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
7	22HE2071	Design Thinking	AEC	1	0	2	2	3	100	0	100
8	22HE2072	Soft Skills -1	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
9	22MC2091/ 22MC2092	தமிழர்மரபு/ Heritage of Tamil	MC	2	0	0	0	2	0	0	0
10	22MC2093	NCC */NSS / YRC / Sports / Clubs / Society Service - Enrollment (Common)	MC	All students shall enroll, on admission, in anyone of the personality and character development programmes and undergo training for about 80 hours							
TOTAL				**18**	**1**	**10**	**22**	**29**			

Chairman - BoS
MECH - HiCET

Chairman
ACADEMIC COUNCIL
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

SEMESTER III											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22MA3105	Fourier Series and Transforms	BSC	3	1	0	4	4	40	60	100
2	22ME3201	Engineering Thermodynamics	PCC	3	0	0	3	3	40	60	100
3	22ME3202	Engineering Materials and Metallurgy	PCC	3	0	0	3	3	40	60	100
4	22XXXX	Electrical Drives and Control	PCC	3	0	0	3	3	40	60	100
5	22ME3204	Manufacturing Technology-I	PCC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22ME3251	Fluid Mechanics and Machinery	PCC	3	0	2	4	5	50	50	100
PRACTICAL											
7	22ME3001	Manufacturing Technology Laboratory-I	PCC	0	0	4	2	4	60	40	100
8	22ME3002	Computer Aided Modeling Lab	AEC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	22HE3071	Soft Skills -2	SEC	1	0	0	1	1	100	0	100
MANDATORY COURSES											
10	22MC3091	Essence of Indian Traditional Knowledge	MC	2	0	0	0	2	0	0	0
		TOTAL		**15**	**3**	**14**	**25**	**32**			

SEMESTER IV											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22HE4101	IPR and Start-ups	HSC	2	0	0	2	2	40	60	100
2	22ME4201	Kinematics of Machinery	PCC	3	0	0	3	3	40	60	100
3	22ME4202	Hydraulic and Pneumatic Systems	PCC	3	0	0	3	3	40	60	100
4	22ME4203	Manufacturing Technology – II	PCC	3	0	0	3	3	40	60	100
5	22ME4204	Thermal Engineering	PCC	3	1	0	3	4	40	60	100
THEORY WITH LAB COMPONENT											
6	22ME4251	Strength of Materials	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
7	22ME4001	Manufacturing Technology Laboratory-II	PCC	0	0	4	2	4	60	40	100
8	22ME4002	Thermal Engineering Lab	PCC	0	0	4	2	4	60	40	100
9	22ME4003	Mini Project	PCC	0	0	2	1	2	60	40	100
EEC COURSES (SE/AE)											
10	22HE4071	Soft Skills -3	SEC	1	0	0	1	1	100	0	100
		TOTAL		**16**	**1**	**12**	**23**	**29**			

Chairman - BoS
MECH - HiCET

Chairman
ACADEMIC COUNCIL
KARPAGAM COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

SEMESTER V											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22ME5201	Design of Machine Elements	PCC	3	1	0	3	4	40	60	100
2	22ME5202	Heat and Mass Transfer	PCC	3	0	0	2	3	40	60	100
3	22MT53XX	Professional Elective-1	PEC	3	0	0	3	3	40	60	100
4	22MT53XX	Professional Elective-2	PEC	3	0	0	3	3	40	60	100
5	22MT53XX	Professional Elective-3	PEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
7	22ME5251	Dynamics of Machines	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
8	22ME5001	Heat Transfer Lab	PCC	0	0	4	2	4	60	40	100
9	22ME5072	Machine Drawing	ESC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
10	22HE5071	Soft Skills -4/Foreign languages	SEC	1	0	0	1	1	100	0	100
		TOTAL		**18**	**1**	**6**	**22**	**25**			

SEMESTER VI											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22HE6101	Professional Ethics	HSC	3	0	0	3	3	40	60	100
2	22ME6201	Design of Transmission systems	PCC	3	0	0	2	3	40	60	100
3	22MT63XX	Professional Elective-4	PEC	3	0	0	3	3	40	60	100
4	22MT63XX	Professional Elective-5	PEC	3	0	0	3	3	40	60	100
5	22XX64XX	Open Elective – 1*	OEC	3	0	0	3	3	40	60	100
6	22XX64XX	Open Elective – 2*	OEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
7	22ME6251	Metrology and Quality control	PCC	2	0	2	3	4	50	50	100
PRACTICAL											
8	22ME6001	CAD/CAM Lab	PCC	0	0	4	2	4	60	40	100
EEC COURSES (SE/AE)											
9	**22HE6071**	Soft Skills - 5	SEC	2	0	0	2	2	100	0	100
		TOTAL		**20**	**0**	**8**	**24**	**28**			

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

SEMESTER VII											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
THEORY											
1	22ME7201	Engineering Economics and Finance Management	PCC	3	0	0	3	3	40	60	100
2	22ME7202	Artificial Intelligence for Mechanical Engineering	PCC	3	1	0	3	4	40	60	100
3	22MT73XX	Professional Elective-6	PEC	3	0	0	3	3	40	60	100
4	22XX74XX	Open Elective – 3*	OEC	3	0	0	3	3	40	60	100
5	22XX74XX	Open Elective – 4*	OEC	3	0	0	3	3	40	60	100
THEORY WITH LAB COMPONENT											
6	22ME7251	Finite Element Analysis	PCC	2	0	2	3	4	50	50	100
EEC COURSES (SE/AE)											
7	22ME7701	Internship	SEC	0	0	0	2	2	100	0	100
		TOTAL		**15**	**1**	**4**	**20**	**22**			
*** - Four weeks internship carries 2 credit and it will be done in before Semester VI summer vacation/placement training and same will be evaluated in Semester VII.**											

SEMESTER VIII											
S No	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**TCP**	**CIA**	**ESE**	**Total**
EEC COURSES (SE/AE)											
1	22ME8901	Project Work/Granted Patent	SEC	0	0	20	10	20	100	100	200
		TOTAL		**0**	**0**	**20**	**10**	**20**			

Note:

1. As per the AICTE guideline, in Semester I, II, III & IV NCC one credit subject is added as Value Added Course with Extra Credit. Further, the students' who enrolled his/her name in HICET NCC and Air Wing are eligible to undergo this subject. The earned extra credits printed in the Consolidated Mark sheet as per the regulation.
2. NCC course level 1 & Level 2 will be added in the list of open elective subjects in the appropriate semester. Further, the students' who have opted NCC subjects in Semester I, II, III & IV are eligible to undergo NCC Open Elective Subjects.
3. The above-mentioned NCC Courses will be offered to theStudents who are going to be admitted in the Academic Year 2022 – 23.

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

SEMESTER WISE CREDIT DISTRIBUTION

B.E. / B.TECH.PROGRAMMES										
S.No.	Course Area	CreditsperSemester								TotalCredits
		I	II	III	IV	V	VI	VII	VIII	
1	HSC	3	3	-	2	-	3	-	-	**11**
2	BSC	7	9	4	-	-	-	-	-	**20**
3	ESC	6	7	-	-	2	-	-	-	**15**
4	PCC	-	-	18	20	10	7	9	-	**64**
5	PEC	-	-	-	-	9	6	3	-	**18**
6	OEC	-	-	-	-	-	6	6	-	**12**
7	EEC	3	3	3	1	1	2	2	10	**25**
8	MC	✓	✓	-	-	-	-	-	-	-
Total		**19**	**22**	**25**	**23**	**22**	**24**	**20**	**10**	**165**

OPEN ELECTIVE I AND II
(EMERGINGTECHNOLOGIES)

To be offered for the students other than CSE, IT, AI&ML, ECE & BIOMEDICAL

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PERWEEK			TOTALCONTACTPERIODS	CREDITS
				L	T	P		
1	22AI6401	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2	22CS6401	Blockchain Technology	OEC	2	0	2	4	3
3	22EC6401	Cyber security	OEC	2	0	2	4	3
4	22EC6402	IoT Concepts and Applications	OEC	2	0	2	4	3
5	22IT6401	Data Science and Analytics	OEC	2	0	2	4	3
6	22BM6401	Augmented and Virtual Reality	OEC	2	0	2	4	3

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * KAMARAJ COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

OPEN ELECTIVE I AND II

To be offered for the students other than AUTO, AERO, AGRI, MECH, MCTS, CIVIL, EEE, CHEMICAL, FOOD TECH, E&I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22AE6401	Space Science	OEC	3	0	0	3	3
2	22MT6401	Introduction to Industrial Engineering	OEC	3	0	0	3	3
3	22MT6402	Industrial Safety and Environment	OEC	3	0	0	3	3
4	22CE6401	Climate Change and its Impact	OEC	3	0	0	3	3
5	22CE6402	Environment and Social Impact Assessment	OEC	3	0	0	3	3
6	22ME6401	Renewable Energy System	OEC	3	0	0	3	3
7	22ME6402	Additive Manufacturing systems	OEC	3	0	0	3	3
8	22EI6401	Introduction to Industrial Instrumentation and Control	OEC	3	0	0	3	3
9	22EI6402	Graphical Programming using Virtual Instrumentation	OEC	3	0	0	3	3
10	22AU6401	Fundamentals of Automobile Engineering	OEC	3	0	0	3	3
11	22AU6402	Automotive Vehicle Safety	OEC	3	0	0	3	3
12	22EE6401	Digital Marketing	OEC	3	0	0	3	3
13	22EE6402	Research Methodology	OEC	3	0	0	3	3
14	22FT6401	Traditional Foods	OEC	3	0	0	3	3
15	22AG6401	Urban Agriculture and Organic Farming	OEC	3	0	0	3	3
16	22CH6401	Biomass and Biorefinery	OEC	3	0	0	3	3

Note: Non-Circuit Departments can add one Open Elective course in the above list to offer for the circuit branches

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

OPEN ELECTIVE III

Students shall choose any one of the open elective courses such that the course content or title not belong to their own programme.

(Note: Each programme in our institution is expected to provide one course only)

SL. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22ME7402	Hybrid and Electric Vehicle Technology	OEC	3	0	0	3	3
2	22MT7401	Project Management (Must in the list)	OEC	3	0	0	3	3
3	22ME7401	Total Quality Management (Must in the list)	OEC	3	0	0	3	3

OPEN ELECTIVE IV

SL. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22LS7401	General studies for competitive examinations	OEC	3	0	0	3	3
2	22LS7402	Human Rights, Women Rights and Gender equity	OEC	3	0	0	3	3
3	22LS7403	Indian ethos and Human values	OEC	3	0	0	3	3
4	22LS7404	Financial independence and management	OEC	3	0	0	3	3
5	22LS7405	Yoga for Human Excellence	OEC	3	0	0	3	3
6	22LS7406	Democracy and Good Governance	OEC	3	0	0	3	3
7	22LS7407	NCC Level - II	OEC	3	0	0	3	3

Service Paper (Chemical Engineering)

SL. NO.	COURSE CODE	COURSETITLE	CATEGORY	PERIODS PERWEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	22ME3231	Basic Mechanical Engineering	PCC	3	0	0	3	3

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I General	Vertical II Modern Mobility Systems	Vertical III Product and Process Development	Vertical IV Robotics and Automation	Vertical V Digital and Green Manufacturing	Vertical VI Logistics and Supply Chain Management
22ME5301 Automobile Engineering	**22ME5304** Automotive Materials, Components, Design& Testing	**22ME5307** Value Engineering	**22ME5310** Sensors and Instrumentation	**22ME5313** Digital Manufacturing and IoT	**22ME5316** Automation in Manufacturing
22ME5302 Internet of Things for Mechanical Engineers	**22ME5305** Conventional and Futuristic Vehicle Technology	**22ME5308** Quality and Reliability Engineering	**22ME5311** Electrical Drives and Actuators	**22ME5314** Lean Manufacturing	**22ME5317** Warehousing Automation
22ME5303 Additive Manufacturing systems	**22ME5306** Renewable Powered Off Highway Vehicles and Emission Control Technology	**22ME5309** Production and Operations Management	**22ME5312** Embedded Systems and Programming	**22ME5315** Green Manufacturing Design and Practices	**22ME5318** Material Handling Equipment, Repair and Maintenance
22ME6301 Principles of Management	**22ME6303** Vehicle Health Monitoring, Maintenance and Safety	**22ME6305** Ergonomics in Design	**22ME6307** Robotics	**22ME6309** Environment Sustainability and Impact Assessment	**22ME6311** Container Logistics
22ME6302 CAD/CAM	**22ME6304** CAE and CFD Approach in Future Mobility	**22ME6306** New Product Development	**22ME6308** Smart Mobility and Intelligent Vehicles	**22ME6310** Energy Saving Machinery and Components	**22ME6312** Robotics in Logistics
22ME7301 Entrepreneurship Development and Business Concepts	**22ME7302** Thermal Management of Batteries and Fuel Cells	**22ME7303** Product Life Cycle Management	**22ME7304** Haptics and Immersive Technologies	**22ME7305** Green Supply Chain Management	**22ME7306** Data Science

Note:

Students are permitted to choose all professional electives from any of the verticals.

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Vertical I
General Core

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5301	Automobile Engineering	PEC	3	0	0	3	3
2	22ME5302	Internet of Things for Mechanical Engineers	PEC	3	0	0	3	3
3	22ME5303	Additive Manufacturing systems	PEC	3	0	0	3	3
4	22ME6301	Design of Transmission systems	PEC	3	0	0	3	3
5	22ME6302	CAD/CAM	PEC	3	0	0	3	3
6	22ME7301	Entrepreneurship Development and Business Concepts	PEC	3	0	0	3	3

Vertical II
Modern Mobility Systems

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5304	Automotive Materials, Components, Design & Testing	PEC	3	0	0	3	3
2	22ME5305	Conventional and Futuristic Vehicle Technology	PEC	3	0	0	3	3
3	22ME5306	Additive Manufacturing systems	PEC	3	0	0	3	3
4	22ME6303	Principles of Management	PEC	3	0	0	3	3
5	22ME6304	CAD/CAM	PEC	3	0	0	3	3
6	22ME7302	Entrepreneurship Development and Business Concepts	PEC	3	0	0	3	3

Vertical III
Product and Process Development

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5307	Value Engineering	PEC	3	0	0	3	3
2	22ME5308	Quality and Reliability Engineering	PEC	3	0	0	3	3
3	22ME5309	Production and Operations Management	PEC	3	0	0	3	3
4	22ME6305	Ergonomics in Design	PEC	3	0	0	3	3
5	22ME6306	New Product Development	PEC	3	0	0	3	3
6	22ME7303	Product Life Cycle Management	PEC	3	0	0	3	3

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

Vertical IV
Robotics and Automation

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5310	Sensors and Instrumentation	PEC	3	0	0	3	3
2	22ME5311	Electrical Drives and Actuators	PEC	3	0	0	3	3
3	22ME5312	Embedded Systems and Programming	PEC	3	0	0	3	3
4	22ME6307	Robotics	PEC	3	0	0	3	3
5	22ME6308	Smart Mobility and Intelligent Vehicles	PEC	3	0	0	3	3
6	22ME7304	Haptics and Immersive Technologies	PEC	3	0	0	3	3

Vertical V
Digital and Green Manufacturing

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5313	Digital Manufacturing and IoT	PEC	3	0	0	3	3
2	22ME5314	Lean Manufacturing	PEC	3	0	0	3	3
3	22ME5315	Green Manufacturing Design and Practices	PEC	3	0	0	3	3
4	22ME6309	Environment Sustainability and Impact Assessment	PEC	3	0	0	3	3
5	22ME6310	Energy Saving Machinery and Components	PEC	3	0	0	3	3
6	22ME7305	Green Supply Chain Management	PEC	3	0	0	3	3

Vertical VI
Logistics and Supply Chain Management

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5316	Automation in Manufacturing	PEC	3	0	0	3	3
2	22ME5317	Warehousing Automation	PEC	3	0	0	3	3
3	22ME5318	Material Handling Equipment, Repair and Maintenance	PEC	3	0	0	3	3
4	22ME6311	Container Logistics	PEC	3	0	0	3	3
5	22ME6312	Robotics in Logistics	PEC	3	0	0	3	3
6	22ME7306	Data Science	PEC	3	0	0	3	3

Chairman - BoS
MECH - HiCET

HMS INSTITUTE OF TECHNOLOGY ACADEMIC COUNCIL Chairman

Dean (Academics)
HiCET

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for theaward of B.E. / B. Tech. (Honors) or Minor Degree.For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester Vonwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10of Regulation 2022 is applicable for the Enrolmentof B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

MECHANICAL ENGINEERING OFFERING MINOR DEGREE PROGRAM IN ELECTRIC VEHICLES

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22ME5231	Sem 5: EV and Sub Systems.	MDC	3	0	0	3	3
2	22ME6231	Sem 6: E vehicle Dynamics	MDC	3	0	0	3	3
3	22ME6232	Sem6: Cell and battery management system	MDC	3	0	0	3	3
4	22ME7231	Sem 7: Electric Motor and control system	MDC	3	0	0	3	3
5	22ME7232	Sem 7: EV sensors and actuators	MDC	3	0	0	3	3
6	22ME8231	Sem 8: EV charging station	MDC	3	0	0	3	3

*MDC – Minor Degree Course

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I
Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5231	Financial Management	MDC	3	0	0	3	3
2	22MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	22MB6232	Banking, Financial Services andInsurance	MDC	3	0	0	3	3
4	22MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	22MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	22MB8231	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II
Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	22MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	22MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	22MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	22MB72334	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	22MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III
Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	22AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	22BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	22ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	22CE7233	Green Technology	MDC	3	0	0	3	3
6	22CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL Chairman KINGS COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

B E (HONS) MECHANICAL ENGINEERING
DIGITAL AND GREEN MANUFACTURING

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MEXXX1	Sem 5: Digital Manufacturing and IoT	MDC	3	0	0	3	3
2	22MEXXX2	Sem 6: Lean Manufacturing	MDC	3	0	0	3	3
3	22MEXXX3	Sem 6: Modern Robotics	MDC	3	0	0	3	3
4	22MEXXX4	Sem 7: Green Manufacturing Design and Practices	MDC	3	0	0	3	3
5	22MEXXX5	Sem 7: Environment Sustainability and Impact Assessment	MDC	3	0	0	3	3
6	22MEXXX6	Sem 8: Green Supply Chain Management	MDC	3	0	0	3	3

RENEWABLE ENERGY TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MEXXX1	Sem 5: Bioenergy Conversion Technologies	MDC	3	0	0	3	3
2	22MEXXX2	Sem 6: Energy Conservation in Industries	MDC	3	0	0	3	3
3	22MEXXX3	Sem 6: Energy Storage Devices	MDC	3	0	0	3	3
4	22MEXXX4	Sem 7: Solar Energy Technology	MDC	3	0	0	3	3
5	22MEXXX5	Sem 7: Renewable Energy Technologies	MDC	3	0	0	3	3
6	22MEXXX6	Sem 8: New and Renewable Sources of Energy	MDC	3	0	0	3	3

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

PRODUCT AND PROCESS DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	22MEXXX1	Sem 5: New Product Development	MDC	3	0	0	3	3
2	22MEXXX2	Sem 6: Ergonomics in Design	MDC	3	0	0	3	3
3	22MEXXX3	Sem 6: Advances in Composite Materials	MDC	3	0	0	3	3
4	22MEXXX4	Sem 7: Logistics and Supply Chain Management	MDC	3	0	0	3	3
5	22MEXXX5	Sem 7: EV Technologies	MDC	3	0	0	3	3
6	22MEXXX6	Sem 8: Heating, Ventilation and Air Conditioning Systems	MDC	3	0	0	3	3

Chairman, BoS

Chairman - BoS
MECH - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College of Engineering & Technology
COIMBATORE - 641 032

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	**22MA1101**	**MATRICES AND CALCULUS (Common to all Branches)**	3	1	0	4

Course Objective

1. Construct the characteristic polynomial of a matrix and use it to identify eigenvalues and Eigenvectors
2. To impart the knowledge of sequences and series.
3. Analyseanddiscussthemaximaandminimaofthefunctionsofseveralvariables.
4. Evaluate the multiple integrals and apply in solving problems.
5. Apply vector differential operator for vector function and theorems to solve engineering problems.

Unit	Description	Instructional Hours
I	**Matrices** Eigen values and Eigen vectors – Properties of Eigen values and Eigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
II	**Single Variate Calculus** Rolle's Theorem–Lagrange's Mean Value Theorem-Maxima and Minima–Taylor's and Maclaurin's Series.	12
III	**Functions of Several Variables** Partial derivatives-Total derivative, Jacobian, Maxima, minima and saddle points; Method of Lagrange multipliers.	12
IV	**Integral Calculus** Double integrals in Cartesian coordinates–Area enclosed by plane curves (excluding surface area)– Triple integrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid , Tetrahedron) using Cartesian co-ordinates.	12
V	**Vector Calculus** Gradient, divergence and curl; Green's theorem, Stoke's and Gauss divergence theorem (statement only) for cubes only.	12
	Total Instructional Hours	**60**

Course Outcome

CO1: Compute Eigen values and Eigen vectors of the given matrix and transform given quadratic form into canonical form.
CO2: Apply the concept of differentiation to identify the maximum and minimum values of curve.
CO3: Compute partial derivatives of function of several variables and write Taylor's series for functions with two variables.
CO4: Evaluate multiple integral and its applications in finding area, volume.
CO5: Apply the concept of vector calculus in two and three dimensional spaces.

TEXTBOOKS:

T1:G.B.ThomasandR.L.Finney,"CalculusandAnalyticalGeometry",9thEditionAddisonWesleyPublishingcompany,2016.
T2:ErwinKreyszig,"AdvancedEngineeringMathematics",JohnWiley&Sons,2019.
T3:K.P.UmaandS.Padma,"EngineeringMathematicsI(MatricesandCalculus) ",PearsonLtd,2022.

REFERENCEBOOKS:

R1-JerroldE.Marsden,AnthonyTromba,"VectorCalculus",W.H.Freeman,2003
R2-StraussM.J,G.L.BradleyandK.J.Smith,"Multivariablecalculus",PrenticeHall,2002.
R3-VeerarajanT,"EngineeringMathematics",McGrawHillEducation(India)PvtLtd,NewDelhi,2016.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/I	**22HE1151**	**ENGLISH FOR ENGINEERS- (Common to all Branches)**	2	0	2	3

Course Objective

1. To improve the communicative proficiency of learners
2. To help learners use language effectively in professional writing
3. To advance the skill of maintaining the suitable tone of communication.
4. To introduce the professional life skills.
5. To impart official communication etiquette.

Unit	Description	Instructional Hours
I	**Language Proficiency:** Types of Sentences, Functional Units, Framing question. **Writing:** process description, Writing Checklist. **Vocabulary –** words on environment. **Practical Component: Listening**- Watching short videos and answer the questions, **Speaking**- Self introduction, formal & semi-formal	7+2
II	**Language Proficiency**: Tenses, Adjectives and adverbs. **Writing:** Formal letters (letters conveying positive and negative news), Formal and informal email writing (using emoticons, abbreviations& acronyms), reading comprehension**. Vocabulary–** words on entertainment. **Practical Component: Listening**-Comprehensions based on TED talks **Speaking-** Narrating a short story or an event happened in their life	7+2
III	**Language Proficiency:** Prepositions, phrasal verbs. **Writing:** Formal thanks giving, Congratulating, warning and apologizing letters, cloze test. **Vocabulary –** words on tools.**PracticalComponent:Listening**-Listentosongsandanswerthequestions**Speaking**-Justaminute	5+4
IV	**Language Proficiency:** Subject verb concord, Prefixes & suffixes. **Writing:** Preparing agenda &minutes, writing an event report. **Vocabulary–** words on engineering process. **Practical Component: Listening**- Comprehensions based on Talk of orators or interview shows **Speaking-**Presentation on a general topic with ppt.	5+4
V	**Language Proficiency:** Modal Auxiliaries, Active & passive voice, **Writing:** Project report (proposal & progress), sequencing of sentences **Vocabulary –**words on engineering material **Practical Component: Listening**- Listening- Comprehensions based on Nat Geo/Discovery channel videos **Speaking-** Preparing posters and presenting as a team.	6+3
	Total Instructional Hours	**45**

Course Outcome

CO1:To communicate in a professional forum
CO2:To speak or write a content in the proficient language
CO3:To maintain and use appropriate tone of the communication.
CO4:To read, write and present in a professional way.
CO5:To follow the etiquettes informal communication.

TEXTBOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press,2016.T2-Raymond Murphy, "Essential English Grammar", Cambridge UniversityPress,2019.

REFERENCEBOOKS:

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.
R2-RaymondMurphy, "EnglishGrammarinUse"-4theditionCambridgeUniversityPress,2004.
R3-KamaleshSadanan"AFoundationCoursefortheSpeakersofTamil-Part-I&II",OrientBlackswan,2010.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
BE/B.Tech	**22PH1151**	**PHYSICS FOR NON- CIRCUIT EGINEERING (Common to Non Circuit branches)**	2	0	2	3

Course Objective

The student should be able to

1.Gain knowledge about laser, their applications and Conversant with principles of optical fiber, types and applications of optical fiber
2. Enhance the fundamental knowledge in properties of matter
3. Extend the knowledge about wave optics
4. Gain knowledge about magnetic materials.
5.Acquire fundamental knowledge of nano materials which is related to the engineering program

Unit	Description	Instructional Hours
I	**LASER AND FIBRE OPTICS** Spontaneous emission and stimulated emission –Type of lasers – Nd:YAG laser - Laser Applications – Holography – Construction and reconstruction of images. Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index and modes) – Fiber optical communication link. **Determination of Wavelength and particle size using Laser**	6 3
II	**PROPERTIES OF MATTER** Elasticity – Hooke's law –Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment. Twisting couple - torsion pendulum: theory and experiment **Determination of Young's modulus by uniform bending method** **Determination of Rigidity modulus – Torsion pendulum**	6 3 3
III	**WAVE OPTICS** Interference of light – air wedge –Thickness of thin paper - Diffraction of light – Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating. **Determination of wavelength of mercury spectrum – spectrometer grating** **Determination of thickness of a thin wire – Air wedge method**	6 3 3
IV	**QUANTUM PHYSICS** Black body radiation –Compton effect: theory and experimental verification – wave particle duality –concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box .	6
V	**THERMAL PHYSICS** Transfer of heat energy –thermal conduction, convection and radiation – thermal conductivity - Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – applications: solar water heaters.	6
	Total Instructional Hours	**45**

Course Outcome

After completion of the course the learner will be able to

CO1: Understand the advanced technology of LASER and optical communication in the field of Engineering
CO2: Illustrate the fundamental properties of matter
CO3: Discuss the Oscillatory motions of particles
CO4: Understand the advanced technology of magnetic materials in the field of Engineering
CO5: Develop the technology of smart materials and Nano materials in engineering field

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi2016
R2 -Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2021

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ sem	Course Code	Name of the Course	L	T	P	C
B.E/ I	22IT1151	PYTHON PROGRAMMING ANDPRACTICES	2	0	2	3

Course Objective

The learner should be able to

1. To know the basics of algorithmic problem solving
2. To read and write simple Python programs
3. To develop Python programs with conditionals and loops and to define Python functions and call them
4. To use Python data structures –- lists, tuples, dictionaries
5. To do input/output with files in Python

Unit	Description	Instructional Hours
I	**ALGORITHMIC PROBLEM SOLVING**	
	Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). **Illustrative problems: To find the Greatest Common Divisor (GCD)oftwo numbers, Fahrenheit to Celsius, Perform Matrix addition.**	5 4
II	**DATA, STATEMENTS,CONTROL FLOW**	
	Data Types, Operators and precedence of operators, expressions, statements, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if –elif-else); Iteration: state, while, for, break, continue, pass; **Simple algorithms and programs: Area of the circle, check the given year is Leap year or not, Factorial of a Number.**	5 4
III	**FUNCTIONS, STRINGS**	
	Functions, parameters and arguments; Fruitful functions: return values, local and global scope, function composition, recursive functions. Strings: string slices, immutability, string functions and methods, string module. **Illustrative programs: Perform Linear Search, Selection sort, Sum of all elements in a List, Pattern Programs**	5 4
IV	**LISTS, TUPLES, DICTIONARIES**	5
	Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension. **Illustrative programs: List Manipulation, Finding Maximum in a List, String processing.**	4
V	**FILES, MODULES, PACKAGES**	
	Files and exception: text files, reading and writing files, errors and exceptions, handling exceptions, modules, packages **Illustrative programs: Reading writing in a file, word count, Handling Exceptions**	9
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, the learner will be able to

CO1: Develop algorithmic solutions to simple computational problems

CO2: Read, write, execute by hand simple Python programs

CO3: Structure simple Python programs for solving problems and Decompose a Pythonprogram into functions

CO4: Represent compound data using Python lists, tuples, dictionaries

CO5: Read and write data from/to files in Python Programs.

TEXT BOOKS:

T1: Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.6.2, Shroff Publishers, First edition (2017).

T2:S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019

REFERENCE BOOKS:

R1:CharlesDierbach, ―Introduction to Computer Science using Python: A Computational Problem- Solving Focus, Wiley India Edition, 2013.

R2:Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E/ I	**22ME1201**	**ENGINEERING DRAWING**	**1**	**0**	**4**	**3**

Course Objective

The learner should be able to

1. To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
2. To learn about the orthogonal projections of straight lines and planes.
3. To acquire the knowledge of projections of simple solid objects in plan and elevation.
4. To learn about the projection of sections of solids and development of surfaces.
5. To study the isometric projections of different objects.

Unit	Description	Instructional Hours
I	**PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales.Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabolaand hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
II	**PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclinedto both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	**PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined toone of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions.Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
	Total Instructional Hours	**60**

Course Outcome

At the end of the course, the learner will be able to

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.

CO2: Draw the orthogonal projections of straight lines and planes.

CO3: Interpret the projections of simple solid objects in plan and elevation.

CO4: Draw the projections of section of solids and development of surfaces of solids.

CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOK:

T1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5thedition New Age International Publishers, New delhi 2016.

T2. K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

REFERENCES:

R1. Basant Agrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited,New Delhi 2013.

R2. N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ II	**22HE1071**	**UNIVERSAL HUMAN VALUES –II** (COMMON TO ALL BRANCHES)	2	0	0	2

Course Objective

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. TofacilitatethedevelopmentofaHolisticperspectiveamongstudentstowardslifeandprofession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. TohighlightplausibleimplicationsofsuchaHolisticunderstandingintermsofethicalhumanconduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Unit	Description	Instructional Hours
I	**Introduction to Value Education** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)-Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations	6
II	**Harmony in the Human Being and Harmony in the Family** Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body - The Body as an Instrument of the Self - Understanding Harmony in the Self- Harmony of the Self with the Body - Programme to ensure self-regulation and Health	6
III	**Harmony in the Family and Society** Harmony in the Family – the Basic Unit of Human Interaction. Values in Human to Human Relationship 'Trust' – the Foundational Value in Relationship Values in Human to Human Relationship 'Respect' – as the Right Evaluation Understanding Harmony in the Society	6
IV	**Harmony in the Nature / Existence** Understanding Harmony in the Nature. Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature- Understanding Existence as Co-existence of mutually interacting units in all pervasive space Realizing Existence as Co-existence at All Levels The Holistic Perception of Harmony in Existence. Vision for the Universal Human Order	6
V	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values Definitiveness of (Ethical) Human Conduct A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies Strategies for Transition towards Value-based Life and Profession	6
	Total Instructional Hours	**30**

Course Outcome

CO1: To become more aware of holistic vision of life - themselves and their surroundings.
CO2: To become more responsible in life, in the Society and in handling problems with sustainable Solutions.
CO3: To sensitive towards their commitment towards what they understood towards environment and Socially responsible behavior.
CO4: To able to apply what have learnt to their own self in different day-to-day settings in real life and In handling problems with sustainable solutions.
CO5: To develop competence and capabilities for maintaining Health and Hygiene.

Reference Books:

R1.*A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
R2.Teachers'Manualfor*AFoundationCourseinHumanValuesandProfessionalEthics*,RRGaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-53-2
R3.JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak,1999.
R4.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi,2004.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme /sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/II	**22HE1072**	**ENTREPRENEURSHIP & INNOVATION**	1	0	0	1

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
5: To make students understand organizational performance and its importance.

Module	Description
1	**Entrepreneurial Thinking**
2	**Innovation Management**
3	**Design Thinking**
4	**Opportunity Spotting/Opportunity Evaluation**
5	**Industry and Market Research**
6	**Innovation Strategy and Business Models**
7	**Financial Forecasting**
8	**Business Plans/Business Model Canvas**
9	**Entrepreneurial Finance**
10	**Pitching to Resources Providers/Pitch Deck**
11	**Negotiating Deals**
12	**New Venture Creation**
13	**Lean Start-ups**
14	**Entrepreneurial Ecosystem**
15	**Velocity Venture**

Course Outcome

CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
CO3: Remember effectivelyandefficientlythepotentialofnewbusinessopportunities.
CO4: Assess the market potential l for a new venture, including customer need, competitors, and industry attractiveness..
CO5: Develop a business model for a new venture , including revenue. Margins ,operations, Working capital ,and investment

TEXTBOOKS

T1**:**AryaKumar"Entrepreneurship–CreatingandleadinganEntrepreneurialOrganization",Pearson,SecondEdition(2012).
T2:EmrahYayici"DesignThinkingMethodology", Artbiztech,FirstEdition(2016).

REFERENCEBOOKS

R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).R2:ThomasLockWood&EdgerPapke"InnovationbyDesign",CareerPress.com,SecondEdition(2017).R3:Jonathan Wilson "EssentialsofBusinessResearch", SagePublication, FirstEdition(2010).

WEBRESOURCES

W1:https://blof.forgeforward.in/tagged/startup-lessons
W2:https://blof.forgeforward.in/tagged/entrepreurship
W3:https://blof.forgeforward.in/tagged/minimum-viable-product
W4:https://blof.forgeforward.in/tagged/minimum-viable-product
W5:https://blof.forgeforward.in/tagged/innovation

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	CourseCode	Name of the Course	L	T	P	C
B.E./B.Tech/III.	**22MC1091**	**INDIAN CONSTITUTION**	2	0	0	0

CourseObjective

1. Sensitizationofstudenttowardsself,family(relationship),societyand nature
2. Understanding(ordevelopingclarity)ofnature,societyandlargersystems,onthebasisofhumanrelationshipsandresolvedindividuals
3. Strengthening of self-reflection
4. Development of commitment and courage to act

Unit	Description	Instructional Hours
	BASICFEATURESANDFUNDAMENTALPRINCIPLES	
I	Meaningoftheconstitutionlawandconstitutionalism– Historicalperspectiveoftheconstitutionof India– salient features and characteristics of the constitution of India.	**6**
	FUNDAMENTALRIGHTS	
II	Schemeofthefundamentalrights–fundamentaldutiesanditslegislativestatus– Thedirectiveprinciplesofstatepolicy–itsimportanceandimplementation- Federalstructureanddistribution Of legislative and financial powers between the union and states.	**6**
III	**PARLIAMENTARYFORMOFGOVERNMENT**	
	Theconstitutionpowersandthestatusofthepresidentin India.–Amendmentoftheconstitutional Powersandprocedures–Thehistoricalperspectiveoftheconstitutionalamendmentof India– Emergencyprovisions: National emergency, President rule, Financial emergency.	**6**
	LOCALGOVERNANCE	
IV	Localself-government-RuralLocalGovernment-PanchayathRaj,ElectionsofPanchayat- StateElectionCommission-UrbanLocalGovernment-AmendmentAct,UrbanLocalGovernment Structures in India -	**6**
	INDIANSOCIETY	
V	ConstitutionalRemediesforcitizens–PoliticalPartiesandPressureGroups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.	**6**
	Total Instructional Hours	**30**

Course Outcome

Upon completion of the course, students will be able to
CO1: Understand the functions of the Indian government.
CO2:Understandand abide the rules of the Indian constitution

TEXTBOOKS:

T1-DurgaDasBasu,"IntroductiontotheConstitutionofIndia",PrenticeHallofIndia,NewDelhi,1997.T2-AgarwalRC.,"IndianPoliticalSystem", S.Chand and Company, NewDelhi,1997.
T3-MaciverandPage,"Society:AnIntroductionAnalysis",MacMilanIndiaLtd.,NewDelhi.
T4-SharmaKL., "Social Stratification in India: Issues and Themes", Jawaharlal NehruUniversity, NewDelhi,1997.

REFERENCEBOOKS:

R1-Sharma, Brij Kishore,"IntroductiontotheConstitutionofIndia:,PrenticeHallofIndia,NewDelhi.R2-GahaiUR.,"IndianPoliticalSystem",NewAcademicPublishingHouse, Jalaendhar.
R3-Sharma RN.,"Indian Social Problems",Media Promoters an dPublishers Pvt.Ltd.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E/ II	22MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS (AERO, AGRI, AUTO, MECH,MECT)	3	1	0	4

Course Objective

The learner should be able to

1. Describe some methods to solve different types of first order differential equations.
2. Understand the various approach to find general solution of the ordinary differential equations
3. Evaluate the various types of Partial differential equations and methods to find solution.
4. Introduction to analytic functions and its properties.
5. Understand Cauchy's theorem and its applications in evaluation of integral.

Unit	Description	Instructional Hours
I	**ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER** Basic concepts, separable differential equations, exact differential equations, integrating factors, linear differential equations, Bernoulli equation.	12
II	**LINEAR DIFFERENTIAL EQUATIONS OF SECOND ORDER** Second order linear differential equations with constant with RHS of the form e^{ax} , x^n , sinax, cosax- – Cauchy's linear equations– Method of variation of parameters.	12
III	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by eliminating arbitrary constants and functions – Solution of first order partial differential equations of the form f(p,q)=0, Clairaut's equation – Lagrange's equation.	12
IV	**COMPLEX DIFFERENTIATION (9)** Functions of complex variables – Analytic functions – Cauchy's – Riemann equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping w = A+z , Az, 1/z and bilinear transformations.	12
V	**COMPLEX INTEGRATION (9)** Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) –Residues - Cauchy's Residue theorem - Contour Integration with unit circle only.	12
	Total Instructional Hours	**60**

Course Outcome

At the end of the course, the learner will be able to

CO1: Apply few methods to solve different types of first order differential equations.
CO2: Evaluate the solutions of higher order ordinary differential equations and its properties.
CO3: Compute the solution of first order partial differential equations.
CO4: Understand the concept of analytic functions and discuss its properties.
CO5: Evaluate various integrals by using Cauchy's residue theorem and classify singularities and derive Laurent series expansion

TEXT BOOKS:

T1 – Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2019.
T2 - William E. Boyce, Richard C. DiPrima, Douglas B. Meade, Elementary Differential Equations and Boundary Value Problems, Wiley, 2017.
T3 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS:

R1 - James Ward Brown, Ruel Vance Churchill, Complex Variables and Applications, McGraw-Hill Higher Education, 2004
R2 - Dennis Zill, Warren S. Wright, Michael R. Cullen, Advanced Engineering Mathematics, Jones &

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E/ II	22CY2101	ENVIRONMENTAL STUDIES (common to all branches except CSE,IT & AIML)	3	0	0	2

Course Objective

The learner should be able to

1. Grasp the importance and issues related to ecosystem and biodiversity and their protection.
2. Acquire knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. Identify the various natural resources, exploitation and its conservation
4. Gain knowledge on the scientific, technological, economic and political solutions to environmental problems.
5. Become aware on the national and international concern for environment and its protection

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	9
II	**NATURAL RESOURCES** Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	9
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution.	9
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones.	9
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health.	9
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, the learner will be able to

CO1: Discuss the importance of ecosystem and biodiversity for maintaining ecological balance.
CO2: Identify the causes of environmental pollution and hazards due to manmade activities.
CO3: Develop an understanding of different natural resources including renewable resources.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Describe about the importance of women and child education, existing technology to protect environment.

TEXT BOOKS:

T1 – S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020
T2 - Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCE BOOKS:

R1 - Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015
R2 - G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
R3 – Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.Tech II	22PH2101	**BASICS OF MATERIAL SCIENCE (Common to all branches except MCT)**	2	0	0	2

Course Objective

The student should be able to

1.Gain knowledge about Crystal systems and crystal structures
2. Understand the knowledge about electrical properties of materials
3. Enhance the fundamental knowledge in semiconducting materials.
4. Gain knowledge about magnetic materials
5. Acquire fundamental knowledge new engineering materials which is related to the engineering program

Unit	Description	Instructional Hours
I	**CRYSTAL PHYSICS** Crystal systems - Bravais lattice - Lattice planes - Miller indices – Inter planar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
II	**ELECTRICAL PROPERTIES OF MATERIALS** Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression – Widemann - Franz law – Success and failures -– Fermi-Dirac statistics – Density of energy states .	6
III	**SEMICONDUCTING MATERIALS** Introduction – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Intrinsic semiconductor — electrical conductivity – band gap determination. - Extrinsic semiconductor – n type and p type semiconductor –Light Emitting Diode.	6
IV	**MAGNETIC MATERIALS** Origin of magnetic moment – Bohr magnetron – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.	6
V	**NEW ENGINEERING MATERIALS** Metallic glasses: melt spinning process, Preparation and applications - shape memory alloys: phases, shape memory effect - Characteristics of SMA : Pseudoelastic effect, Super elasticity and Hystersis. Applications of SMA. Nanomaterials preparation (bottom up and top down approaches) – various techniques - pulsed laser deposition - Chemical vapor deposition	6
	Total Instructional Hours	30

Course Outcome

After completion of the course the learner will be able to

CO1: Understand the Crystal systems and crystal structures in the field of Engineering
CO2: Illustrate the fundamental of electrical properties of materials
CO3: Discuss concept of acceptor or donor levels and the band gap of a semiconducting materials
CO4: Develop the technology of the magnetic materials and its applications in engineering field
CO5: Understand the advanced technology of new engineering materials in the field of Engineering

TEXT BOOKS:

T1 - Rajendran V, "Materials Science", Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2022

REFERENCE BOOKS:

R1 – Charles Kittel "Introduction to Solid State Physics". Wiley., New Delhi 2017
R2 - Dr. M.Arumugam "Materials Science " Anuradha publications., 2019

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E. / II	22ME2101	ENGINEERING MECHANICS (AERO, AUTO,CIVIL,MECH)	3	0	0	3

Course Objective

The student should be able

1. To understand basic concepts and force systems in a real world environment.
2. To understand the static equilibrium of particles and rigid bodies both in two dimensions.
3. To understand the moment of surfaces and solids.
4. To understand the effect of static friction on equilibrium.
5. To understand the dynamic equilibrium equation.

Unit	Description	Instructional Hours
I	**STATICS OF PARTICLES** Introduction to engineering mechanics - Classifications, force vector, Law of mechanics, System of forces, transmissibility, Force on a particle – resultant of two forces and several concurrent forces – resolution of a force – equilibrium of a particle — forces in space – equilibrium of a particle in space..	9
II	**EQUILIBRIUM OF RIGID BODIES** Free body diagram, moment of a force – varignon's theorem – moment of a couple – resolution of a force and a couple. Support reactions of the beam.	9
III	**CENTROID, CENTRE OF GRAVITY AND MOMENT OF INERTIA** Centroids of simple plane areas, composite areas, determination of moment of inertia of composite plane figures, polar moment of inertia-radius of gyration – mass moment of inertia of simple solids.	9
IV	**FRICTION** Laws of dry friction – angles of friction- angle of repose-coefficient of static and kinetic friction — Friction in inclined plane, Ladder friction, Screw friction– rolling resistance – belt friction.	9
V	**DYNAMICS OF PARTICLES** Rectilinear and Curvilinear motion, -Newton's II law – D'Alembert's principle- Energy - potential energy kinetic energy-conservation of energy-work done by a force - work energy method, Impulse momentum method, Impact of bodies, Translation and rotation of the particles.	9
	TOTAL INSTRUCTIONAL HOURS	**45**

Course Outcome

At the end of the course, the learner will be able to

CO1: Define and illustrate the basic concepts of force system.
CO2: Identify the resultant force and couple, support reactions of the beam.
CO3: Calculate the Centre of gravity and moment of inertia of an object.
CO4: Examine the friction force of particles and objects for Impending Motion.
CO5: Determine the Displacement, velocity and acceleration of particles and objects

TEXT BOOKS:

T1. F.P.Beer, and Jr. E.R.Johnston., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 11th Edition, Tata McGraw-Hill Publishing company, New Delhi (2018).
T2. NH.Dubey, "Engineering Mechanics", Tata Mcraw Hill, New Delhi, 2016.

REFERENCE BOOKS:

1. R.C.Hibbeller, and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. S.S.Bhavikatti, and K.G.Rajashekarappa, "Engineering Mechanics", New Age International (P) Limited Publishers, 2015.
3. P. JagetBabu, "Engineering Mechanics", Pearson Education, India Ltd, 2016.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

B.E./B.Tech/ II	22HE2151	EFFECTIVE TECHNICAL COMMUNICATION (Common to all Branches)	2	0	2	3

Course Objective

The learner should be able

1. To improve essential business communication skills.
2. To enrich employability knowledge.
3. To acquire the crucial organizing ability in official forum.
4. To impart important business writings.
5. To make effective presentation with essential etiquette.

Unit	Description	Instructional Hours
I	Language Proficiency: Types of sentences in English according to structure Writing: writing definitions, Describing product, work place and service (purpose, appearance, function) Vocabulary – words on nature **Practical Component: Listening- Watching and interpreting advertisements/short films Speaking- Extempore speech**	9
II	Language Proficiency: Direct and Indirect speech. Writing: Formal memos, Job application and resume preparation Vocabulary - words on offense and ethics**Practical Component: Listening- Comprehensions based on telephonic conversation Speaking- Vote of thanks& welcome address**	9
III	Language Proficiency: Homophones and Homonyms, Writing: Preparing a detail plan for an official visit, schedule and Itinerary, reading comprehension, Vocabulary– words on society **Practical Component: Listening- Listening- paraphrasing the listened content Speaking- Group Discussion with preparation**	9
IV	Language Proficiency: Idioms Writing: Report writing (marketing, investigating) Vocabulary-words involved in business **Practical Component: Listening- Watching technical discussions and preparing MoM Speaking- On the spot Group Discussion**	9
V	Language Proficiency: spotting errors Writing: making /interpreting chart, sequencing of sentences Vocabulary- words involved in finance **Practical Component: Listening- Comprehensions based on announcements Speaking- Presentation on a technical topic with ppt.**	9
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, learners will be able

CO1: To the business procedure and promotion skills.
CO2: To make oral and written presentation in corporate forum.
CO3: To schedule official events and participate in official discussions without reluctance.
CO4: To take an effective role and manage in an organizational sector.
CO5:To prepare and demonstrate a professional presentation

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.
T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 -Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.
R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3-Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ sem	Course Code	Name of the Course	L	T	P	C
B.E/ II	22CY2152	APPLIED CHEMISTRY (MECH,AERO,CIVIL,AUTO,MCT)	2	0	2	3

Course Objective

The learner should be able to

1. Acquire knowledge on the concepts of chemistry involved in day today life.
2. Identify the water related problems and water treatment techniques.
3. Enhance the fundamental knowledge on electro chemistry and the mechanism of corrosion and its control.
4. Acquire knowledge on various thermo dynamical laws and its importance in engineering applications.
5. Acquire knowledge on the types of fuels, calorific value calculations, and manufacture of various types of fuels.

Unit	Description	Instructional Hours
I	**CHEMISTRY IN EVERYDAY LIFE** Chemicals in food – Food colors – Artificial sweeteners – Food preservatives. Soaps and Detergents – Soaps – Types of Soap – Detergents – Types of detergents. Drugs – Classification of drugs - Therapeutic Action of Different Classes of Drugs. Chemicals in Cosmetics – Creams – Talcum powders- Deodorants – Perfumes. Plastics – Thermoplastics- Preparation, properties and uses of PVC, Teflon and Thermosetting plastics - Preparation, properties and uses of Polyester and Polyurethane.	6
II	**WATER TECHNOLOGY** Impurities in Water, Hardness of Water, Boiler feed Water – Boiler troubles -Sludge and scale formation, Caustic embrittlement, priming and foaming, boiler corrosion- -Softening Methods (Zeolite & Ion-Exchange Methods)- Desalination of Brackish Water - Reverse Osmosis, Potable water and treatment. **Estimation of total, permanent and temporary hardness of water by EDTA Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method.**	6
III	**ELECTROCHEMISTRY AND CORROSION** Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electro chemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Estimation of Ferrous iron by Potentiometry.**	6
IV	**CHEMICAL THERMODYNAMICS** Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs Helmholtz equation- Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore..	6
V	**FUELS AND COMBUSTION** Fuels : Classification of fuels - coal varieties - analysis of coal (proximate and ultimate analysis) - coke manufacture (Otto-Hoffman byproduct coke oven method) - characteristics of metallurgical coke - cracking (thermal and catalytic cracking definition only) – manufacturing of synthetic petrol (Fischer Tropsch method, Bergius process) – knocking (octane number, cetane number) - gaseous fuels (production, composition and uses of producer gas and water gas).Combustion : gross and net calorific value - explosive range - spontaneous ignition temperature - flue gas analysis (Orsat apparatus).	6
	Total Instructional Hours	**30**
	Total Lab Instructional Hours	**30**

Course Outcome

At the end of the course, the learner will be able to

CO1: List out the chemicals used in food, soaps and detergents, drugs, cosmetics and plastics

CO2: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life

CO3:Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design

CO4: Develop sound knowledge on second law of thermodynamics and second law based derivations and its importance in engineering applications in all disciplines.

CO5: Classify the various types of fuel and their analysis and other techniques.

TEXT BOOKS

T1 - P. C. Jain & Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

T2 - O .G. Palanna, "Engineering chemistry" McGraw Hill Education India (2017).

REFERENCES

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech	**22ME2001**	**Engineering Practices (Common to all branches)**	**0**	**0**	**4**	**2**

Course Objective: To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

Unit **Description of the Experiments**

GROUP A (CIVIL AND MECHANICAL)

1. Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2. Arrangement of bricks using English Bond for one brick thick wall for right angle corner junction and T- junction
3. Arrangement of bricks using English Bond for one and a half brick thick wall for right angle corner and T- junction
4. Preparation of arc welding of Butt joints, Lap joints and Tee joints.
5. Practice on sheet metal Models– Trays and funnels
6. Hands-on-exercise in wood work, joints by sawing, planning and cutting.
7. Practice on simple step turning, taper turning and drilling.
8. Demonstration on Smithy operation.
9. Demonstration on Foundry operation.
10. Demonstration on Power tools.

GROUP B (ELECTRICAL ENGINEERING)

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring.
4. Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5. Measurement of energy using single phase energy meter.
6. Soldering practice using general purpose PCB.
7. Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8. Study of Energy Efficient Equipment's and Measuring Instruments.

Total Instructional Hours 45

Course Outcome

- Fabricate wooden components and pipe connections including plumbing works.
- Fabricate simple weld joints.
- Fabricate different electrical wiring circuits and understand the AC Circuits.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TECH II	22HE2071	DESIGN THINKING	2	0	0	2

The student should be able to

Course Objective

1. To expose students to the design process
2. To develop and test innovative ideas through a rapid iteration cycle.
3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
I	**DESIGN ABILITY** Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	6
II	**DESIGNING TO WIN** Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	5
III	**DESIGN TO PLEASE AND DESIGNING TOGETHER** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	6
IV	**DESIGN EXPERTISE** Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	6
V	**DESIGN THINKING TOOLS AND METHODS** Purposeful Use of Tools and Alignment with Process - Journey Mapping - Value Chain Analysis - Mind Mapping – Brainstorming - Design Thinking Application: Design Thinking Applied to Product Development	7
	Total Instructional Hours	**30**

Course Outcome

After completion of the course the learner will be able to

CO1: Develop a strong understanding of the Design Process
CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.
CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, “Design Thinking”, Kindle Edition.

REFERENCE BOOKS:

R1 - Tom Kelley, “Creative Confidence”, 2013.
R2 - 3. Tim Brown, “Change by Design”, 2009.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
BE/B.TECH II	22HE2072	SOFT SKILLS AND APPTITUDE I	0	0	0	1

The student should be able to

Course Objective

1. To develop and nurture the soft skills of the students through instruction, knowledge acquisition, demonstration and practice.
2. To enhance the students ability to deal with numerical and quantitative skills.
3. To identify the core skills associated with critical thinking.
4. To develop and integrate the use of English language skills

Unit	Description	Instructional Hours
I	**Lessons on excellence** Skill introspection, Skill acquisition, consistent practice	2
II	**Logical Reasoning** Problem Solving - Critical Thinking- Lateral Thinking - Coding and Decoding – Series – Analogy - Odd Man Out - Visual Reasoning - Sudoku puzzles - Attention to detail	11
III	**Quantitative Aptitude** Addition and Subtraction of bigger numbers - Square and square roots - Cubes and cube roots - Vedic maths techniques - Multiplication Shortcuts - Multiplication of 3 and higher digit numbers – Simplifications - Comparing fractions - Shortcuts to find HCF and LCM - Divisibility tests shortcuts - Algebra and functions	11
IV	**Recruitment Essentials** Resume Building - Impression Management	4
V	**Verbal Ability** Nouns and Pronouns – Verbs - Subject-Verb Agreement - Pronoun-Antecedent – Agreement - Punctuations	4
	Total Instructional Hours	**30**

Course Outcome

After completion of the course the learner will be able to

CO1: Students will analyze interpersonal communication skills. public speaking skills.
CO2: Students will exemplify tautology, contradiction and contingency by logical thinking.
CO3: Students will be able to develop an appropriate integral form to solve all sorts of quantitative problems.
CO4:Students can produce a resume that describes their education, skills, experiences and measurable achievements with proper grammar, format and brevity
CO5: Students will be developed to acquire the ability to use English language with an error while making optimum use of grammar

REFERENCE BOOKS:

R1 - Quantitative Aptitude – Dr. R S Agarwal
R2 -Speed Mathematics: Secret Skills for Quick Calculation - Bill Handley
R3 -Verbal and Non – Verbal Reasoning – Dr. R S Agarwal
R4- Objective General English – S.P.Bakshi

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

GE3152	தமிழர் மரபு	L T P C 1 0 0 1

அலகு I **மொழி மற்றும் இலக்கியம்:** 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II **மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை:** 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:** 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV **தமிழர்களின் திணைக் கோட்பாடுகள்:** 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:** 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme/ Sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	**22MC2092**	**HERITAGE OF TAMIL**	**2**	**0**	**0**	**0**

The learner should be able to

Course Objective

1. Introduce students to the great History of Tamil literature.
2. Establish the heritage of various forms of Rock art and Sculpture art.
3. To study and understand the various folk and Martial arts of Tamil culture
4. Introduce students to Ancient Tamil concepts to understand the richness of Tamil literature.
5. To learn about the various influences or impacts of Tamil language in Indian culture.

Unit	Description	Instructional Hours
I	**Language and Literature** Language families in India – Dravidian Languages – Tamil as a classical language – Classical Literature in Tamil- Secular nature of Sangam Literature – Distributive justice in Sangam Literature – Management principles in Thirukural – Tamil epics and impacts of Buddhism & Jainism in Tamil and Bakthi literature of Azhwars and Nayanmars – Forms of minor poetry _ Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidasan.	6
II	**Heritage _ Rock Art Paintings to Modern Art – Sculpture** Hero Stone to Modern Sculpture – Bronze icons – Tribes and their handcrafts - Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar statue at Kanyakumari, Making of musical instruments – Mridangam, Parai, Yazh and Nadhaswaram - Role of Temples in social and economic life of Tamils.	6
III	**Folk and Martial Arts** Therukoothu, Karagattem, Villupattu, Kaniyan koothu, Oyilattam, Leather puppertry, Silambattam., Valari Tiger dance – Sports and Games of Tamils.	6
IV	**Thinai Concept of Tamils** Flora and Fauna of Tamils – Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram concept of Tamils – Education and Literacy during Sangam Age - Ancient cities and ports of Sangam age – Exporot and Import during Sangam age – Overseas conquest of Cholas.	6
V	**Contribution of Tamils to Indian National Movement and Indian Culture** Contribution of Tamils to Indian freedom struggle – The cultural influence of Tamils over the other parts of India – Self respect movement – Role of Siddha Medicine in indigenous systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil books**.**	6
	Total Instructional Hours	**30**

At the end of the course, the learner will be able to

Course Outcome

CO1: Learn about the works pertaining to Sangam age
CO2: Aware of our Heritage in art from Stone sculpture to Modern Sculpture.
CO3Appreciate the role of Folk arts in preserving, sustaining and evolution of Tamil culture.
CO4: Appreciate the intricacies of Tamil literature that had existed in the past.
CO5: Understand the contribution of Tamil Literature to Indian Culture

TEXTBOOKS:

T1: Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
T2: Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
T3: Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).

REFERENCEBOOKS:

R1-The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
R2- Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
R3-Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	22MC2093	SOCIAL SERVICES AND COMMUNITY DEVELOPMENT	1	0	0	1

Course Objectives:

The student should be able to

1. Acquire the knowledge and active participate in social service and community development activities.
2. Understand the concept of disaster management and role of NCC cadets in disaster management..
3. Understand the concept thinking and reasoning process..
4. Understand about maps and use of bearing and service protector
5. Know about the principles of flight and Aero foil structure and ATC procedures.

Unit	Description	Instructional Hours
I	**SOCIAL SERVICES AND COMMUNITY DEVELOPMENT** Basics of social services and its need - Rural development programs - Contribution of youth towards social welfare - NGOs in social services Swach bharath Abhiyan - Social evils - Mission Indra danush - Beti bacho Beti pado - Digital awareness - Constitution day.	3
II	**DISASTER MANAGEMENT** Organization of Disaster management -Types of emergencies - Natural and manmade disasters - fire service and fire fighting - prevention of fire.	3
III	**PERSONALITY DEVELOPMENT** Introduction to personality development - public speaking Intra and Inter personal skills -self awareness - critical thinking - Decision making and problem solving.	3
IV	**MAP READING** Types of maps - conventional signs - scales and Grid system - relief and contour gradient - cardinal points - Types of North - types of bearing and use of service protector - Prismatic compass and its uses - setting of map - finding North and own position.	3
V	**PRINCIPLES OF FLIGHT AND AIRMANSHIP** Introduction to principle of flight - Forces acting on the aircraft - Angle of attack - Angle of incidence - Newton's - law of motion - Bernauli's theorem and Venturi effect - Aerofoil - Airfield layout - ATC (Air Traffic Control) - circuit procedures - Aviation medicine.	3
	Total Instructional Hours	15

Course Outcome:

After completion of the course the learner will be able to

CO1:Perform the social services on various occasions for better community and social life
CO2:Appreciate the need and requirement for disaster management and NCC role in disaster management activities.
CO3: Define thinking, reasoning, critical thinking and creative thinking
CO4:Use of bearing and service protector and locate the places and objects on the ground.
CO5:Understand the principles of flight and Aerofoil structure

Reference:

1. UGC and AICTE circulated syllabus.

Text Books :

1. NCC cadet Guide (SD/SW) Army
2. NCC cadet Guide (SD/SW) Airforce.
3. ANOs Guide (SD/SW) by DG NCC, Ministry of Defence, New Delhi
4. Digital Forum App 1.0 & 2.0, by DG NCC DG NCC, Ministry of Defence, New Delhi

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL COLLEGE OF ENGG & TECH Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22MA3105	FOURIER SERIES AND TRANSFORMS (MECT, MECH)	3	1	0	4

Course Objective

The learner should be able to

1. Analyze Fourier series which is central to many applications in engineering.
2. Apply the effective tools for the solutions of one dimensional boundary value problems.
3. Apply the effective tools for the solutions of two dimensional heat equations.
4. Apply Fourier transform techniques in various situations.
5. Analyze Z transform techniques for discrete time systems

Unit	Description	Instructional Hours
I	**FOURIER SERIES** Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series – Change of Interval - Parseval's Identity - Harmonic analysis.	**12**
II	**BOUNDARY VALUE PROBLEMS** Classification of PDE - Solutions of one dimensional wave equation - One dimensional equation of heat conduction (excluding insulated edges).	12
III	**TWO DIMENSIONAL HEAT EQUATIONS** General and Steady state solution of two dimensional equation of heat conduction in infinite plate and semi circular plate.	12
IV	**FOURIER TRANSFORMS** Fourier Transform Pairs - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem (Statement only) – Parseval'sidentity(Statement only).	12
V	**Z - TRANSFORMS AND DIFFERENCE EQUATIONS** Z- Transforms - Elementary properties – Inverse Z - transform (using partial fraction and residues) – Convolution theorem(excluding proof)– Solution of difference equations using Z – transform.	**12**
	Total Instructional Hours	**60**

Course Outcome

At the end of the course, the learner will be able to

CO1: Understand the principles of Fourier series which helps them to solve physical problems of engineering.

CO2: Employ Fourier series in solving the boundary value problems.

CO3: Understand Fourier series in solving the two dimensional heat equations.

CO4: Apply Fourier transform techniques which extend its applications.

CO5: Illustrate the Z- transforms for analyzing discrete-time signals and systems.

TEXT BOOK:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018

T2 - Bali. N.P and Manish Goyal& Watkins, "Advanced Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd, 2007

REFERENCES:

R1 - Veerarajan. T.,"Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.

R2 - Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi,2018.

R3 -Ramana. B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company Limited, New Delhi, 2018.

Chairman, Board of Studies

Chairman - BoS MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics) HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3201	ENGINEERINGTHERMODYNAMICS	3	0	0	3

Course Objective

The learner should be able to

1. To learn the fundamentals of thermodynamics and energy conversion.
2. To gain knowledge on energy degradation in thermodynamic systems.
3. To impart knowledge on behavior of pure substances and working principle of steam power cycles.
4. To learn the thermodynamic relations.
5. To study the properties of atmospheric air.

Unit	Description	Instructional Hours
I	**FIRST LAW OF THERMODYNAMICS** Basic concepts: concept of continuum, microscopic and macroscopic approach, path and point functions, properties, thermodynamic system, equilibrium, state, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer: definition and comparison, sign convention. Zeroth law of thermodynamics: thermal equilibrium. First law of thermodynamics: application to closed and open systems.	**9**
II	**SECOND LAW OF THERMODYNAMICS** Heat Reservoirs: source and sink. Heat Engine, Refrigerator, and Heat pump. Statements and its corollaries. Carnot cycle, Clausius inequality. Concept of entropy: T-s diagram, Tds Equations, entropy change of pure substance, ideal gases, different processes, principle of increase in entropy and availability concepts.	9
III	**PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLES** Steam: formation and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of steam tables and Mollier Chart. Estimation of steam properties and dryness fraction. Steam power cycles: Rankine cycle, Reheat and Regenerative cycles	9
IV	**THERMODYNAMIC RELATIONS AND GASES** Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule- Thomson Coefficient, Clausius Clapeyron equation. Properties of Ideal and real gases: equations of state, Vander Waals equation for ideal and real gases, reduced properties, compressibility factor, generalised compressibility chart and its usage. Gas mixtures: mole and mass fractions, gas laws, gas constant.	9
V	**PSYCHROMETRY** Psychrometric properties, Property calculations of air vapour mixtures using psychrometric chart and expressions. Psychrometric process: sensible heating and cooling, humidification, dehumidification, adiabatic saturation, adiabatic mixing of two streams.	**9**
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, the learner will be able to

CO1: Understand the thermodynamic principles and its applications.

CO2: Quantify the energy conversion in various thermal systems.

CO3: Identify the losses and inefficient components in the thermodynamic system.

CO4: Apply the thermodynamic principles for predicting the properties of steam, gas and gas mixtures.

CO5: Apply the psychrometric principles for design of air conditioning systems.

TEXT BOOK:

T1 - Nag.P.K, “Engineering Thermodynamics”, 5th Edition, Tata McGraw-Hill, New Delhi, 2017.

T2 - Cengel. Y. and Boles.M, "Thermodynamics - An Engineering Approach", 8 th Edition, Tata McGraw Hill, 2010.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3202	ENGINEERING MATERIALS AND METALLURGY	3	0	0	3

Course Objective

The learner should be able to

1. To learn material classification and their atomic structure.
2. To study mechanical behavior of materials, Phase diagrams and its importance.
3. To understand heat treatment and surface treatments of metals.
4. To study the stress-strain behavior of various materials, fracture types.
5. To learn the properties of nonferrous alloys, polymers and ceramics.

Unit	Description	Instructional Hours
I	**BASIC CONCEPTS** Introduction to Materials Science, Defects-Point, Line, Area, Volume-Slip planes and slip systems, Schmidt's rule, Polymorphism and allotropy -Solidification–Nucleation and Growth mechanism, Cooling curve of pure metal and alloy	**9**
II	**PHASE DIAGRAMS AND PHASE TRANSFORMATION** Gibbs's Phase rule, Solubility and Solid Solutions -Isomorphous alloy system -Binary Eutectic alloy system (Lead-Tin System), Eutectoid and Peritectic system, Iron-Iron carbide equilibrium diagram, Phase Transformation-Temperature-Time-Transformation (TTT) and Continuous Cooling Transformation (CCT) Diagrams -Steels, Cast Irons and Stainless steels –types and applications –Effects of alloying elements.	9
III	**HEAT TREATMENT & SURFACE TREATMENTS** Heat Treatment –Annealing and its types, Normalizing, Aus-tempering, Mar-tempering, Quenching, Hardenability -Surface hardening processes –Flame and induction hardening, Carburizing, Nitriding and Carbonitriding-–Basic concepts of wear and corrosion & their types.	9
IV	**MECHANICAL PROPERTIES AND MATERIALS** Stress-strain behavior of ferrous & non-ferrous metals, polymer and ceramics -Hardness, Fracture of metals -Ductile Fracture, Brittle Fracture, Fatigue –Endurance limit of ferrous and non-ferrous metals – Fatigue, Creep and rupture–mechanism of creep –stages of creep..	9
V	**NON FERROUS ALLOYS & COMPOSITE MATERIALS** Non Ferrous Alloys of Aluminum, Magnesium, Copper –Microstructure and mechanical property, Composites- Classification, properties and applications, Ceramics –Alumina, Zirconium, Silicon Carbide, Sialons -Processing, properties and applications of ceramics, Glasses –properties and applications.	**9**
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, the learner will be able to

CO1: Understand the atomic structure & classification of engineering materials

CO2: Predict the alloy components and its composition variation with respect to temperature changes.

CO3: Select suitable materials and heat treatment methods for various industrial applications.

CO4: Gain knowledge on testing different types of materials and their applications.

CO5: Explain the properties of non-ferrous alloys, polymers and ceramics.

TEXT BOOK:

T1 - Callister.W.D., Jr., (2010), Materials Science and Engineering: An Introduction, 8th ed., Wiley & Sons.
T2 -William F. Smith and Javad Hashemi (2014), Foundations of Materials Science and Engineering 4th edition.Mc Graw Hill

REFERENCES:

R1 - Anderson.C, K.D. Leaver, P. Leavers and R.D. Rawlings, (2013), Materials Science for Engineers, 5th edition, Tata McGraw Hill Publishers.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22XXXX	ELECTRICAL DRIVES AND CONTROLS	3	0	0	3

Course Objective

The learner should be able to

1. To understand the basic concepts of different types of electrical machines and their performance.
2. To study the different methods of starting D.C motors and induction motors.
3. To study the conventional and solid-state drives.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors	**8**
II	**DRIVE MOTOR CHARACTERISTICS** Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.	9
III	**STARTING METHODS** Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors	8
IV	**CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES** Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers – applications.	10
V	**CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES** Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.	**10**
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, the learner will be able to

CO1: Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

TEXT BOOK:

T1 - Nagrath .I.J. & Kothari .D.P, “Electrical Machines”, Tata McGraw-Hill, 2006
T2 - Vedam Subrahmaniam, “Electric Drives (Concepts and Applications)”, Tata McGraw-Hill, 2010

REFERENCES:

1. Partab. H., “Art and Science and Utilisation of Electrical Energy”, Dhanpat Rai and Sons, 2017
2. Pillai.S.K “A First Course on Electric Drives”, Wiley Eastern Limited, 2012
3. Singh. M.D., K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, 2006.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3204	MANUFACTURING TECHNOLOGY – I	3	0	0	3

Course Objective

The learner should be able to

1. To learn the concepts of some basic manufacturing processes and fabrication techniques
2. To know the manufacturing of metal components in different methods such as metal casting.
3. To gain the metal joining, metal forming techniques.
4. To acquire knowledge in the bulk forming process such as forging and rolling.
5. To learn the manufacturing of plastic components.

Unit	Description	Instructional Hours
I	**METAL CASTING PROCESSES** Sand Casting: Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces: Blast and Cupola Furnaces; Special casting processes : Shell - investment – Pressure die casting - Centrifugal Casting - Continuous casting process – Stir casting; Casting Defects.	**9**
II	**METAL JOINING PROCESSES** Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure.	9
III	**METAL FORMING PROCESSES** Hot working and cold working of metals – Forging processes – Open and closed die forging – forging operations. Rolling of metals– Types of Rolling mills – Flat strip rolling – shape rolling operations – Defects in rolled parts. Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion Principle of rod and wire drawing.	9
IV	**SHEET METAL FORMING PROCESS** Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal –Special forming processes; Hydro forming – Rubber pad forming – Metal spinning– Explosive forming- Magnetic pulse forming- Peen forming- Super plastic forming – Micro forming.	9
V	**MANUFACTURE OF PLASTIC COMPONENTS** Types and characteristics of plastics –Thermoplastics and Thermosetting plastics – working principles and typical applications of Injection moulding, Plunger and screw machines – Compression moulding, Transfer Moulding – Blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics -industrial applications of plastics.	**9**
	Total Instructional Hours	**45**

Course Outcome

At the end of the course, the learner will be able to

CO1: Identify the suitable casting process for the given component.

CO2: Identify the suitable welding process and integrate the basic knowledge from material science

CO3: Compare the functions and applications of metal forming process

CO4: Develop basic calculation to fabricate sheet metal components.

CO5: Understand plastic component manufacturing.

TEXT BOOK:

T1 - Hajra Choudhary S.K and Hajra Choudhury. AK, “Elements of workshop Technology", volume I and II, Media promoters and Publishers pvt, Mumbai, 2013.

T2 - Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 2nd Ed, TMH-2015.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3251	FLUID MECHANICS AND MACHINERY	3	0	2	4

Course Objective

The learner should be able to

1. To study the fluid laws, properties and measurements.
2. To expose various fluid flow measuring devices and calculate the flow losses in pipes.
3. To learn the concept of dimensional analysis
4. To gain the knowledge on working principles and performance curves of fluid pumps
5. To impart knowledge on various hydraulic turbines and performance curves...

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FLUID AND FLUID FLOW** Fluid Properties - density, specific weight, specific volume, specific gravity, viscosity, compressibility, capillary, surface tension and buoyancy – pressure measurements- manometers, Continuity equation, theory of various types of flow - laminar, turbulent, unsteady, steady, non-uniform and uniform flows. Stream line, streak line and path.	**8**
II	**FLUID DYNAMICS AND FLOW THORUGH PIPE** Navier Stokes equation – derivation and problems, derivation of Euler's equation and Bernoulli's energy equation, Pipes in series and parallel. Reynolds number, Darcy-Weisbach equation, use of Moody diagram, minor losses-sudden expansion, sudden contraction and losses in pipe fittings.	9
III	**FLOW MEASUREMENT AND DIMENSIONAL ANALYSIS** Orificemeter, Venturimeter, Pitot tubes, Rotameter, dimensional analysis-Buckingham‘s theorem, Reynolds, Froude, Weber, Euler and Mach number and their applications. Calculation of discharge using Venturimeter & Orificemeter	9+5
IV	**HYDRAULIC PUMPS** Classifications of pumps –Centrifugal pumps– work done by the impeller -Head and efficiencies performance curves-velocity triangles – cavitation-priming-Reciprocating pump-slip, Indicator diagram, efficiency. Performance curves- theory of Air vessel. Experimentation on centrifugal pump and reciprocating pump.	9+5
V	**HYDRAULIC TURBINES** Classification of turbines – heads and efficiencies – velocity triangles. Theory of axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- work done by water on the runner. Specific speed– performance curves. Experimentation on Pelton wheel and Francis turbine.	**9+5**
	Total Instructional Hours	**60**

Course Outcome

At the end of the course, the learner will be able to

CO1: Apply the properties of fluids and flow characteristics.
CO2: Apply the momentum principle and losses in pipes in solving real life problems.
CO3: Perform the Dimensional and Model analysis.
CO4: Design suitable types of pumps for various applications.
CO5: Analyze the performance of various hydraulic turbines.

TEXT BOOK:

T1- Rajput, R.K., “Fluid Mechanics and Hydraulic Machines,”S.Chand Publishers 2013.
T2 - Streeter, V.L., and Wylie, E.B., “Fluid Mechanics”, McGraw-Hill Education, 2010.

REFERENCES:

R1- Ramamrutham.S and Narayanan.R. “Fluid Hydraulics and Fluid Machines”, Dhanpat Rai Publishing House (P) Ltd, New Delhi, 2012.

Programme	Course code	Name of the course	L	T	P	C
B.E.	**22ME3001**	**MANUFACTURING TECHNOLOGY LAB – I**	**0**	**0**	**4**	**2**

Course Objective

The student should be able

1. To Study and practice the various operations that can be performed on the lathe, drilling and grinding machines etc. and equip with the practical knowledge required in the core industries.

Description of the Experiments

I.LIST OF EXPERIMENTS

1. Machining of Step Turning using a Lathe.
2. Machining of Knurling & Grooving using a Lathe.
3. Machining of Taper Turning using a Lathe.
4. Machining of Boring using a Lathe.
5. Machining of Internal Thread Cutting using a Lathe.
6. Machining of External Thread cutting using aLathe.
7. Machining of Eccentric Turning using a Lathe.
8. Drilling & Tapping in plates using drilling machine.
9. Surface grinding of a plate using surface grinder.

Total Instructional Hours **45**

Course Outcome

The Students will be able to

CO1 - Upon completion of this course, the students can be able to use various lathe, drilling and grinding machines to fabricate various operations.

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME3002	COMPUTER AIDED MODELING LAB	0	0	4	2

Course Objective

The student should be able

1. To develop skills on using software for preparing 2D Drawings and 3D modeling.
2. To learn the importance of computer aided design and drawing in Engineering society.

Description of the Experiments

LIST OF EXERCISES USING DRAFTING SOFTWARE

1. Study of drafting software– Coordinate systems (absolute, relative, polar, etc.) – Creation of simple geometries like polygon, conic and special curves.
2. Draw the orthographic projections of simple solids like Prism, Pyramid, Cylinder, Cone and its dimensioning.
3. Draw and dimension the orthographic projections of Shaft Support.
4. Draw and dimension the orthographic projections of Machine Component.
5. Draw and dimension the orthographic projections of simple gate valve.
6. Draw the Plan and Elevation of simple Residential Building.

LIST OF EXERCISES USING MODELLING SOFTWARE

1. Study of Modeling software-Sketching and Part modeling - Tool familiarizations on Extrude, Revolve, Hole, shell.
2. Creation of Machine Block using 3D Modeling software.
3. Creation of solid journal bearing using 3D Modeling software.
4. Creation of step cone pulley using 3D Modeling software.

Total Instructional Hours **45**

Course Outcome

The Students will be able to

CO1: Apply the software package for drafting and modeling.

CO2: Create 2D Drawing and 3D modeling of Engineering Components. CO3: Apply basic concepts to develop construction drawing techniques

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
BE/BTECH	19HE6071	Soft Skill-II	1	0	0	1

Course Objectives

1. To make the students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
2. To learn everything from equations to probability with a completely different approach.
3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	**Group Discussion & Presentation Skills:** GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
II	**Interview Skills and Personality Skills:** Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
III	**Business Etiquette & Ethics:** Etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news	3
IV	**Quantitative Aptitude:** Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry -	3
V	**Logical Reasoning:** Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2

Course Outcome

CO1	Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.
CO2	Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations
CO3	Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment
CO4	Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.
CO5	Students will excel in complex reasoning.

Reference Books:

R1: Bridging the Soft Skills Gap: How To Teach The Missing Basics To Todays Young Talent- Bruce Tulgan

R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha

R3: How to crack test of Reasoning - Jaikishan and Premkishan

R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH * ACADEMIC COUNCIL * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme /sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ IV	**22MC3091**	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**	2	0	0	0

Course Objective

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyze it and apply It to their day today life.
3. To impart basic principles of thought process, Itihas and Dharma Shastra and Connecting society and nature.
4. To understand the concept to intellectual and intellectual property rights with special Reference.
5. The course focuses on introduction to Indian Knowledge System, Indian perspective of a modern scientific world-view and basic principles of Yoga and Indian philosophy.

Unit	Description	Instructional Hours
I	**Introduction to traditional knowledge:** Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vs indigenous knowledge, traditional knowledge vs western knowledge	6
II	**Protection of traditional knowledge:** The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Government to harness TK	6
III	**Itihas and Dharma-Shastra** **Itihas:** The Mahabharata-The Puranas-The Ramayana **Dharma - Shastra**: Manu Needhi-The Tirukkural–Thiru Arutpa	6
IV	**Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	6
V	**Indian philosophy** Jain–Buddhist–Charvaka–Samkhya-Yoga-Nyaya-Vaisheshika-SaivaSiddhanta	6
	Total Instructional Hours	**30**

Course Outcome

CO1: Identify the concept of Traditional knowledge and its importance.
CO2: Explain the need and importance of protecting traditional knowledge.
CO3: Explain the need and importance of Itihas and Dharma Shastra.
CO4:InterprettheconceptsofIntellectualpropertytoprotectthetraditional knowledge.
CO5:Interprettheconceptsofindianphilosophyto protect the traditional knowledge

REFERENCEBOOKS

R1.TraditionalKnowledgeSysteminIndia, byAmitJha,2009.
R2. Traditional Knowledge System in India by Amit Jha Atlantic publishers,2002.
R3."KnowledgeTraditionsandPracticesofIndia"KapilKapoor1,MichelDanin
R4.V.Sivaramakrishna(Ed.),CulturalHeritageofIndia-CourseMaterial,BharatiyaVidyaBhavan,Mumbai, 5thEdition, 2014.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Semester – I

Course Code & Name : 22MA1101/ MATRICESS AND CALCULUS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	1
Avg	3	3	3	2.6	2.8	-	-	-	-	-	-	2	1.8	2

Course Code & Name : 22HE1151/ ENGLISH FOR ENGINEERS

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1	2	-	1	2	1	2	3	1	3	3	2
CO2	1	2	1	1	1	2	1	1	1	3	1	2	2	3
CO3	1	2	1	1	1	2	1	1	2	3	1	2	2	2
CO4	1	1	-	1	1	1	1	1	2	3	1	2	3	3
CO5	-	1	1	1	1	1	1	2	2	3	1	2	2	2
Avg	1	1.4	1	1.2	1	1.4	1.2	1.2	1.8	3	1	2.2	2.4	2.4

Course Code & Name : 22PH1151/ PHYSICS FOR NON CIRCUIT ENGINEERING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	3	3
CO3	3	2	1	2	2	-	-	-	-	-	-	1	3	3
CO4	3	2	3	2	3	1	-	-	-	-	-	1	2	2
CO5	3	2	3	2	2	2	-	-	-	-	-	1	2	3
Avg	3	2.2	2	1.6	2	1.333333	-	-	-	-	-	1	2.4	2.4

Course Code & Name : 22IT1151/PYTHON PROGRMMING AND PRACTICES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	3	3	-	2	-	-	-	-	-	-	2	2	2
CO2	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO3	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO4	2	3	3	-	2	-	-	-	2	-	-	2	2	2
CO5	2	3	3	-	2	-	-	-	2	-	-	2	2	2
Avg	2	3	3	-	2	-	-	-	2	-	-	2	2	2

Course Code & Name : 22ME1101 ENGINEERING DRAWING

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	-	-	-	-	-	3	-	1	-	1
CO2	3	2	2	-	-	-	-	-	-	2	-	-	-	1
CO3	3	2	3	-	2	-	-	-	-	2	-	1	-	2
CO4	3	2	3	-	2	-	-	-	-	2	-	-	2	2
CO5	3	2	3	-	2	-	-	-	-	2	-	-	2	2
Avg	3	2	2.6	0	2	0	0	0	0	2.2	0	1	2	1.6

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL Chairman KARPAGAM COLLEGE OF ENGG & TECH

Dean – Academics
Dean (Academics)
HiCET

Semester – II

Course Code & Name : 22MA2101/ DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO5	3	3	3	3	3	-	-	-	-	-	-	2	2	2
Avg	3	3	3	2.4	2.4	-	-	-	-	-	-	2	2	2

Course Code & Name : 22CY2101/ ENVIRONMENTAL STUDIES

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO2	2	-	-	-	-	2	3	3	2	-	-	2	-	-
CO3	2	1	1	-	-	2	3	3	2	-	-	2	-	-
CO4	2	1	2	-	-	2	3	3	2	-	-	2	-	-
CO5	2	1	2	-	-	2	3	3	2	-	-	2	-	-
Avg	2	1	1.7	-	-	1	2	3	2	-	-	2	-	-

Course Code & Name : 22PH2101/ BASICS OF MATERIAL SCIENCE

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	1	1	1	1	-	-	-	-	-	1	2	1
CO2	3	3	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	1	2	2	-	-	-	-	-	-	1	2	3
CO4	3	3	1	2	2	1	-	-	-	-	-	1	2	2
CO5	3	2	2	3	2	1	2	-	-	-	-	1	2	3
Avg	3	2.4	1.2	1.8	1.8	1	2	-	-	-	-	1	2	2.2

Course Code & Name : 22ME2101 Engineering Mechanics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1				1				1	1	1	2
CO2	3	3	2	1			1				1	1	1	2
CO3	3	3	1			1	1			1	1		1	1
CO4	3	3	2	1		2	1			1	1	1	1	1
CO5	3	3	2	1		3	1			1	1	1	1	1
Avg	3	3	1.6	0.6	0	1.2	1	0	0	0.6	1	0.8	1	1.4

Course Code & Name : 22HE2151/ EFFECTIVE TECHNICAL COMMUNICATION

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	2	1	1	1	2	1	2	2	3	-	3	1	-
CO2	2	1	1	1	1	2	2	2	2	3	-	2	-	1
CO3	2	2	1	1	1	2	2	2	2	3	1	3	1	-
CO4	2	2	1	1	2	2	2	2	3	3	1	3	1	1
CO5	1	1	1	1	1	2	2	1	2	3	1	3	1	1
Avg	1.6	1.6	1	1	1.2	2	1.8	1.8	2.2	3	1	2.8	1	1

Course Code & Name : 22CY2152/ APPLIED CHEMISTRY

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	2	1	1	-	-	-	-	1	1	1
CO2	3	2	2	-	2	1	-	-	-	-	-	1	1	-
CO3	3	2	2	-	2	1	1	-	-	-	-	1	1	-
CO4	3	2	2	2	2	1	-	-	-	-	-	1	1	1
CO5	3	2	2	-	2	1	-	-	-	-	-	1	1	1
Avg	3	2	2	2	2	1	1	-	-	-	-	1	1	1

Course Code & Name : 22ME2001 Engineering Practices

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	-	-	-	2	-	-	-	-	1	2	3	1
CO2	2	1	-	1	-	3	-	-	-	-	2	2	3	1
CO3	3	1	-	1	-	3	-	1	-	2	2	2	3	1
CO4	2	1	-	1	-	2	-	1	-	2	2	2	3	1
CO5	3	-	-	-	-	2	-	1	-	1	2	3	3	1
Avg	2.6	0.8	0	0.6	0	2.4	0	0.6	0	1	1.8	2.2	3	1

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH *
Chairman

Dean – Academics
Dean (Academics)
HiCET

Semester – III

Course Code & Name: 22MA3105/ Fourier Series and Transforms

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	3	1	2	-	-	-	-	-	-	2	3	1
CO2	3	3	3	2	1	-	-	-	-	-	-	3	2	3
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	2
CO4	3	3	3	1	2	2	-	-	-	-	-	2	2	2
CO5	3	3	3	2	1	1	-	-	-	-	-	2	2	3
Avg	3	2.8	3	1.4	1.4	2	-	-	-	-	-	2.2	2.2	2.2

Course Code & Name : 22ME3201 Engineering Thermodynamics

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1										1	1
CO2	1	2	2	2									2	
CO3	2	2	3	2										
CO4	3	1	1	2										
CO5	2	2	3	2	1					1			2	1
Avg	1.8	1.6	2	1.6	0.2	0	0	0	0	0.2	0	0	1	0.4

Course Code & Name : 22ME3202 Engineering Materials and Metallurgy

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	-	-	-	-	2	2	-	-	1	-	3	1	2
CO2	3	-	-	-	-	2	2	-	-	1	-	3	1	1
CO3	3	-	-	-	-	2	2	-	-	1	-	3	1	1
CO4	3	-	-	-	3	3	3	-	-	1	-	3	2	2
CO5	3	-	-	-	-	2	2	-	-	1	-	3	1	1
Avg	3	0	0	0	0.6	2.2	2.2	0	0	1	0	3	1.2	1.4

Course Code & Name : 22EE3231

Electrical Drives and Control

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	1	1	1	1	-	1	1	-	2	1	-	1	-	-
CO2	2	2	2	2	-	1	2	-	2	2	1	2	2	1
CO3	1	1	1	1	-	1	1	-	2	1	1	1	1	1
CO4	2	2	1	1	-	1		-	2	1	1	1	2	-
CO5	2	2	2	1	-	2	2	-	2	2	1	2	2	2
Avg	**1.6**	**1.6**	**1.4**	**1.2**	**-**	**1.2**	**1.2**	**-**	**2**	**1.4**	**0.8**	**1.4**	**1.4**	**0.8**

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Course Code & Name : 21ME3204 Manufacturing Technology-I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	2	2	1	-	-	1	-	-	-	1	1	1
CO2	3	1	2	2	2	-	-	1	-	-	-	1	1	1
CO3	3	1	2	2	1	-	-	1	-	-	-	1	1	1
CO4	3	1	2	2	1	-	-	1	-	-	-	1	1	1
CO5	3	1	2	2	1	-	-	1	-	-	-	1	1	1
Avg	3	1	2	2	1.2	0	0	1	0	0	0	1	1	1

Course Code & Name : 22ME3251 Fluid Mechanics and Machinery

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	1.4	1	1.8	1.2	1.2	1.4	1.2	1	1	1.4	1	1	2	1.2

Course Code & Name : 22ME3001 Manufacturing Technology Lab – I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	3	3	-	1	-	2	-	-	-	2	1
Avg	3	3	3	3	3	-	1	-	2	-	-	-	2	1

Course Code & Name : 22ME3002 Computer Aided Drawing Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	3	3	-	1	-	2	-	-	-	2	1
CO2	3	3	3	3	3		1		2				2	1
CO3	3	3	3	3	3		1		2				2	1
CO4	3	3	3	3	3		1		2				2	1
CO5	3	1	2	2	1								1	1
Avg	3	2.6	2.8	2.8	2.6	0	0	0	0	0	0	0	1.8	1

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22HE4101	IPR AND START-UPS	2	0	0	2

Course Objective

The student should be able

1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right,
3. To learn about the trademarks and geographical indications (GI) in our country and foreign countries of their invention.
4. To gain the knowledge about designs and layout design Act-2000.
5. To learn about the technology transfer to product and Start-up knowledge.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO IPR** Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights Introduction to Trade-Related of Intellectual Property Rights (TRIPS) and World Trade Organization (WTO). - Kinds of Intellectual property rights—Copy Right, Patent, Trade Mark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge.	6
II	**PATENT RIGHTS AND COPY RIGHTS** Origin, Meaning of Patent, Types, Procedure to follow the methods of IP agents, Inventions, which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, IT Act- introduction. COPY RIGHT- Origin, Definition &Types of Copy Right, Patent Ethics, Registration procedure, Assignment & licence, Terms of Copy Right, Piracy, Infringement, Remedies,	6
III	**TRADE MARKS AND GEOGRAPHICAL INDICATION** Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing off, Penalties. GEOGRAPHICAL INDICATION – International Protection, plant varieties, Infringement of GI, licencing, legal issues.	6
IV	**DESIGN** Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000.	6
V	**START-UPS** Process of Innovation, Monetizing Ideas, Technology transfer to product, Funding Options for Start-up, Start-up Models, Preparation of Project Report, Start up to MNC, Start-up Audit.	6
	Total Instructional Hours	**30**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand IPR and aware the invention rights.

CO2: Get awareness of acquiring the patent for their project ideas

CO3: Learn obtaining copyright for their innovative works

CO4: Understand the designs and layout design Act-2000.

CO5: Understand the concept of start-ups, identify the required strategic resources.

TEXT BOOK:

T1. Intellectual Property Rights (IPR) by M.K Bhandari 2021

T2. Law relating to Intellectual Property Rights, by V.K Ahuja 2017

T3. Intellectual Property Rights (IPR) for Start-ups by Vinay Vaish 2016

T4. Intellectual Property - Patents, Copyright, Trade Marks and Allied Rights (South Asian Edition) by W Cornish and D Llewelyn and T Pain 8th South Asian Edition. 2016.

T5 Peter Thiel & Blake Masters, Zero to One: Notes on Start Ups, or How to Build the Future, Random House, 2014.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO2	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO3	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO4	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO5	3	-	3	-	-	3	-	-	-	-	-	3	2	2
Avg.	3	-	3	-	-	3	-	-	-	-	-	3	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH *
Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4201	KINEMATICS OF MACHINERY	3	1	0	4

Course Objective

The student should be able

6. To impart the knowledge on the concept of simple mechanisms.
7. To provide knowledge on kinematic analysis of simple mechanisms.
8. To study and construct the cam profile for the various follower motions.
9. To learn the gear nomenclature and calculate speed ratio of gear trains.
10. To introduce the concept of friction drives in kinematics of machines.

Unit	Description	Instructional Hours
I	**BASICS OF MECHANISMS** Basic Terminology – Degree of Freedom – Mobility - Gruebler's & Kutzbach criterion - Grashoff's law- Kinematic Inversions of Four bar chain and Slider crank chain – Mechanical Advantage - Transmission angle - Straight line generators - Ratchets and escapements - Indexing Mechanisms	**12**
II	**KINEMATICS ANALYSIS** Velocity and acceleration analysis of simple mechanisms using relative velocity method – Rubbing velocity of kinematic pair - Coriolis component of acceleration. Analyzer tools used	12
III	**KINEMATICS OF CAM** Basic Terminology – Classifications of Cams and Followers – Types of follower motions – Construction of cam profile for radial cam - Pressure angle and undercutting.	12
IV	**GEARS AND GEAR TRAINS** Gear tooth terminology - Classification of gears – Law of toothed gearing - Involute and Cycloidal tooth profiles – Interference and undercutting - Gear trains – Simple, Compound and Epicyclic gear trains - Differentials.	12
V	**FRICTION IN MACHINE ELEMENTS** Friction in screw jack - Plate clutches - Belt and rope drives - Block brakes, band brakes.	**12**
	Total Instructional Hours	**60**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the process of air standard cycles.

CO2: Demonstrate the operating characteristics of internal combustion engines.

CO3: Apply the thermodynamic laws to various thermal equipments like steam nozzles and steam turbines.

CO4: Understand the types of compressors, fans and blowers and its applications.

CO5: Understand the principles of air-conditioning system and estimate the cooling loads.

TEXT BOOK:

T1 – Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2015.

T2 – Rattan,S.S., "Theory of Machines", Tata Mcgraw-Hill Publishing Company Ltd., New Delhi, 2015.

REFERENCES:

R1 - Khurmi,R.S., and Gupta, J.K., "Theory of Machines", S.Chand & Company, 2014.

R2 - Uicker J.J.,Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms"(Indian Edition), Oxford University Press, 2009.

R3 - Ghosh A and A.K.Mallick, "Theory of Mechanisms and Machines", Affiliated East- West Pvt. Ltd., New Delhi, 2016.

R4 - Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", Wiley-Eastern Ltd., New Delhi, 2016.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	3				2		2			2	1
CO2	3	1	2	1				1		1			2	
CO3	3	1	1	1				1		1			2	1
CO4	2	1	1										1	
CO5	3	2	1										2	
Avg	3	3	1	3				2		2			2	1

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ ENGG & TECH ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4202	HYDRAULICS AND PNEUMATICS SYSTEMS	3	0	0	3

Course Objective

The student should be able

1. To know the physical properties to the hydraulic systems and basic laws of hydrostatics and hydrodynamics.
2. To know the theory of operation and the structure and know the symbols of pumps, cylinders, hydraulic motors and the directional control valves and the control valves of pressure and flowrate.
3. To know of the basic properties of the compressed air as medium used in energy transmission for the purposes of control and the other necessary specific properties of the compressed air.
4. To know the principles that should awarded in preparing the compressed air, the devices that are used in pneumatic energy conversion also the control devices in the pneumatic energy.
5. To provide exposure to various problems and maintenance of Hydraulic and Pneumatic circuits for various engineering applications.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FLUID POWER AND HYDRAULIC PUMPS** Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – Fluid power symbols. Basics of Hydraulics - Applications of Pascal's Law. Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps.	9
II	**HYDRAULIC ACTUATORS AND CONTROL VALVES** Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder. Control Valves: Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable	9
III	**DESIGN OF HYDRAULIC SYSTEMS AND INDUSTRIAL APPLICATIONS** Reciprocating circuit, Synchronizing circuit, Regenerative circuit, Pump unloading circuit, Counterbalance valve circuit. Types of accumulators – Accumulators circuits, sizing of accumulators- Intensifier, Fail-safe circuits - Speed control circuits	9
IV	**PNEUMATIC SYSTEMS AND COMPONENTS** Properties of air – Compressors – Filter, Regulator, Lubricator, and Muffler – Air control valves, Quick exhaust valves, pneumatic actuators. Sequential circuit design for simple applications using cascade method.	9
V	**SERVO SYSTEMS AND MAINTENANCE** Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits. Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting. Internet of things in automation.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO 1: Choose hydraulic and pneumatic elements and demonstrate the applicability of fluid power systems for engineering applications.

CO 2: Design customized circuits in hydraulics, pneumatics and servo systems for various industrial needs.

CO 3: Draw and explain the working of various types of pumps and hydraulic motors and cylinders.

CO 4: Explain the fundamentals of pneumatic systems and working of pneumatic components.

CO 5: Draw ladder logic diagrams and explain about low cost automation.

TEXT BOOK:

T1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.

T2. Peter Rohner, "Industrial Hydraulic Control" 4th Revised Edition 2005

REFERENCES:

R1. Majumdar S.R.,"Pneumatic systems – Principles and maintenance". Tata McGraw Hill, 1995.

R2. Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey, 1976.

R3. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.

R4. Majumdar S.R., "Oil Hydraulics". Tata McGraw-Hill, 2000.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	**1.4**	**1**	**1.8**	**1.2**	**1.2**	**1.4**	**1.2**	**1**	**1**	**1.4**	**1**	**1**	**2**	**1.2**

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4202	MANUFACTURING TECHNOLOGY – II	3	0	0	3

Course Objective

The student should be able

1. To acquire knowledge of Metal Cutting Theory concepts.
2. To impart knowledge on the working and various functions of Turning Machines.
3. To know about Shaping, Milling and Gear cutting machines.
4. To gain knowledge about grinding and broaching machines.
5. To learn the basic concepts in CNC machines.

Unit	Description	Instructional Hours
I	**THEORY OF METAL CUTTING** Mechanism of metal cutting – types – cutting force – chip formation – Merchant's circle diagram – calculations – tool geometry – machinability – tool wear – tool life – cutting tool materials – cutting fluids – types, problems on cutting force and tool life.	9
II	**TURNING MACHINES** Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments. Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle. Problems on thread cutting and taper turning	9
III	**SHAPER, SLOTTING, MILLING AND GEAR CUTTING MACHINES** Shaper - Types of operations. Slotting machine- Types of operations. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling, hobbing and gear shaping processes –finishing of gears. Drilling machine - Types of operations.	9
IV	**ABRASIVE PROCESS AND BROACHING** Grinding, broaching, spinning: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications. Broaching machines: broach construction – push, pull, surface and continuous broaching machines and its applications. Super finishing – honing and lapping-precision machining processes, Nano Machining.	9
V	**CNC MACHINING** Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining and IOT.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: understand the concept of metal cutting principles and tool life

CO2: Fabricate engineering components using various lathes and special attachments.

CO3: conduct experiments on conventional machining processes

CO4: demonstrate the basic concepts of abrasive process and gear cutting operations.

CO5: demonstrate the understanding of surface finishing process in the CNC machine tools.

TEXT BOOK:

T1 - HajraChoudhury, "Elements of Workshop Technology", Vol.II., Media Promoters, 2015.

T2 - Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw-Hill, New Delhi, 2013.

T3 - Gary F. Benedict 'Nontraditional Manufacturing Processes' , Taylorfrancis, Boca Raton 2019

REFERENCES:

R1 - HMT, "Production Technology", Tata McGraw Hill, 2015.

R2 - GeofreyBoothroyd, "Fundamentals of Metal Machining and Machine Tools", McGraw Hill, 2014.

R3 - Roy. A.Lindberg, "Process and Materials of Manufacture," Fourth Edition, PHI/Pearson Education, 2016.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	2	1								1	1
CO2	3	1	2	2	2								1	1
CO3	3	1	2	2	1								1	1
CO4	3	1	2	2	1								1	1
CO5	3	1	2	2	1								1	1
Avg	3	1	2	2	1.2	0	0	0	0	0	0	0	1	1

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4203	THERMAL ENGINEERING	3	0	0	3

Course Objective

The student should be able

1. To learn the concepts of gas power cycles.
2. To study the components and performance of internal combustion engines.
3. To acquire knowledge on steam nozzles and steam turbines.
4. To impart knowledge on working principles and performance of air compressors.
5. To study the working principle of refrigeration and air conditioning systems.

Unit	Description	Instructional Hours
I	**GAS POWER CYCLES** Air standard cycles-assumptions- Otto, Diesel, Dual and Brayton cycles-calculation of mean effective pressure-and air standard efficiency - comparison of cycles.	8
II	**INTERNAL COMBUSTION ENGINES** Classification - components and their functions. valve timing and port timing diagrams – actual and theoretical p-V diagrams of four stroke and two stroke engines. Fuel supply systems for SI and CI engines. Types of ignition systems, Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculations of IC engines.	10
III	**STEAM NOZZLES AND TURBINES** Flow of steam through nozzles-shapes of nozzles-effect of friction-critical pressure ratio and supersaturated flow. Impulse and Reaction principles. Compounding, velocity diagram for simple steam turbines.	9
IV	**AIR COMPRESSOR, FANS AND BLOWERS** Classification and working principle of various types of compressors-work of compression with and without clearance, compressor efficiency, Multistage air compressor and inter cooling –work of multistage air compressor, Fans & blowers-types and its industrial applications.	9
V	**REFRIGERATION AND AIR CONDITIONING** Refrigeration cycles: vapour compression systems- working principle and performance calculations. vapour absorption systems – working principle of ammonia –water and lithium bromide – water systems (Description only). Refrigerants properties and selection. Air conditioning system: Types-summer, winter and year around air conditioning systems, description of window and split air conditioning system, Cooling load calculations – simple problems only.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to

CO1: Understand the process of air standard cycles.

CO2: Demonstrate the operating characteristics of internal combustion engines.

CO3: Apply the thermodynamic laws to various thermal equipments like steam nozzles and steam turbines.

CO4: Understand the types of compressors, fans and blowers and its applications.

CO5: Understand the principles of air-conditioning system and estimate the cooling loads.

TEXT BOOK:

T1- Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2000 Third edition, 2015.

T2- Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition,"Dhanpat Rai & sons, 2012.

T3- Eastop, T.D., Mcconkey, A., Applied Thermodynamics for Engineering Technologies, 5th Edition, New Age International (p) Ltd., New Delhi, 2012

REFERENCES:

R1 - Arora.C.P."Refrigeration and Air Conditioning," Tata McGraw-Hill Publishers 2014.

R2 - Ganesan V.." Internal Combustion Engines". Third Edition, Tata Mcgraw-Hill 2017.

R3 - Rudramoorthy, R, "Thermal Engineering ". Tata McGraw-Hill, New Delhi, 2013.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	1	-	1	-	-		-	-	1	1	1
CO2	3	1	1	1	-	2	2	-	1	-	1	1	1	1
CO3	3	1	1	1	-	-	-	-		-	-	1	1	1
CO4	3	1	1	1	-	-	-	-		-	-	1	1	1
CO5	3	1	1	1	-	2	1	-	1	-	1	1	1	1
Avg	**3**	**1**	**1**	**1**	**-**	**1**	**0.6**	**-**	**0.4**	**-**	**0.4**	**1**	**1**	**1**

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4251	STRENGTH OF MATERIALS	3	0	2	4

Course Objective

The student should be able

1. To study the principles of simple stress, strain and deformation in components.
2. To assess stresses and deformations through mathematical models of beams.
3. To learn about torsion of components.
4. To gain knowledge about deflections on beams.
5. To understand the stress analysis in thin cylinders & Spherical Shells

Unit	Description	Instructional Hours
I	**ANAYSIS OF STRESSES** Rigid and Deformable bodies - Mechanical Properties - Deformation of simple and compound bars - Thermal stresses - Elastic constants - Volumetric strains, Principal Planes & Stress - Mohr'scircle. Hardness test on metals -***Brinell and Rockwell. Tension test on a mild steel rod.***	**9+3**
II	**STRESSES IN BEAMS** Types of beams: Supports and Loads - Shear force and Bending Moment in beams - Cantilever, Simply supported - Stresses in beams - Theory of simple bending - Stress distribution along length in beam section - Shear stresses in beams. ***Deflection test on beams.***	9+3
III	**TORSION IN SHAFTS AND HELICAL SPRINGS** Analysis of torsion of circular and hollow shafts - Deflection in shaft subjected to various boundary conditions - Stresses in helical springs and Leaf springs. ***Torsion test on mild steel rod***	9+3
IV	**DEFLECTION OF BEAMS** Evaluation of beam deflection - Double integration method - Macaulay Method - Strain Energy - Strain energy in uniaxial loads. ***Compression test on helical springs.***	9+3
V	**STRESS ANALYSIS IN THIN CYLINDERS & SPHERICAL SHELLS** Stresses in Thin cylindrical shell due to internal pressure, Circumferential and Longitudinal stresses and deformation in Thin Cylinders - Spherical shells subjected to internal pressure - Deformation in spherical shells. ***Testing of impacting resistance of steels.***	**9+3**
	Total Instructional Hours	**(45+15_60**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Apply mathematical knowledge to estimate the deformation behavior of simple structures.
CO2: Calculate shear force and bending moment in different types of beams.
CO3: Determine torsion in shafts and stresses in various types of springs.
CO4: Analyze deflection in various beams.
CO5: Estimate the stresses developed in cylinders and spherical shells.

TEXT BOOK:

T1 -Bansal.R.K, "Text Book of Strength of Materials", Laxmi Publications, New Delhi, 2017.
T2 -Khurmi.R.S, "Strength of Materials", S.Chand Publications, 2016.

REFERENCES:

R1 - Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Seventh Edition, 2017.
R2 - Popov E.P, "Engineering Mechanics of solids", Prentice -Hall of India, New Delhi, Second edition, 2017.
R3 - Ryder G.H, "Strength of Materials, Macmillan India Ltd", Third Edition, 2012.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1	2	-	-	-	-	-	-	2	2	3	3
CO2	3	3	1	2	-	-	-	-	-	-	2	2	3	3
CO3	3	3	1	2	-	-	-	-	-	-	2	2	3	3
CO4	3	3	1	2	-	-	-	-	-	-	2	2	3	3
CO5	3	3	1	2	-	-	-	-	-	-	2	2	3	3
Avg	3	3	1	2	0	0	0	0	0	0	2	2	3	3

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean – Academics
(Dean Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4001	MANUFACTURING TECHNOLOGY LABORATORY - II	0	0	4	2

Course Objective

The student should be able

1. To Study and acquire knowledge on various basic machining operations in special machines and its applications in real life manufacture of components in the industry

Description of the Experiments

1 Contour milling using vertical milling machine.
2 Spur gear cutting in milling machine.
3 Helical Gear Cutting in milling machine.
4 Gear generation in gear hobbing machine.
5 Surface machining and V groove using shaping machine.
6 Internal grooving in slotter machine.
7 Machining operation using Centreless grinding.
8 Tool angle grinding with tool and Cutter Grinder.
9 Measurement of cutting forces in Milling / Turning Process / cycle time estimation.
10 Surface machining in Planner machine.
11 Machining operation using Turret and capstan lathe.
12 CNC Part Programming.

Total Instructional Hours 45

Course Outcome

The Students will be able to
CO1: Demonstrate various machining operations using machine tools
CO2: Fabricate different types of components for industrial applications
CO3: Manufacture tools using cutter grinder.
CO4: Develop CNC part programming for the simple components.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3	-	1	-	2	-	-	-	2	1
CO2	3	3	3	3	3		1		2				2	1
CO3	3	3	3	3	3		1		2				2	1
CO4	3	3	3	3	3		1		2				2	1
CO5	3	1	2	2	1								1	1
Avg	3	2.6	2.8	2.8	2.6	0	0	0	0	0	0	0	1.8	1

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * MINUTES * KARPAGAM COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4002	THERMAL ENGINEERING LABORATORY	0	0	4	2

Course Objective

The student should be able

1. To study the valve timing and port timing diagram.
2. To understand the basic concepts and working of IC engines.
3. To study the characteristics of fuels/Lubricants used in IC engines.
4. To study the principle of air compressor.
5. To study the principle of centrifugal blower.

Description of the Experiments

1. Draw the Valve and Port Timing diagrams.
2. Determination of Brake Thermal Efficiency of a four stroke Diesel Engine.
3. Determination of heat losses by Heat Balance Test in a four stroke Diesel Engine.
4. Determination of Indicated Power of a Multi-cylinder Petrol Engine using Morse Test.
5. Determination of Friction Power of a Diesel Engine using Retardation Method.
6. Determination of Flash and Fire Point of fuels and lubricants by using Pensky Marten's apparatus.
7. Determination of Calorific Value of fuels.
8. Determination of Viscosity of lubricants using Redwood viscometer.
9. Determination of Volumetric and Isothermal Efficiencies of a Two Stage Reciprocating Air Compressor.
10. Determination of stage efficiency of a Centrifugal Blower.

Total Instructional Hours **45**

Course Outcome

The Students will be able to

CO1: Demonstrate the principles of spark ignition and compression ignition engines.
CO2: Evaluate the various performance parameters of Internal Combustion Engines.
CO3: Determine the properties of fuels and lubricating oils.
CO4: Evaluate the performance of air compressors.
CO5: Evaluate the performance of centrifugal blower.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	1	1	-	1	1	-	2	1	-	1	-	-
CO2	2	2	2	2	-	1	2	-	2	2	1	2	2	1
CO3	1	1	1	1	-	1	1	-	2	1	1	1	1	1
CO4	2	2	1	1	-	1		-	2	1	1	1	2	-
CO5	2	2	2	1	-	2	2	-	2	2	1	2	2	2
Avg	1.6	1.6	1.4	1.2	-	1.2	1.2	-	2	1.4	0.8	1.4	1.4	0.8

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * Chairman * HiCET

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	22ME4003	MINI PROJECT	0	0	2	1

Course Objective

The student should be able

1. To develop skills to formulate a technical project.
2. To give guidance on the various tasks of the project and standard procedures.
3. To teach use of new tools, algorithms and techniques required to carry out the projects.
4. To get hands on training in the fabrication of one or more components of a complete working models.
5. To train the students in preparing project reports and to face reviews and viva voce examination.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total Instructional Hours **20**

Course Outcome

The Students will be able to

CO1: Identify the requirement and develop the design solutions.

CO2: Identify technical ideas, strategies and methodologies.

CO3: Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.

CO4: Take up any challenging practical problems and find solution by formulating proper methodology.

CO5: Fabricate any components using different manufacturing tools.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	-	-	-	-	-	-	1	3	2	2
CO2	3	2	3	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	-	-	-	-	-	-	-	1	3	2	2
CO4	3	2	3	-	-	-	-	-	-	-	2	3	2	2
CO5	3	3	3	-	-	-	-	-	-	-	1	3	2	2
Avg	3	2.3	2.6	-	-	-	-	-	-	-	1.3	3	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. MECHANICAL ENGINEERING REGULATION-2019 (Revised on July 2021)

(For the students admitted during the academic year 2021-2022 and onwards)

SEMESTER I – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	25	75	100
2	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	21PH1101	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1101	Engineering Chemistry	BS	2	0	2	3	50	50	100
5	21CS1151	Problem Solving and Python Programming	ES	2	0	2	3	50	50	100
6	21ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21HE1001	Language Competency Enhancement Course - I	HS	0	0	1	1	100	0	100
MANDATORY										
8	21MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	*21HE1072*	*Career Guidance –Level I*	*EEC*	*1*	*0*	*0*	*0*	*100*	*0*	*100*
10	*21HE1073*	*Entrepreneurship & Innovation*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				15	2	11	20	550	350	900

SEMESTER II – 22 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	21PH2151	Materials Science	BS	2	0	2	3	25	75	100
4	21CY2151	Environmental Sciences	BS	2	0	2	3	25	75	100
5	21EE2103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
6	21ME2101	Engineering Mechanics	ES	3	0	0	3	25	75	100
PRACTICAL										
7	21ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	21HE2071/ 21HE2071R	Language Enhancement Course-II	HS	1	0	0	1	100	0	100
9	*21HE2072*	*Career Guidance – Level II*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				18	2	8	22	400	500	900

SEMESTER III – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3101	Fourier Series and Statistics	BS	3	1	0	4	25	75	100
2	21ME3201	Manufacturing Technology-I	PC	3	0	0	3	25	75	100
3	21ME3202	Engineering Thermodynamics	PC	3	0	0	3	25	75	100
4	21ME3203	Engineering Materials and Metallurgy	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	21ME3251	Fluid Mechanics and Machinery	PC	3	0	2	4	50	50	100
PRACTICAL										
6	21ME3001	Manufacturing Technology Lab – I	PC	0	0	3	1.5	50	50	100
7	21ME3002	Computer Aided Drawing Lab	PC	0	0	3	1.5	50	50	100
MANDATORY										
8	21AC3191	India Constitution	AC	2	0	0	0	0	0	0
9	*21HE3071*	*Career Guidance Level – III*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
10	*21HE3073*	*Leadership Management Skills*	*EEC*	*1*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				20	1	8	20	450	450	900

SEMESTER IV – 21 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA4101	Numerical Methods	BS	3	1	0	4	25	75	100
2	21ME4201	Manufacturing Technology – II	PC	3	0	0	3	25	75	100
3	21ME4202	Thermal Engineering	PC	3	0	0	3	25	75	100
4	21ME4203	Kinematics of Machinery	PC	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
5	21ME4251	Strength of Materials	PC	3	0	2	4	50	50	100
PRACTICAL										
6	21ME4001	Manufacturing Technology Lab–II	PC	0	0	3	1.5	50	50	100
7	21ME4002	Thermal Engineering Lab	PC	0	0	3	1.5	50	50	100

MANDATORY										
8	21AC4191	Value Education - Essence of Indian Traditional Knowledge	AC	2	0	0	0	0	0	0
9	*21HE4072*	*Career Guidance Level – IV*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
10	*21HE4073*	*Ideation Skills*	*EEC*	*1*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				20	2	8	21	450	450	900

SEMESTER V – 24 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21ME5201	Dynamics of Machines	PC	3	0	0	3	25	75	100
2	21ME5202	Heat and Mass Transfer	PC	3	1	0	4	25	75	100
3	21ME5203	Design of Machine Elements	PC	3	0	0	3	25	75	100
4	21ME5204	Automobile Engineering	PC	3	0	0	3	25	75	100
5	21ME53XX	**Professional Elective – I**	PE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
6	21ME5251	Machine Drawing	PC	2	0	2	3	50	50	100
PRACTICAL										
7	21ME5001	Dynamics Lab	PC	0	0	3	1.5	50	50	100
8	21ME5002	Heat Transfer Lab	PC	0	0	3	1.5	50	50	100
9	*21HE5071*	*Soft Skills - I*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
10	*21HE5072*	*Design Thinking*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
Total Credits				19	1	8	24	350	525	1000

SEMESTER VI – 24 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21ME6181	Principles of Management	HS	3	0	0	3	25	75	100
2	21ME6201	CAD/CAM	PC	3	0	0	3	25	75	100
3	21ME6202	Metrology and Quality Control	PC	3	0	0	3	25	75	100
4	21ME6203	Design of Transmission Systems	PC	3	0	0	3	25	75	100
5	21ME63XX	**Professional Elective - II**	PE	3	0	0	3	25	75	100
6	21XX64XX	**Open Elective –I**	OE	3	0	0	3	25	75	100
PRACTICAL										
7	21ME6001	CAD/CAM Lab	PC	0	0	3	1.5	50	50	100
8	21ME6002	Metrology and Measurements Lab	PC	0	0	3	1.5	50	50	100
9	*21HE6071*	*Soft Skill-II*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
10	*21HE6072*	*Intellectual Property Rights (IPR)*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
11	21ME6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits				20	0	6	24	450	650	1000

SEMESTER VII – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21ME7201	Finite Element Analysis	PC	3	0	0	3	25	75	100
2	21ME7202	Power Plant Engineering	PC	3	0	0	3	25	75	100
3	21XX74XX	Open Elective -II	OE	3	0	0	3	25	75	100
4	21ME73XX	Professional Elective – III	PE	3	0	0	3	25	75	100
5	21ME73XX	Professional Elective- IV	PE	3	0	0	3	25	75	100
PRACTICAL										
6	21ME7001	Computer Aided Analysis Lab	PC	0	0	3	1.5	50	50	100
7	21ME7002	Comprehension Lab	PC	0	0	3	1.5	50	50	100
8	21ME7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total Credits				15	0	10	20	275	525	800

SEMESTER VIII – 14 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21ME8201	Engineering Economics and Cost Estimation	PC	3	0	0	3	25	75	100
2	21ME8XXX	**Professional Elective- V**	PE	3	0	0	3	25	75	100
PRACTICAL										
3	21ME8901	Project Work – Phase II	EEC	0	0	12	8	100	100	200
Total Credits				6	0	12	14	150	250	400

LIST OF PROFESSIONAL ELECTIVES

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21ME5301	Advanced Foundry Technology	PE	3	0	0	3	25	75	100
2	21ME5302	Advanced Welding Technology	PE	3	0	0	3	25	75	100
3	21ME5303	CNC Technology	PE	3	0	0	3	25	75	100
4	21ME5304	Unconventional Machining Processes	PE	3	0	0	3	25	75	100
5	21ME5305	Hydraulic and Pneumatic systems	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE II

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME6301	Refrigeration and Air Conditioning	PE	3	0	0	3	25	75	100
2	21ME6302	Advanced I.C. Engines	PE	3	0	0	3	25	75	100
3	21ME6303	Design of Heat Exchangers	PE	3	0	0	3	25	75	100
4	21ME6304	Gas Dynamics and Jet Propulsion	PE	3	0	0	3	25	75	100
5	21ME6305	Energy Conservation and Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE III

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME7301	Design of Jigs, Fixtures and Press Tools	PE	3	0	0	3	25	75	100
2	21ME7302	Tool and Die Design	PE	3	0	0	3	25	75	100
3	21ME7303	Mechatronics	PE	3	0	0	3	25	75	100
4	21ME7304	Composite materials	PE	3	0	0	3	25	75	100
5	21ME7305	Industrial Robotics and Expert Systems	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE IV

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME7306	Operations Research	PE	3	0	0	3	25	75	100
2	21ME7307	Industrial Engineering	PE	3	0	0	3	25	75	100
3	21ME7308	Industrial Safety Engineering	PE	3	0	0	3	25	75	100
4	21ME7309	Maintenance Engineering	PE	3	0	0	3	25	75	100
5	21ME7310	Metrology and Non Destructive Testing	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME8181	Total Quality Management	HS	3	0	0	3	25	75	100
2	21ME8182	Entrepreneurship Development and Business Concepts	HS	3	0	0	3	25	75	100
3	21ME8183	Logistics and Supply Chain Management	HS	3	0	0	3	25	75	100
4	21ME8301	Production Planning and Control	PE	3	0	0	3	25	75	100
5	21ME8302	Heating, Ventilation and Air Conditioning Systems	PE	3	0	0	3	25	75	100

OPEN ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	21ME6401	Renewable Energy Sources	OE	3	0	0	3	25	75	100
2	21ME7401	Additive Manufacturing Techniques	OE	3	0	0	3	25	75	100

List of Life Skill Courses under Open Elective									
S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	21LSZ401	General Studies for Competitive Examinations	3	0	0	3	25	75	100
2	21LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	25	75	100
3	21LSZ403	Indian Ethos and Human Values	3	0	0	3	25	75	100
4	21LSZ404	Indian Constitution and Political System	3	0	0	3	25	75	100
5	21LSZ405	Yoga for Human Excellence	3	0	0	3	25	75	100

(Note: Z Stands for semester, students can't choose twice the course)

ADDITIONAL CREDIT COURSE FOR MECHANICAL ENGINEERING

S. No.	Sem. No	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	IV	21ME4071	Geometric dimensioning and tolerance	2	0	0	1	100	-	100
2	V	21ME5071	Tool and Die Design	2	0	0	1	100	-	100
3	VI	21ME6071	Servicing of Refrigeration and Air Conditioning Equipment's	2	0	0	1	100	-	100
4	VII	21ME7071	Energy Auditing Practices	2	0	0	1	100	-	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

* Student can earn extra credit 35 over and above the total credits

Enrollment for B.E. / B. TECH. (HONOURS) / Minor Degree (optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honors) or Minor Degree For B.E. / B. Tech. (Honors), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

Clause 4.10of Regulation 2019 is applicable for the Enrolment of B.E. / B. TECH. (HONOURS) / Minor Degree (Optional).

VERTICALS FOR MINOR DEGREE

Heads are requested to provide one vertical from their program to offer for other program students to register for additional courses (18 Credits) to become eligible for the B.E./B.Tech. Minor Degree.

MECHANICAL ENGINEERING OFFERING MINOR DEGREE PROGRAM IN ELECTRIC VEHICLES

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21ME5231	Sem 5: EV and Sub Systems.	MDC	3	0	0	3	3
2	21ME6231	Sem 6: E vehicle Dynamics	MDC	3	0	0	3	3
3	21ME6232	Sem6: Cell and battery management system	MDC	3	0	0	3	3
4	21ME7231	Sem 7: Electric Motor and control system	MDC	3	0	0	3	3
5	21ME7232	Sem 7: EV sensors and actuators	MDC	3	0	0	3	3
6	21ME8231	Sem 8: EV charging station	MDC	3	0	0	3	3

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

Vertical I

Fintech and Block Chain

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MB5231	Financial Management	MDC	3	0	0	3	3
2	21MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	21MB6232	Banking, Financial Services andInsurance	MDC	3	0	0	3	3
4	21MB7231	Introduction to Blockchain and its Applications	MDC	3	0	0	3	3
5	21MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	21MB8231	Introduction to Fintech	MDC	3	0	0	3	3

Vertical II

Entrepreneurship

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	21MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	21MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	21MB7233	Principles of Marketing Management for Business	MDC	3	0	0	3	3
5	21MB72334	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	21MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

Vertical III

Environment and Sustainability

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21CE5232	Sustainable Infrastructure Development	MDC	3	0	0	3	3
2	21AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	21BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	21ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	21CE7233	Green Technology	MDC	3	0	0	3	3
6	21CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

B E (HONS) MECHANICAL ENGINEERING

DIGITAL AND GREEN MANUFACTURING

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MEXXX1	Sem 5: Digital Manufacturing and IoT	MDC	3	0	0	3	3
2	21MEXXX2	Sem 6: Lean Manufacturing	MDC	3	0	0	3	3
3	21MEXXX3	Sem 6: Modern Robotics	MDC	3	0	0	3	3
4	21MEXXX4	Sem 7: Green Manufacturing Design and Practices	MDC	3	0	0	3	3
5	21MEXXX5	Sem 7: Environment Sustainability and Impact Assessment	MDC	3	0	0	3	3
6	21MEXXX6	Sem 8: Green Supply Chain Management	MDC	3	0	0	3	3

RENEWABLE ENERGY TECHNOLOGY

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MEXXX1	Sem 5: Bioenergy Conversion Technologies	MDC	3	0	0	3	3
2	21MEXXX2	Sem 6: Energy Conservation in Industries	MDC	3	0	0	3	3
3	21MEXXX3	Sem 6: Energy Storage Devices	MDC	3	0	0	3	3
4	21MEXXX4	Sem 7: Solar Energy Technology	MDC	3	0	0	3	3
5	21MEXXX5	Sem 7: Renewable Energy Technologies	MDC	3	0	0	3	3
6	21MEXXX6	Sem 8: New and Renewable Sources of Energy	MDC	3	0	0	3	3

PRODUCT AND PROCESS DEVELOPMENT

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MEXXX1	Sem 5: New Product Development	MDC	3	0	0	3	3
2	21MEXXX2	Sem 6: Ergonomics in Design	MDC	3	0	0	3	3
3	21MEXXX3	Sem 6: Advances in Composite Materials	MDC	3	0	0	3	3
4	21MEXXX4	Sem 7: Logistics and Supply Chain Management	MDC	3	0	0	3	3
5	21MEXXX5	Sem 7: EV Technologies	MDC	3	0	0	3	3
6	21MEXXX6	Sem 8: Heating, Ventilation and Air Conditioning Systems	MDC	3	0	0	3	3

Chairman, BoS

Chairman - BoS
MECH - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College of Engineering & Technology
COIMBATORE - 641 032

SYLLABUS

Programme	Course code	Name of the course	L	T	P	C
B.E.	21MA5201	DYNAMICS OF MACHINES	3	0	0	3

Course Objective

The student should be able

1. To study the method of static force analysis and dynamic force analysis of mechanisms and flywheel.
2. To study the undesirable effects of unbalances in rotors and engines.
3. To learn the concept of natural vibratory systems and their analysis.
4. To learn the concept of forced vibratory systems and their analysis.
5. To know principles of governors and gyroscopes.

Unit	Description	Instructional Hours
I	**FORCE ANALYSIS AND FLYWHEELS** Static force analysis of mechanisms – D Alembert's principle - Inertia force and Inertia torque – Dynamic force analysis - Dynamic Analysis in Reciprocating Engines – Gas Forces – Equivalent masses - Bearing loads - Crank shaft torque – Engine shaking forces. Turning moment diagrams – Fluctuation of energy, speed - Flywheels of engines and punching press.	**9**
II	**BALANCING** Static and dynamic balancing – Balancing of rotating masses - Balancing of reciprocating masses in a single cylinder engine – Primary and secondary unbalanced forces - Balancing in multi- cylinder engines – Balancing machines	9
III	**FREE VIBRATION** Basic features of vibratory systems - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - Natural frequency - Whirling of shafts and critical speed - Torsional vibration of two and three rotor systems, torsionally equivalent shaft. Determination of frequency for various elements.	9
IV	**DAMPED AND FORCED VIBRATIONS** Damped vibration - Types of damping – Logarithmic decrement - Response to periodic forcing - Harmonic Forcing – Forced vibration caused by unbalance - Support motion – Force transmissibility and amplitude transmissibility - Vibration isolation.	9
V	**MECHANISMS FOR CONTROL** Governors - Types - Centrifugal governors – Porter & Proell governor, Hartnell, Hartung – Characteristics - Effect of friction - Controlling Force Gyroscopes - Gyroscopic couple – Gyroscopic stabilization - Gyroscopic effects in airplanes and ships.	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course Student will be able to:

CO1: Calculate the inertia forces in reciprocating and rotating masses and turning moments in flywheels.

CO2: Balance reciprocating and rotating masses.

CO3: Analyze free vibration systems.

CO4: Determine the frequency of damped forced vibration systems.

CO5: Evaluate the gyroscopic couple and sensitivity of governor.

TEXT BOOK:

T1 -Rattan S.S., "Theory of Machines", 3rd edition, TMH, New Delhi, 2009.

T2 -Uicker. J.J, G.R. Pennock, J.E. Shigley, "Theory of Machines and Mechanisms", 4th Ed, Oxford University Press, New York, 2011.

REFERENCES:

R1 -Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 4th Ed, 2010.

R2 -Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East- West Press Pvt. Ltd., New Delhi, 3rd edition, 2004.

R3 -Khurmi, R.S.,"Theory of Machines", 14th Edition, S Chand Publications, 2005.

R4- F. B. Sayyad, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5202	HEAT AND MASS TRANSFER	3	0	0	3

Course Objective

The student should be able

1. To study the various modes of heat transfer and its applications.
2. To enable the students to understand the free and forced convection concepts.
3. To learn about phase change heat transfer and heat exchangers.
4. To acquire knowledge about radiation laws and gas radiation.
5. To enhance the students for understanding the basic concepts of mass transfer.

Unit	Description	Instructional Hours
I	**CONDUCTION** Heat Conduction equation – Cartesian and Cylindrical Coordinates-One Dimensional Steady State Heat Conduction: Plain and Composite Systems- Conduction with heat generation. Extended Surfaces- Unsteady State Heat Conduction: Lumped Analysis, Semi Infinite and Infinite Solids –Use of Heisler's charts.	**9**
II	**CONVECTION** Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer- Free and Forced Convection during external flow over Horizontal, Vertical, Inclined Plates, Cylinders and Internal flow through tubes.	9
III	**PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS** Nusselt's theory of condensation - Regimes of Pool boiling and Flow boiling-Correlations in boiling and condensation. Heat Exchanger Types: Overall Heat Transfer Coefficient, Fouling Factors –Analysis of heat exchanger: LMTD – NTU method.	9
IV	**RADIATION** Basic Concepts, Laws of Radiation – Black and Grey body radiation –radiation shield - Shape Factor– Gas radiations (basics study) - Green House Effect.	9
V	**MASS TRANSFER** Basic Concepts – Diffusion Mass Transfer – Flick's Law of Diffusion – Steady state Molecular Diffusion– Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations.	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Know about the conduction heat transfer concepts in the engineering applications.
CO2: Understand the convection phenomena.
CO3: Solve problems on heat exchangers and phase change heat transfer.
CO4: Gain knowledge about Black Body and Grey body radiation.
CO5: Understand the basics of mass transfer.

TEXT BOOK:

T1 Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, August 2007, Reprint 2008, 3rd edition.
T2 Yunus Cengal "Heat and Mass Transfer" Tata McGraw Hill, 3rd edition, 2008.

REFERENCES:

R1 Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, 3rd Edition, 2006, Reprint 2008.
R2 Nag P.K, "Heat Transfer" - Tata McGraw-Hill, New Delhi, 2002 .
R3 Holman J.P, "Heat Transfer" - Tata McGraw Hill, Ninth edition, 2007.
R4 S.P. Venkateshan, "Heat Transfer", Ane Books, New Delhi, 2014

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH * ACADEMIC COUNCIL * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
		DESIGN OF MACHINE ELEMENTS				
B.E.	21ME5203	(Common to mechanical and Automobile Engineering)	3	0	0	3

Course Objective

The student should be able

1. To study the design function in mechanical engineering, different steps involved in designing and the relation of design activity with manufacturing activity.
2. To know the different types of failure modes and criteria.
3. To learn the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
4. To gain design knowledge of the different types of elements used in the machine design process, for e.g. Shafts, couplings etc. and will be able to design these elements for each application.
5. To learn to use catalogues and standard machine components

Unit	Description	Instructional Hours
I	**STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS** Introduction to the design process - factors influencing machine design – selection of materials based on mechanical properties–preferred numbers, fits and tolerances - calculation of principal stresses for various load combinations, eccentric loading – theories of failure –Variable stresses - Soderberg, Gerber and Goodman methods for combination of stresses and their application in design problems.	**10**
II	**DESIGN OF SHAFTS AND COUPLINGS** Design of solid & hollow shaft based on strength and rigidity with steady loading subjected to pure torsion. Design of shafts carrying pulleys & gears (Combined loading), Design and drawing of couplings – Rigid and Flexible.	8
III	**DESIGN OF TEMPORARY AND PERMANENT JOINTS** Threaded fasteners - Bolted joints, Knuckle joints – Welded joints, riveted joints for structures – theory of bonded joints	9
IV	**DESIGN OF SPRINGS AND FLYWHEEL** Various types of springs, Design of helical springs and Leaf springs – Design of Flywheel considering stresses in rims and arms for engines and presses.	9
V	**DESIGN OF BEARINGS** Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfield Number, Raimondi and Boyd graphs- Selection of Rolling Contact bearings.	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1 - Demonstrate the use of stress analysis, theories of failure and materials in the design of machine components.

CO2 - Identify proper assumptions with respect to material, factor of safety, static and dynamic loads for various machine components.

CO3 - Design shafts based on strength and rigidity and couplings.

CO4 - Design springs and considering stresses in flywheel components.

CO5 - Design Sliding contact and rolling contact bearings.

TEXT BOOK:

T1. Bhandari V.B, “Design of Machine Elements”, 3rd Edition, Tata McGraw-Hill Book Co, 2010.

T2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett “Mechanical Engineering Design”, 8th Edition, Tata McGraw-Hill, 2008

REFERENCES:

R1. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Design”, 4th Ed, Wiley, 2005.

R2. Alfred Hall, Halowenko, A and Laughlin, H., “Machine Design”, Tata McGraw-Hill BookCo.(Schaum’s Outline), 2010.

R3. Sundararajamoorthy T. V. Shanmugam .N, “Machine Design”, Anuradha Publications, Chennai, 2003.

R4. Ansel C Ugural, “Mechanical Design – An Integral Approach”, 1st Edition, Tata McGraw-Hill Book Co, 2004

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5204	AUTOMOBILE ENGINEERING	3	0	0	3

Course Objective

The student should be able

1. The anatomy of the automobile in general.
2. The location and importance of each part.
3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels.
4. Suspension, frame, springs and other connections.
5. Emissions, ignition, controls, electrical systems and ventilation.

Unit	Description	Instructional Hours
I	**VEHICLE STRUCTURES AND ENGINE** Types of Automobiles - Vehicle Construction, Chassis –Types, Frame and Body – Types. Engine types, Components of Engine – Functions and Materials. Vehicle aerodynamics, Introduction to Electronic Engine Management System.	9
II	**FUEL SUPPLY SYSTEM AND ELECTRICAL SYSTEM** Carburetion and Simple carburetor - Electronically controlled gasoline fuel injection system – Mono- point and Multi-Point Fuel Injection Systems (MPFI). Diesel engine fuel supply system - Types, Electronically controlled diesel fuel injection system – CRDI. General layout of electrical system – Different sub circuits. Construction and operation of battery - Lighting system – Starting motor and drives.	9
III	**TRANSMISSION SYSTEMS** Clutch – Types and Construction, Gear Boxes – Types, Manual and Automatic, Selector mechanism - Over Drives – Transfer Box - Fluid flywheel - Torque converter – Propeller shaft – Slip Joint – Universal Joints – Differential unit. Rear Axle – Hotchkiss drive and Torque Tube drive. Turbocharger and supercharger.	9
IV	**STEERING, BRAKES AND SUSPENSION SYSTEMS** Wheels and Tyres – Wheel alignment parameters, Types of Front axle - Steering geometry and mechanism - Steering gear box and types – Power Steering. Brakes – Types, Hydraulic and Pneumatic braking systems - Construction and working, Antilock Braking System, electronic brake force distribution (EBD) and Traction Control.	9
V	**ALTERNATIVE FUELS IN AUTOMOBILES** Introduction to MV Act, Pollution Norms, Alternative fuels - Hydrogen- Ethanol – Compressed Natural Gas (CNG) - Liquefied Petroleum Gas (LPG), alternative power plants, Nano flow – Electric - Hybrid Vehicle -Fuel Cells-Solar Cars. Emission Control & Safety: Global Standards, Indian Pollution norms for Petrol & Diesel vehicles, Safety measures in automobiles.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1 - Understand the function of various automobile components and engine parts.
CO2 - Understand the fuel supply systems and electrical systems in automobiles.
CO3 - Understand the working of transmission system and its various elements.
CO4 - know the working of suspension, steering and braking systems.
CO5 - Understand the various alternate fuels that could be used in automobiles.

TEXT BOOK:

T1 Kirpal Singh, “Automobile Engineering”, Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 2011.
T2 Jain K.K. and Asthana .R.B, “Automobile Engineering” Tata McGraw Hill Publishers, New Delhi, 2002.

REFERENCES:

R1 Joseph Heitner, “Automotive Mechanics,” Second Edition, East-West Press, 2006.
R2 Martin W, Stockel and Martin T Stockle , “Automotive Mechanics Fundamentals,” The Good heart –Will Cox Company Inc, USA ,2002.
R3 Srinivasan S., "Automotive Mechanics", Tata McGraw Hill, 2nd Edition, 2009.
R4 Ganesan V. “Internal Combustion Engines”, Third Edition, Tata McGraw-Hill, 2012

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * NAMAKKAL * KSR COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5251	MACHINE DRAWING (Theory with Lab Component)	2	0	2	3

Course Objective

The student should be able

1. To impart the knowledge of limits, fits and tolerances, orthographic-sectional and assembly drawing procedures.
2. To provide the practice to draw assembly orthographic views of various machine parts.
3. To provide the practice and develop the detailed part drawing.
4. To impart the knowledge of shape and structure of different types of screws, keys and Couplings.
5. To provide the practice and develop the detailed mechanical components drawing.

Unit	Description	Instructional Hours
I	**LIMITS, FITS AND TOLERANCES** Limit System- Tolerance, Limits, Deviation, Actual Deviation, Upper Deviation, Lower Deviation, Allowance, Basic Size, Design Size, Actual Size. Fits-Types, Tolerances of Form and Position-Form and Position Variation, Geometrical Tolerance, Tolerance Zone, Indicating Geometrical Tolerances. Indication of Surface Roughness, Standard Abbreviations and Symbols used in industries.	**7**
II	**SECTIONAL VIEWS** Sections- Hatching of Sections, Cutting Planes, Revolved or Removed Section, Sectional Views- Full Section, Half Sections and Auxiliary Sections.	7
III	**STANDARD PART DRAWINGS** Drawing standards and Designation of Bolts, nuts, screws, keys, pins, Rivets, Welded Joints- Dimensioning of Welds	7
IV	**DRAWINGS OF VARIOUS VIEWS** Shaft joints: Cotter joint and Knuckle joint. Keys & Shaft coupling: Flanged coupling, Flexible coupling and Universal coupling. Shaft bearing: Solid and bush bearing, Plummer block. Pulley: Belt pulley, V belt pulley.	12
V	**ASSEMBLY DRAWING OF MECHANICAL COMPONENTS** Lathe Tail stock, Machine Vice, Pipe Vice, Simple Eccentric, Screw jack, Stuffing Box, Plummer Block.	**12**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1 Use limits, fits and tolerances, orthographic-sectional and assembly drawing procedures in real world problems.

CO2 Apply sectional view, assembly and orthographic concepts to draw various machine parts.

CO3 Understand the Concept of fasteners and different joints.

CO4 Draw and demonstrate the projections and sectional views of various mechanical elements.

CO5 Construct assembly drawings of mechanical components.

TEXT BOOK:

T1. Narayana K.L. and Kannaiah P., ―Machine Drawing, 4th Edition, New Age International Publishers Ltd., New Delhi, 2010.

T2. Gopalakrishna K.R., ―Machine Drawing‖, 22nd Edition, Subhas Publications, New Delhi, 2013.

REFERENCES:

R1. Bhatt N.D. and Panchal V.M., ―Machine Drawing‖, 45th Edition, Charotar Publishing House Pvt. Ltd., Gujarat, 2010.

R2. Sidheswar N., Kannaiah P., Sastry V.V., ―Machine Drawing‖, 27th Reprint, Tata-McGraw Hill Education, Chennai, 2004.

R3. Faculty of Mechanical Engineering ―Design Data‖, Revised Edition 1978, Reprint on October 2011, Kalaikathir Achchagam, 2011.

R4. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5001	DYNAMICS LABORATORY	0	0	3	1.5

Course Objective

The student should be able

1. To learn the concepts of generalized forces and the Principle of Virtual Work.
2. To acquire concepts of static and dynamic mass balancing and flywheels.
3. To be aware of the approaches and mathematical models used dynamical analysis of machinery.
4. To learn the applications of measuring devices used for dynamic testing.

Description of the Experiments

1. Experimental study of velocity ratio for various types of gear trains – simple and Compound.
2. To draw the profile of CAM and to determine the jump speed of cam.
3. To perform static balancing on static balancing machine.
4. To perform dynamic balancing on dynamic balancing machine.
5. To determine Moment of Inertia of Round bar by Bifilar Suspension and Compound Pendulum.
6. To determine the Natural Frequency of Torsional Vibrations.
7. To determine the following:
   a) Natural Frequency of Longitudinal Vibrations of helical spring.
   b) Transverse Vibrations.
8. To determine the critical speed of Shaft.
9. T0 perform experiment on Watt and Porter Governors and draw the performance characteristic Curves, find stability and sensitivity
10. To perform experiment on Proell Governor and draw performance characteristic Curves, find stability & sensitivity.
11. To determine the gyroscopic couple on Motorized Gyroscope.

Total Instructional Hours 45

Course Outcome

The Students will be able to

CO1	Understand the velocity ratio for various types of gear trains – simple and Compound.
CO2	Conduct experiments on vibrating bodies for predicting natural frequency.
CO3	Draw the cam profiles.
CO4	Perform experiments on balancing of masses and determine unbalanced force.
CO5	Draw characteristic curves for governors and effect of gyroscopic couple.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5002	HEAT TRANSFER LAB	0	0	3	1.5

Course Objective

The student should be able

1. Determination of thermal conductivity of conduction apparatus.
2. Determination of the heat transfer coefficient of convection apparatus.
3. Calculation of effectiveness of heat exchangers.
4. Determination of emissivity of a grey surface.
5. Performance of air conditioning and refrigeration systems.

Description of the Experiments

1. Thermal conductivity measurement using guarded plate apparatus.
2. Thermal conductivity measurement of pipe insulation using lagged pipe apparatus.
3. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
4. Determination of heat transfer coefficient under forced convection from a tube.
5. Determination of Thermal conductivity of composite wall.
6. Determination of Thermal conductivity of insulating powder.
7. Heat transfer from pin-fin apparatus.
8. Determination of Stefan – Boltzmann constant.
9. Determination of Emissivity of a grey surface.
10. Effectiveness of Parallel / Counter flow heat exchanger.
11. Performance test on refrigeration system.
12. Performance test on air-conditioning system.

Total Instructional Hours **45**

Course Outcome

The Students will be able to
CO1: Apply the various modes of heat transfer in thermal systems.
CO2: Understand the working principle of refrigeration and air conditioning systems.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21HE5071	SOFT SKILLS - I	1	0	0	1

Course Objective

The student should be able

1. To employ soft skills to enhance employability and ensure workplace and career success.
2. To enrich students' numerical ability of an individual and is available in technical flavor.
3. To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO SOFT SKILLS** Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management- Critical Thinking-Reflective thinking and writing- p2p Interaction	3
II	**ART OF COMMUNICATION** Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
III	**WORLD OF TEAMS** Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	3
IV	**QUANTITATIVE APTITUDE** Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	**LOGICAL REASONING** Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	4
	Total Instructional Hours	**15**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.

CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others

CO3: Students will understand how teamwork can support leadership skills

CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.

CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.

REFERENCES:

R1 Frederick H. Wentz , Soft Skills Training: A Workbook to Develop Skills for Employment

R2 Arun Sharma, How to prepare for data interpretation for CAT.

R3 Jaikishan and Premkishan, How to Crack TEST OF REASONING in all competitive examinations.

R4 B.S. Sijwali, A New Approach To Reasoning Verbal & Non-Verbal

R5 Dr. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations - S. Chand

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5072	DESIGN THINKING	1	0	0	1

Course Objective

The student should be able

1. To expose students to the design process
2. To develop and test innovative ideas through a rapid iteration cycle.
3. To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
I	**DESIGN ABILITY** Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	**4**
II	**DESIGNING TO WIN** Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	4
III	**DESIGN TO PLEASE AND DESIGNING TOGETHER** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	4
IV	**DESIGN EXPERTISE** Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert.	3
	Total Instructional Hours	**15**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Develop a strong understanding of the Design Process

CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.

CO3: Develop teamwork and leadership skills

TEXT BOOK:

T1 Nigel Cross, “Design Thinking”, Kindle Edition

REFERENCES:

R1 Tom Kelley, “Creative Confidence”, 2013

R2 Tim Brown, “Change by Design”, 2009.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

PROFESSIONAL ELECTIVE – I

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5301	ADVANCED FOUNDRY TECHNOLOGY	3	0	0	3

Course Objective

The student should be able

1. To provide problem solving skills among students in various foundry technologies.
2. To learn the understanding of basic facts and concepts in foundry process while retaining the excitement of foundry industry.
3. To know the foundry technology in academic and Industrial courses.
4. To provide practical knowledge in the fields of foundry concepts like investment castings, shell moulding, die castings, etc.
5. To learn about testing and quality assurance in foundry.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FOUNDRY AND PATTERN** Introduction foundry as a manufacturing centre and types of foundries. Types of patterns Pattern materials-Pattern allowances-Pattern layout, Pattern making	9
II	**GATING AND RISERING SYSTEM** Gates and risers -their functions - Types - Design principles, design of gating and risering for steels and cast irons	9
III	**MOULDING AND CORE MAKING** Materials: Ingredients, properties, Moulding methods:- Green sand moulding, dry sand moulding, CO2moulding, no bake moulding, shell moulding, Investment casting, permanent moulding, die casting and centrifugal casting, Cold box and Hot box. No bake processes.	9
IV	**MELTING AND POURING PRACTICE** Classification of melting furnaces used in Foundry, Selection of melting furnaces, essential features of a melting furnace, Refractory materials – types, properties and application. Cupola melting - Cupola furnace: types of cupola- divided blast, hot blast, oil fired, coke less etc., Furnaces heated by electricity - Resistance, Arc and Induction furnaces various types, brief description and application and merits of each. Influence of melting and pouring practice on casting quality, shop floor tests for quality assurance.	9
V	**PRODUCTION PRACTICE FOR FERROUS AND NON-FERROUS METALS** Important aspects of foundry practice for castings of Cast irons – grey, malleable and ductile irons, modularizing treatment. Steel foundry practice, practice and quality control in moulding, melting and pouring for production of carbon and alloy steel castings, High –manganese and Stainless steel castings, finishing operations and safety aspects. Foundry practice for copper and aluminum alloys, melting and pouring practice, degassing and dross removal, precautions required. Cleaning of castings: knockout, fettling, shot blasting and grinding of casting components. Hardness tests and Tensile tests of castings, Non-destructive tests of castings. Casting defects: Causes and remedial measures	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the use of foundry in manufacturing sector and design of patterns for steel and cast Iron components.

CO2: Understand the concepts of Gates and risers for steel and cast iron components.

CO3: Analyze moulding materials and methods such as green sand ,dry sand, carbon dioxide, Investment casting, Die casting and permanent moulding for steel and cast iron Weighing upto 25kg.

CO4: Gain the knowledge about different types of furnaces.

CO5: Understand theoretical knowledge in testing and determine the composition, temperature, sand reclamation, moulding machines for foundry and cast iron components.

TEXT BOOK:

T1. Heine R W., Loper,C.R.Rosenthal,P.C., “Principles of Metal Casting”, Tata-McGraw Hill,New Delhi 2017.

T2. Jain P.L,”Principles of Foundry Technology”, Tata-McGraw Hill, New Delhi,2004.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5302	ADVANCED WELDING TECHNOLOGY	3	0	0	3

Course Objective

The student should be able

1. To learn the basic skill in welding technologies.
2. To learn the special processes which require competency & certification to perform the job activity.
3. To learn some common hazards in welding.
4. To learn about proper personal protection used in welding.
5. To learn safety techniques for storing and handling cylinders.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Welding as compared with other fabrication processes, Importance and application of welding, classification of welding processes, Health & safety measures in welding. **Welding Power Sources:** Physics of welding Arc, Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators. **Physics of Welding Arc:** Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow, Electrode Polarity, Flux Covering. **Metal Transfer:** Mechanism and types of metal transfer in various arc welding processes. Case studies and applications -automotive and aerospace.	**9**
II	**WELDING PROCESSES** Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electro gas and Electro slag, Flux Cored Arc Welding, Resistance welding, Friction welding, Friction Stir welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding, Underwater welding & Microwave welding. Robotic welding.	9
III	**HEAT FLOW WELDING** Calculation of peak temperature; Width of Heat Affected Zone (HAZ); cooling rate and solidification rates, weld thermal cycles, residual stresses and their measurement, weld distortion and its prevention.	9
IV	**REPAIR & MAINTENANCE WELDING** Hard facing, Cladding, Surfacing, Metalizing processes and Reclamation welding Weldability: Effects of alloying elements on weld ability, welding of plain carbon steel, Cast Iron and aluminum. Micro & Macro structures in welding.	9
V	**WELD DESIGN** Types of welds & joints, Joint Design, Welding Symbols, weld defects, Inspection/testingof welds, Introduction to Welding Procedure Specification & Procedure Qualification Record. Life Assessment of Weldment	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to

CO1: Gainthe Knowledge in advanced welding technology.

CO2: Select and operate tools and equipment to support welding and related activities.

CO3: Choose and interpret basic blueprints and welding symbols to fabricate components.

CO4: Develop skills in Gas Metal Arc Welding to industry standards.

CO5: Apply Gas Tungsten Arc Welding to industry standards and pass the AWS Aluminum Aerospace Certification.

TEXT BOOK:

T1: Welding Engineering and Technology – R. S. Parmar, M/s. Khanna Publishers, 2-B Nath Market, NaiSarak, Delhi – 6.

T2: Welding Handbook, American Welding Society, Section-II: Gas Arc and Resistance.

REFERENCES:

R1: Welding and Welding Technology, by- Richard L. Little, McGraw Hill Education.

R2: Welding Principals and Practices, by- Edwars R. Bohnart, McGraw Hill Education.

R3: Welding Engineering and Technology, by- R. S. Parmar,KhannaPublishsers.

R4 Hull., 'Non-Destructive Testing', ELBS Edition, 1991

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5303	CNC TECHNOLOGY	3	0	0	3

Course Objective

The student should be able

1. To impart knowledge in CNC machine tool building.
2. To construct Tooling and work holding devices.
3. To generate CNC codes using CAM software.
4. To develop part programming skills.
5. To illustrate numerical control techniques and functions.

Unit	Description	Instructional Hours
I	**CNC MACHINE TOOLS** CNC Systems-machine control-Interpolations and components. Machining and Turning centres, CNC drilling, milling and grinding machines. Maintenance of CNC machines	**9**
II	**CNC CONSTRUCTIONAL FEATURES** Spindle drives-Transmission belting-Axes feed drives-Sideways-Accessories of Machining and Turning centres. Tools-Tool holders-Tool planning-work holding-fixtures. Feedback devices in CNC machine tools.	9
III	**MANUAL PART PROGRAMMING** Nomenclature - CNC machines, block format-preparatory functions - fixed canned cycles - miscellaneous function - tool offset- tool nose radius compensation - Datum setting - Programs on Turning and Milling	9
IV	**COMPUTER AIDED PART PROGRAMMING** Languages for computer aided part programming-Geometric statements in APT - Point to Point Programming-Programming a tool path-Post processor statements.	9
V	**MANUFACTURING AUTOMATION** Direct numerical control-Flexible manufacturing cells and systems-Integration of manufacturing systems-Tools for manufacturing-Functions of a computer integrated manufacturing. Co-ordinate measuring machine. Robot applications in automation.	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Illustrate the parameters of metal cutting and understand the components of CNC system.
CO2: Select the appropriate drives and controls for CNC machines.
CO3: Construct part programming for various machining process.
CO4: Compute operation and maintenance cost of CNC machines.
CO5: Develop Flexible manufacturing cells and systems.

TEXT BOOK:

T1 -Kalpakjian S. and Schmid S.R., "Manufacturing Engineering and Technology", 5th Edition, Pearson Education India, New Delhi, 2014.
T2 - Radhakrishnan P., "Computer Numerical Control Machines" , New Central Book Agency, 2013.

REFERENCES:

R1 -Narang J.S. and Narang V.D.S., - "CNC Machines and Automation", Dhanpat Rai and Co. Pvt. Ltd., 2014.
R2 - HMT Limited, "Mechatronics", Tata McGraw-Hill, New Delhi, 2001.
R3 -Thyer G.E., "Computer Numeric Control of Machine Tools", 2nd Edition, Butterworth- Heinemann, Burlington, 1996.
R4 -Radhakrishnan P, SubramanyanS.andRaju V., "CAD/CAM/CIM", 2nd Edition, New AgeInternational (P) Ltd, New Delhi,2000.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5304	UNCONVENTIONAL MACHINING PROCESSES	3	0	0	3

Course Objective

The student should be able

1. To learn about various unconventional machining processes.
2. To know the various mechanical energy based process parameters and their influence on performance and their applications.
3. To understand the electrical energy based machining processes.
4. To know the chemical energy based metal removal processes.
5. To learn about thermal energy used in machining processes.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Traditional machining process - Need for non-traditional machining – Classification of modern machining process	**6**
II	**MECHANICAL ENERGY BASED PROCESSES** Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining – Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – Equipment used – Process parameters – MRR- Applications.	9
III	**ELECTRICAL ENERGY BASED PROCESSES** Electric Discharge Machining (EDM) - working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.	9
IV	**CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES** Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant techniques of applying Maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters ECG and ECH - Applications.	11
V	**THERMAL ENERGY BASED PROCESSES** Laser Beam machining and drilling (LBM), Oxyfuel cutting, (Plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques- Applications. **VISUAL STUDY:** Basics of thermal cutting process-Sample product manufacturing process	**10**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Upon completion of this course Demonstrate different unconventional machining processes.

CO2: Identify the influence of difference process parameters and their applications.

CO3: know the mechanical energy based process.

CO4: Gain knowledge about chemical energy processes.

CO5: Understand thermal energy based manufacturing processes

TEXT BOOK:

T1 -Vijay.K. Jain “Advanced Machining Processes” Allied Publishers Pvt. Ltd., New Delhi, 2007

T2- Pandey P.C. and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2007.

REFERENCES:

R1 - Benedict. G.F. “Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 1987.

R2 -Paul De Garmo, J.T.Black, and Ronald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., 8thEdition, New Delhi, 2001.

R3 - Mc Geough, “Advanced Methods of Machining”, Chapman and Hall, London, 1998.

R4 -Adithan. M., “Unconventional Machining Processes”, Atlantic, New Delhi, India, 2009. ISBN13: 9788126910458.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME5305	HYDRAULICS AND PNEUMATICS SYSTEMS	3	0	0	3

Course Objective

The student should be able

1. To know the physical properties to the hydraulic systems and basic laws of hydrostatics and hydrodynamics.
2. To know the theory of operation and the structure and know the symbols of pumps, cylinders, hydraulic motors and the directional control valves and the control valves of pressure and flowrate.
3. To know of the basic properties of the compressed air as medium used in energy transmission for the purposes of control and the other necessary specific properties of the compressed air.
4. To know the principles that should awarded in preparing the compressed air, the devices that are used in pneumatic energy conversion also the control devices in the pneumatic energy.
5. To provide exposure to various problems and maintenance of Hydraulic and Pneumatic circuits for various engineering applications.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO FLUID POWER AND HYDRAULIC PUMPS** Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – Fluid power symbols. Basics of Hydraulics - Applications of Pascal's Law. Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps.	9
II	**HYDRAULIC ACTUATORS AND CONTROL VALVES** Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder. Control Valves: Director control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable	9
III	**DESIGN OF HYDRAULIC SYSTEMS AND INDUSTRIAL APPLICATIONS** Reciprocating circuit, Synchronizing circuit, Regenerative circuit, Pump unloading circuit, Counterbalance valve circuit. Types of accumulators – Accumulators circuits, sizing of accumulators- Intensifier, Fail-safe circuits - Speed control circuits	9
IV	**PNEUMATIC SYSTEMS AND COMPONENTS** Properties of air – Compressors – Filter, Regulator, Lubricator, and Muffler – Air control valves, Quick exhaust valves, pneumatic actuators. Sequential circuit design for simple applications using cascade method.	9
V	**SERVO SYSTEMS AND MAINTENANCE** Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits. Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting. Internet of things in automation.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO 1: Choose hydraulic and pneumatic elements and demonstrate the applicability of fluid power systems for engineering applications.

CO 2: Design customized circuits in hydraulics, pneumatics and servo systems for various industrial needs.

CO 3: Draw and explain the working of various types of pumps and hydraulic motors and cylinders.

CO 4: Explain the fundamentals of pneumatic systems and working of pneumatic components.

CO 5: Draw ladder logic diagrams and explain about low cost automation.

TEXT BOOK:

T1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2000.

T2. Peter Rohner, "Industrial Hydraulic Control" 4th Revised Edition 2005

REFERENCES:

R1. Majumdar S.R.,"Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Semester – V

Course Code & Name : 21ME5201 Dynamics of Machines

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	-	-	1	-	-	-	-	1	1	2	2
CO2	2	1	-	2	-	-	1	-	-	-	2	1	2	1
CO3	3	1	1	1	1	2	-	-	-	-	1	2	3	1
CO4	2	1	1	1	1	2	-	-	-	-	1	2	2	1
CO5	1	1	1	1	-	1	-	-	-	-	-	-	1	1
Avg	2	1.2	1	1	0.4	1.2	0.2	0	0	0	1	1.2	2	1.2

Course Code & Name : 21ME5202 Heat and Mass Transfer

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	1		1						1	1	1
CO2	3	1	1	1		2	2		1		1	1	1	1
CO3	3	1	1	1								1	1	1
CO4	3	1	1	1								1	1	1
CO5	3	1	1	1		2	1		1		1	1	1	1
Avg	3	1	1	1		1	0.6		0.4		0.4	1	1	1

Course Code & Name : 21ME5203 Design of Machine Elements

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	2	2	-	-	-	-	-	2	2	3	2
CO2	3	3	1	2	2	-	-	-	-	-	-	1	3	3
CO3	3	3	1	2	1	-	-	-	-	-	1	1	3	3
CO4	3	3	2	2	2	-	-	-	-	-	1	1	3	3
CO5	3	3	3	2	2	-	-	-	-	-	1	1	3	3
Avg	3	2.8	1.6	2	1.8	0	0	0	0	0	1	1.2	3	2.8

Course Code & Name : 21ME5204 Automobile Engineering

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	**1.4**	**1**	**1.8**	**1.2**	**1.2**	**1.4**	**1.2**	**1**	**1**	**1.4**	**1**	**1**	**2**	**1.2**

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * MNM JAIN ENGINEERING COLLEGE * Chairman

Dean – Academics

Dean (Academics)
HiCET

Course Code & Name : 21ME5251 Machine Drawing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	-	1	-	-	-	-	-	2	-	1
CO2	2	2	1	1	-	-	-	-	-	-	-	1	-	1
CO3	2	3	3	1	1	-	-	-	-	-	-	1	-	1
CO4	3	2	2	2	1	-	-	-	-	-	-	2	1	1
CO5	3	2	2	2	1	-	-	-	-	-	-	2	1	1
Avg	3	2	2	1	-	1	-	-	-	-	-	2	-	1

Course Code & Name : 21ME5303 - CNC Technology

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	1	1	2	-	2
CO2	-	-	-	-	3	-	-	-	-	1	1	3	1	1
CO3	-	-	-	-	3	1	-	-	3	2	1	3	1	2
CO4	-	-	1	2	-	-	-	-	1	3	1	2	2	2
CO5	-	-	1	2	-	1	-	-	1	2	1	3	2	1
Avg	-	-	1	2	3	1	-	-	1.3	1.8	1	2.6	1.5	1.6

Course Code & Name : 21ME5305 Hydraulic and Pneumatic Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	**1.4**	**1**	**1.8**	**1.2**	**1.2**	**1.4**	**1.2**	**1**	**1**	**1.4**	**1**	**1**	**2**	**1.2**

Course Code & Name: 21ME5001 Dynamics Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	2	-	-	-	-	1	2	3	1
CO2	3	-	-	-	-	2	-	-	-	-	2	2	3	1
CO3	3	-	-	-	-	2	-	-	-	-	2	2	3	1
CO4	3	-	-	-	-	2	-	-	-	-	2	2	3	1
CO5	3	-	-	-	-	2	-	-	-	-	2	3	3	1
Avg	3	0	0	0	0	2	0	0	0	0	1.8	2.2	3	1

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * KAMARAJ COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Course Code & Name: 21ME5002 Heat Transfer Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	1	1	1	1	-	-	1	-	1	-	-	-
CO2	2	2	1	2	-	-	-	-	1	1	1	1	2	2
CO3	2	2	2	2	-	2	-	-	1	1	1	1	2	2
CO4	2	2	2	1	-	2	2	-	1	2	1	1	2	2
CO5	2	2	2	2	-	2	2	-	-	2	1	-	2	2
Avg	**2**	**1.8**	**1.6**	**1.6**	**0.2**	**1.4**	**0.8**	**-**	**0.8**	**1.2**	**1**	**0.6**	**1.6**	**1.6**

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6181	PRINCIPLES OF MANAGEMENT	3	0	0	3

Course Objective

The student should be able

1. To study the evolution of Management and learn the functions and responsibilities of managers.
2. To Plan and know the tools and techniques to be used in the performance of the managerial job.
3. To enable them to analyze and understand the environment of the organization.
4. To understand the proper vocabulary to communicate effectively.
5. To comprehend the cognizance of the importance of control methods

Unit	Description	Instructional Hours
I	**PRINCIPLES OF MANAGEMENT** Meaning, Definition and Significance of Management, Basic Functions of Management – Planning, Organizing, Staffing, Directing and Controlling.	9
II	**INDUSTRIAL AND BUSINESS ORGANIZATION** Growth of Industries (Small Scale, Medium Scale and Large Scale Industries). Forms of Business Organizations. Resource Management – Internal and External Sources. Social Responsibility of Engineers.	9
III	**COSTING MANAGEMENT** Overview of Accounting – Costing – Meaning – Cost classification – Cost sheet – Tender and Quotations – Marginal costing – Break Even Analysis	9
IV	**SALES AND MARKETING MANAGEMENT** Marketing mix – Sales Vs Marketing - Sales strategies – Targeting – Positioning – Segmentation – Product Life Cycle	9
V	**HUMAN RESOURCE MANAGEMENT AND WELFARE IN INDUSTRY** Nature of Human Resource Management – Selection – Performance appraisal – career strategy – EPF – ESI - Gratuity – Cultural Diversity. Welfare in Industry - Working condition, service facilities, legal legislation – Factories Act, 1948 and Workmen's Compensation Act.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course Student will be able to:

CO1. Analyze the challenges independently in the work place.
CO2: Create the types of business for one's new venture.
CO3: Analyze the impact of costing in business decisions.
CO4: Demonstrate the various marketing and selling techniques.
CO5: Apply HR and factory Act principles in business.

TEXT BOOK:

T1- Chuck Williams & Manas Ranjan Tripathy, "Principles of Management", Cengage Learning India Pvt. Ltd., New Delhi, 2013.
T2- Harold Koontz, Heinz Weihrich and Ramachandra Aryasri, "Principles of Management", Tata McGraw Hill, New Delhi, 2004.

REFERENCES:

R1- Robert Kreitner, "Management Theory and Application", Cengage Learning India Pvt. Ltd., New Delhi, 2010.
R2 -Rao V.S.P., "Management Text and Cases", Excel books, New Delhi, 2009.
R3- Robert Kreitner, "Management Theory and Application", Cengage Learning India Pvt. Ltd., New Delhi, 2010.
R4- Fred Luthans, "Organizational Behavior", Mc-Graw Hill, New York, 2005.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	2	3	2	3	2	-	3
CO2	-	1	-	-	-	-	-	1	2	2	3	3	1	1
CO3	-	-	-	-	-	-	-	2	3	3	3	3	1	1
CO4	-	-	-	-	-	-	-	2	3	3	3	3	2	2
CO5	-	-	-	-	-	-	-	1	2	2	3	3	1	1
Avg	0	0.2	0	0	0	0	0.4	1.6	2.6	2.4	3	2.8	1	1.6

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6201	CAD / CAM	3	0	0	3

Course Objective

The student should be able

1. To learn the basics of computer based modelling.
2. To Study important methods of principles of modeling features.
3. To learns about CNC machine tools and part programming.
4. To develop process planning techniques and product data management.
5. To learn about integrated manufacturing systems.

Unit	Description	Instructional Hours
I	**PRODUCT CYCLE AND COMPUTER GRAPHICS** Design process-Product development cycle-Sequential engineering-Concurrent engineering- Evolution of CAD/CAM and CIM, Graphic Primitives-Point Plotting-Drawing of lines-View port- 2D and 3D transformations-Clipping	9
II	**GEOMETRIC MODELING TECHNIQUES** CAD process, Wireframe modeling- Surface Modeling-Representation of curves and surfaces- Hermite, Bezier, B-Spline and Rational curve- Types of surfaces. Solid modeling, Drawing utilities-entities-blocks-display-hatching-pattern-dimensioning-enquiry- plotting-Customisation-file interchange-office management-Data transfer. Assembly, Drafting and mechanism.	9
III	**CNC MACHINE TOOLS** NC machine principles-Types of CNC machines-Features of CNC systems-Programming Features- Diagnostic Features-DNC and its Integration-Controllers-Technology and Procedure of CAM.	9
IV	**COMPUTER AIDED MANUFACTURING SYSTEMS** Process planning-computer aided process planning-Group technology-Part families-classification and coding-production flow analysis-Cellular manufacturing systems-Flexible manufacturing systems- Additive Manufacturing- Reverse Engineering process- Virtual Manufacturing-Knowledge Based Engineering.	9
V	**COMPUTER INTEGRATED MANUFACTURING** CIM as a concept and a technology, Benefits of CIM, Product data management-Artificial intelligence and Expert system in CIM. Master production schedule-Material and capacity Requirement Planning, Production planning and control, Shop floor control -Inventory Management, Manufacturing resource planning.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the mathematics behind 2D and 3D CAD models.

CO2: Learn, interpret and analyze different types of modeling techniques.

CO3: Prepare CNC programs and understand the CNC systems.

CO4: Apply computer aided process planning techniques.

CO5: Obtain knowledge of product data management.

TEXT BOOK:

T1 –Mikell.P.Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Pearson Education, New Delhi, 4th Edition - 2015.

T2 – Radhakrishnan. P and S. Subramanyan, Raju. V "CAD/CAM/CIM" New Age International(P) Ltd, New Delhi, 3rd Edition – 2012.

REFERENCES:

R1 - Zeid Ibrahim, "CAD/CAM Theory and Practices", McGraw Hill International, 2nd Edition,2014.

R2 - Mikell P. Groover and Enory W. Zimmers Jr. "CAD/CAM: Computer Aided Design and Manufacturing", Prentice Hall of India, New Delhi.2013.

R3 - Kundra T.K., Rao P.N. and Tiwari N.K., "CNC Machine Tools and Computer Aided Manufacturing," Tata Graw Hill Pub. New Delhi, 2010.

R4 - Chris McMahon and Jimmie Browne "CAD/CAM Principles, practice and manufacturing management ", Pearson education Asia, 2001

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	3	-	-	-	-	3	2	3	3	1
CO2	3	2	2	2	3	-	-	-	-	3	3	3	3	1
CO3	3	1	2	2	3	-	-	-	-	3	3	3	3	2
CO4	3	1	2	-	3	-	-	-	-	2	2	3	2	1
CO5	3	1	2	-	3	-	-	-	-	3	3	3	3	2
Avg	3	1.2	2	2	3	0	0	0	0	2.8	2.6	3	2.8	1.4

Chairman, Board of Studies

Chairman - BoS
MECH - HiCE

HINDUSTHAN ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6202	METROLOGY & QUALITY CONTROL	3	0	0	3

Course Objective

The student should be able

1. To study basic principles of measurements.
2. To learn about the various linear & angular measuring equipments.
3. To learn the basics of form measurements.
4. To acquire knowledge on advanced measuring techniques.
5. To learn concepts of control charts for the variables.

Unit	Description	Instructional Hours
I	**BASICS OF METROLOGY** General concept - Generalized measurement system - Units and Standards - Measuring instruments - sensitivity, stability, range, readability, repeatability, accuracy and precision - static and dynamic response - Errors in Measurements, calibration - Introduction to Dimensional and Geometric Tolerance.	9
II	**LINEAR AND ANGULAR MEASUREMENTS** Linear Measuring Instruments - Vernier, Micrometer, Slip gauges, Comparators - Types, Limit gauges - Tool Makers Microscope. Angular measuring instruments - Sine bar, Sine center, Bevel protractor, Angle Decker & Autocollimator - Applications.	9
III	**FORM MEASUREMENT** Measurement of screw threads: Thread gauges, Floating carriage micrometer - Measurement of gear parameters - Gear tooth vernier caliper method, Constant chord, Base tangent method – Parkinson gear roller tester - Surface finish - Analysis - Measuring Equipments - Roundness measurement.	9
IV	**ADVANCES IN METROLOGY** Basic concept of lasers - Advantages of lasers – Laser Inspection - Laser Interferometers Types – AC Laser Interferometer, NPL Flatness Interferometer, Michelson Interferometer - Applications. Basic concept of CMM - Types of CMM - Constructional features - Probes - Accessories - Software - Applications - Basic concepts of Machine Vision System -Applications.	9
V	**PROCESS CONTROL FOR VARIABLES** Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality cost - Variation in process-factors - process capability - process capability studies and simple problems - Theory of control chart - uses of control chart - Control chart for variables - X chart, R chart and control chart for variables.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the basic principles of measurements.
CO2: Acquire the knowledge about linear and angular measuring instruments.
CO3: Gain the detailed information about form measurements.
CO4: Know the advance measurement concepts in metrology.
CO5: Apply the control charts for the process control

TEXT BOOK:

T1 - Jain R.K. "Engineering Metrology", Khanna Publishers, 2009.
T2 - Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.

REFERENCES:

R1 - Alan S. Morris, "The essence of Measurement", Prentice Hall of India 1996.
R2 - Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2014.
R3 - Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning EMEA, 1990. R4 - Anand K Bewoor and Vinay A Kulkarni (2009), Metrology and measurement, The Tata McGraw-Hill publication.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO2	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO3	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO4	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO5	3	2	2	2	-	1	2	-	-	2	1	2	1	1
Avg	3	1.2	1..2	2	-	1	2	-	-	1.2	1	2	1	1

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6203	DESIGN OF TRANSMISSION SYSTEMS	3	0	0	3

The student should be able

Course Objective

1. To acquire knowledge for the selection of various flexible elements like belt and chain drives.
2. To learn the design and analysis of parallel and non-intersecting type of gear drives.
3. To impart knowledge on design and analysis of non-parallel and intersecting type of gear drives.
4. To acquire the knowledge on design of gear boxes.
5. To learn an overview of the design of transmission elements like clutches and brakes.

Unit	Description	Instructional Hours
I	**DESIGN OF FLEXIBLE ELEMENTS** Selection of V belts and pulleys-Selection of Flat belts and pulleys-Selection of Wire ropes and pulleys – Selection of Transmission chains and Sprockets.	9
II	**DESIGN OF SPUR GEARS AND HELICAL GEARS** Gear Terminology-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength – Factor of safety - Gear materials – Module and Face width-Power rating calculations based on Strength and Wear considerations - Helical gears – Pressure angle in the normal and transverse plane- Equivalent number of teeth-Forces and Stresses.	9
III	**DESIGN OF BEVEL AND WORM GEARS** Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: terminology, Merits and demerits.	9
IV	**DESIGN OF GEAR BOXES** Geometric progression - Standard step ratio - Ray diagram, kinematics layout - Design of sliding mesh gear box - Constant mesh gear box. – Design of multi speed gear box.	9
V	**DESIGN OF CLUTCHES AND BRAKES** Design of plate clutches, cone clutches and jaw clutches –Design of block brakes, internal expanding shoe brakes and band Brakes.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:
CO1: Select the appropriate flexible elements in power transmission systems.
CO2: Design spur and helical gear drives employed in transmission systems.
CO3: Design Bevel and Worm gear drives employed in transmission systems.
CO4: Design single and multispeed gear box.
CO5: Design clutches and brakes.

TEXT BOOK:

T1 - Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
T2 - Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

R1 - Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
R2 - Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
R3 - Md. Jalaludeen , Machine Design, Volume II, Design of Transmission Systems, 4th edition,Anuradha Publications, 2014.
R4 - Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine component Design",5thEdition, Wiley, 2011.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	1	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1	1	1
CO3	3	3	2	-	-	-	-	-	-	-	-	2	1	2
CO4	3	3	3	-	-	-	-	-	-	-	-	2	2	2
CO5	3	2	3	-	-	-	-	-	-	-	-	2	2	2
Avg	3	2.8	2.4	-	-	-	-	-	-	-	-	1.6	1.4	1.6

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL COLLEGE OF ENGG & TECH Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6001	CAD / CAM LAB	0	0	3	1.5

Course Objective

The student should be able

1. To acquire practical experience in using 2D drafting and 3D modeling software.
2. To study the features of CNC Machine Tools.
3. To learn the applications of modern control systems.

Description of the Experiments	Practical Hours
I. 3D GEOMETRIC MODELING	
List of Experiments	
Creation of 3D assembly model of following machine elements using 3D Modeling software	
1. Flange Coupling	
2. Screw Jack	**24**
3. Universal Joint	
4. Stuffing box	
5. Lathe Tailstock	
II. Manual Part Programming.	
(i) Part Programming - CNC Turning Centre	
6. Step Turning and Taper Turning	
7. Step Turning and Circular Interpolation	
8. Drilling, Grooving and Thread Cutting	
(ii) Part Programming - CNC Machining Centre	**21**
9. Milling of a Contour Profile	
10. Milling an arc or Circular Profile	
III. Computer Aided Part Programming	
a) Demonstration on CL Data and Post process generation using CAM software.	
✓ Study and practical demonstration on Coordinate measuring machine.	
Study and practical demonstration on Rapid Prototyping Technologies.	
Total Instructional Hours	**45**

Course Outcome

The Students will be able to

CO1 - Develop 2D drawing and 3D models using modeling software.

CO2 - Understand the CNC control in modern manufacturing system.

CO3 - Prepare CNC part programming and manufacture engineering components.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	-	-	-	-	3	3	3	3	2
CO2	1	2	2	1	2	-	-	-	-	2	2	3	2	2
CO3	1	2	2	1	2	-	-	-	-	2	2	3	2	1
Avg	1.3	2	2	1	1.6	0	0	0	0	2.3	2.3	3	1.3	1.6

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6001	METROLOGY MEASUREMENTS LABORATORY	0	0	3	1.5

Course Objective

The student should be able

1. To learn the basics of metrology & quality control.
2. To study the applications of different measuring instruments and use them in industry for quality inspection.
3. To learn the basic concepts of accuracy, error, and calibration.

Description of the Experiments

1. Calibration of Vernier Caliper.
2. Calibration of Micrometer.
3. Measurement of Gear tooth parameters using Gear Tooth Vernier.
4. Measurement of Taper Angle using Sine bar.
5. Checking the limits of dimensional tolerances using Mechanical Comparators.
6. Measurement of dimensions using Vernier Height Gauge.
7. Measurement of straightness and flatness using Autocollimator.
8. Measurement of Screw thread parameters using Profile Projector.
9. Measurement of dimensions for a threaded specimen using Tool Makers Microscope.
10. Measurement of thread parameters using Floating Carriage Micrometer.
11. Measurement of Temperature using Thermocouple.
12. Measurement of Force using Load cell.
13. Measurement of Torque.
14. Study of Coordinate Measuring Machine.

Total Instructional Hours 45

Course Outcome

The Students will be able to
CO1: Understand the calibration of various measuring instruments.
CO2: Analyze the surface characteristics of components.
CO3: Examine the various profiles of the components.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2							3			2	1	2
CO2	2		2						3			2		1
CO3	3		3	2					3				1	1
CO4	3				2				3					
CO5	3			2					3			2	1	
Avg	3	2	2.5	2	2				3			2	1	1.3

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL OF TECHNOLOGY Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6701	Internship / Industrial Training	0	0	0	1

Course Pre- requisite	Completion of minimum two semesters.
Course Objectives	Designed to expose the students to industry environment and work there as trainees.
Contents	Four weeks of work at industry site. Supervised by an expert at the industry.
Method	Students have to maintain a written record of the assignments, progress and accomplishments. They have to submit a report at the end of the training. An oral presentation on their experiences and the knowledge gained during their work.
Evaluation	1. Viva-voce (50%) 2. Report (50%)
Course Outcome	The Students will be able to CO1: Analyze the various functions of multi disciplinary team. CO2: Create an ability to communicate effectively CO3: Apply the impact of engineering solution in global, economic, environmental and social contexts. CO4: Apply an ability to engage in research and to involve in life- long learning. CO5: Apply knowledge of contemporary issues.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	-	-	-	-	3	3	3	3	2
CO2	1	2	2	1	2	-	-	-	-	2	2	3	2	2
CO3	1	2	2	1	2	-	-	-	-	2	2	3	2	1
Avg	1.3	2	2	1	1.6	0	0	0	0	2.3	2.3	3	1.3	1.6

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH ★ ACADEMIC COUNCIL ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6071	SOFT SKILLS - II	1	0	0	1

Course Objective

The student should be able

1. To make the students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
2. To learn everything from equations to probability with a completely different approach.
3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	**GROUP DISCUSSION & PRESENTATION SKILLS** GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
II	**INTERVIEW SKILLS AND PERSONALITY SKILLS** Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
III	**BUSINESS ETIQUETTE & ETHICS** Etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	3
IV	**QUANTITATIVE APTITUDE** Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	3
V	**LOGICAL REASONING** Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2
	Total Instructional Hours	**15**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.

CO2: Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations

CO3: Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment

CO4: Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.

CO5: Students will excel in complex reasoning.

REFERENCES:

R1 Bruce Tulgan, Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent

R2 Abhjit Guha, Quantitative Aptitude for Competitive Examinations (5th Edition)

R3 Jaikishan and Premkishan, How to crack test of Reasoning

R4 Peeyush Bhardwaj, The hand on guide to Analytical Reasoning and Logical Reasoning

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2							3			2	1	2
CO2	2		2						3			2		1
CO3	3		3	2					3				1	1
CO4	3				2				3					
CO5	3			2					3			2	1	
Avg	3	2	2.5	2	2				3			2	1	1.3

Chairman, Board of Studies

Chairman - BoS
MECH - HICET

Dean – Academics

Dean (Academics)
HICET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21HE6072	INTELLECTUAL PROPERTY RIGHTS (IPR)	1	0	0	1

Course Objective

The student should be able

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
3. To disseminate knowledge on copyrights and its related rights and registration aspects.
4. To disseminate knowledge on trademarks and registration aspects.
5. To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO INTELLECTUAL PROPERTY** Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	3
II	**PATENTS** Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non - Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	3
III	**COPYRIGHTS** Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	3
IV	**TRADEMARKS** Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks -Registration of Trademarks.	3
V	**DESIGN AND GEOGRAPHICAL INDICATION** Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks -Procedure for registration.	3
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.

CO2: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.

CO3: Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.

CO4: Identify different types of trademarks and procedure for registration

CO5: Recognize the concept of design, geographical indication and procedure for registration.

TEXT BOOK:

T1 Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

T2 Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCES:

R1 Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

R2 Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

PO & PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO2	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO3	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO4	3	-	3	-	-	3	-	-	-	-	-	3	2	2
CO5	3	-	3	-	-	3	-	-	-	-	-	3	2	2
Avg.	3	-	3	-	-	3	-	-	-	-	-	3	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * KANDALUR * KALASALINGAM COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

PROFESSIONAL ELECTIVE – II

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6301	REFRIGERATION AND AIR CONDITIONING	3	0	0	3

Course Objective

The student should be able

1. To learn the working principle of Refrigeration & Air conditioning systems.
2. To recognize various components and accessories of refrigeration systems.
3. To understand the applications of refrigeration and air conditioning systems.
4. To become familiarize with refrigeration and air conditioning cooling load calculations.
5. To provide knowledge on design and selection of Air conditioning systems.

Unit	Description	Instructional Hours
I	**VAPOUR COMPRESSION REFRIGERATION SYSTEM** Introduction to Refrigeration: Ton of refrigeration and C.O.P. Vapor compression cycle: p-h and T-s diagrams, deviations from theoretical cycle, sub cooling and super heating, wet and dry compression, effects of system operating pressures, multi-evaporators systems, multi-expansion systems, two stage systems, cascade systems, auto-cascade systems. Refrigerants: classification, designation and nomenclature.	9
II	**SYSTEM COMPOENENTS, CONTROLS AND ACCESSORIES** System components: compressors, condensers, expansion devices and evaporators-types and its working principle. Refrigerant controls: pressure, temperature and refrigerant flow and humidity sensors, actuators & safety controls etc. Electrical controls: relay, over load protectors, capacitors etc. Accessories: liquid receiver, flash chamber, accumulator, refrigerant driers etc.	9
III	**OTHER REFRIGERATION CYCLES AND APPLICATIONS** Other refrigeration cycles: Vapour absorption, adsorption, steam jet, ejector and thermoelectric refrigeration systems. Magnetic – Vortex and Pulse tube refrigeration systems. Air craft refrigeration cycles. Applications: Refrigeration applications such as milk chilling plant, ice plants, cold storage, food processing plants etc. Air conditioning: space cooling and heating.	9
IV	**COOLING LOAD CALCULATIONS** Refrigeration load calculations: Heat gain through the walls, infiltration load, product load. Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, effective temperature & chart, calculation of summer & winter air conditioning load.	9
V	**DESIGN AND SELECTION OF AIR CONDITIONING SYSTEMS** Types of air conditioning systems: All air systems, all water systems, Air-water systems, unitary systems. Air distribution: factors considered in air distribution, types of air distribution, Indoor air quality and human comfort. Sizing of ducts: Classification of air conditioning ducts, duct design methods.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the working principle of various refrigeration cycles.
CO2: Identify the system components and its functions.
CO3: Understand the applications of refrigeration and air conditioning systems.
CO4: Calculate cooling load for an air conditioning buildings.
CO5: Design and selection of air conditioning systems.

TEXT BOOK:

T1 - Arora CP. "Refrigeration and Air Conditioning", 3rd edition, McGraw Hill, New Delhi, 2010.
T2 - Jones WP. "Air conditioning engineering", 5th edition, Elsevier Butterworth-Heinemann, 2001.

REFERENCES:

R1 - Dossat RJ., "Principles of Refrigeration", 4th edition, Pearson Education Asia, 2009.
R2 - Stoecker WF, Jones JW. "Refrigeration and Air Conditioning", McGraw Hill, New Delhi, 1986.
R3 –ASHRAE Hand book, Fundamentals, 2010.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	-	1	-	-	-	-		1	1	1
CO2	3	1	1	1	-	2	2	-	1	-	1	1	1	1
CO3	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO4	3	1	1	1	-	-	-	-	-	-	-	1	1	1
CO5	3	1	1	1	-	2	1	-	1	-	1	1	1	1
Avg	**3**	**1**	**1**	**1**	**-**	**1**	**0.6**	**-**	**0.4**	**-**	**0.4**	**1**	**1**	**1**

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGINEERING & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6302	ADVANCED I.C. ENGINES	3	0	0	3

Course Objective

The student should be able

1. To understand the combustion phenomena in SI engines.
2. To learn the knocking tendency and combustion in CI engines.
3. To enhance the understanding of students in engine pollutants and their control.
4. To teach students about the usage of alternative fuels in IC engines.
5. To introduce students to the recent trends in IC engines.

Unit	Description	Instructional Hours
I	**SPARK IGNITION ENGINES** Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection. Stages of combustion - Normal and Abnormal combustion –knock- Factors affecting knock – Combustion chambers.	9
II	**COMPRESSION IGNITION ENGINES** Diesel Fuel Injection Systems - stages of combustion –knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers -Introduction to Turbo charging.	9
III	**POLLUTANT FORMATION AND CONTROL** Pollutant – Sources – Formation of Carbon Monoxide, Unburned hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction – Particulate Traps – Emission norms.	9
IV	**ALTERNATIVE FUELS** Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.	9
V	**RECENT TRENDS** Air assisted combustion, Homogeneous charge compression ignition engines – Reactivity controlled V compression ignition (RCCI)- Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – Fuel cells.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to

CO1: Explain the working of Gasoline fuel injection systems and SI engine combustion.
CO2: Explain the working of Diesel fuel injection systems and CI engine combustion.
CO3: Identify the sources of pollution formation and its control.
CO4: Select alternative fuel resources and its utilization techniques in IC engines.
CO5: Acquire knowledge on recent trends in IC engines and future power trains systems.

TEXT BOOK:

T1 - Ramalingam. K.K., "Internal Combustion Engine Fundamentals", SciTech Publications, 2002.
T2 - Ganesan. V, "Internal Combustion Engines", II Edition, TMH, 2002.

REFERENCES:

R1 - John B. Heywood, "Internal Combustion Engines Fundamentals", McGraw-Hill, 1988.
R2 - Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons2007
R3 - Duffy Smith, "Auto Fuel Systems", The Good Heart WillcoxCompany, Inc., 1987
R4 - Review articles on HCCI and RCCI –Progress in Energy and Combustion Science Journal– www.sciencedirect.com

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	1	2	2	2	1	2	2	3	2	1
CO2	3	1	2	2	1	2	2	2	1	1	1	3	2	1
CO3	3	1	2	2	1	2	3	2	2	2	1	2	2	3
CO4	3	1	2	2	1	2	3	2	2	1	1	3	1	3
CO5	2	1	2	2	1	3	2	2	2	3	1	3	1	3
Avg	2.8	1	2	2	1	2.2	2.4	2	1.6	1.8	1.2	2.8	1.6	2.2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL Chairman COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6303	DESIGN OF HEAT EXCHANGERS	3	0	0	3

Course Objective

The student should be able

1. To expose the students about the classification of heat exchangers and its applications.
2. To know the factors considered for design of heat exchangers.
3. To develop skills for evaluate the sizing of heat exchangers.
4. To impart the knowledge on phase change heat exchangers.
5. To enable the students to design heat exchanger.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO HEAT EXCHANGERS** Classification of heat exchangers: regenerators, recuperators, mixtures. Design of heat exchangers: laws f heat transfer, factors considered: heat transfer coefficients, wall conductive resistance, fouling resistance, overall heat transfer coefficient. TEMA standards, selection criteria for different types of shells and front and rear head ends, geometrical characteristics of TEMA heat exchangers.	9
II	**DESIGN OF PROCESS HEAT EXCHANGERS** Heat transfer correlations used for predicting heat transfer coefficients. Design methods: LMTD and NTU. Design of finned tube air cooled, shell and tube, tube-in-tube, compact heat exchangers and plate heat exchangers. Calculations: Fouling factor, pressure drop heat exchange area.	9
III	**DESIGN OF COOLING TOWERS** Types, design procedures, tower characteristics, factors influencing the tower performance, Energy savings in cooling towers, water treatment, site selection for installation, selection fans and pumps.	9
IV	**DESIGN OF CONDENSERS AND EVAPORATORS** Condensers: types, factors considered in design of air cooled, water cooled and evaporative condensers, correlations used for design. Evaporators: types, factors considered in design of evaporators, correlations used for heat transfer coefficient calculations	9
V	**DESIGN OF SOLAR COLLECTORS AND HEAT PIPES** Solar collectors: types of solar collectors, factors considered in design of solar air heaters, solar water heaters. Heat pipes: Types of heat pipes, applications of heat pipes, design of heat pipes. Use of Software for design of heat exchangers.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:
CO1: Understand the Industrial applications of heat exchangers.
CO2: Design the process heat exchanger.CO3: Design the cooling towers, condensers, evaporators and solar collectors.
CO4: To perform thermal analysis using LMTD and NTU methods.
CO5: To do thermal design including phase change heat transfer

TEXT BOOK:

T1 - R.S. Khandpur, "Handbook of Analytical Instruments", McGraw Hill Education (India) Private Limited, Third edition, 2015.
T2 - Shah,R. K., Dušan P. Sekulić, "Fundamentals of heat exchanger design", John Wiley & Sons, 2003.

REFERENCES:

R1 - Robert W. Serth, "Process heat transfer principles and applications", Academic press, Elesevier, 2007.
R2 - Sarit Kumar Das, "Process heat transfer", Alpha Science International, 2005.
R3 - John E. Hesselgreaves, "Compact heat exchangers: selection, design, and operation", Elsevier science Ltd, 2001.
R4 - T.W.Fraser Russell, Anne Skaja Robinson and Norman J.Wagner, Mass and Heat Transfer – Analysis of Mass Contractors and Heat Exchangers, Cambridge University Press, 2012.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO2	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO3	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO4	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO5	3	2	2	2	-	1	2	-	-	2	1	2	1	1
Avg	3	1.2	1..2	2	-	1	2	-	-	1.2	1	2	1	1

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HiCET * Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6203	GAS DYNAMICS AND JET PROPULSION	3	0	0	3

Course Objective

The student should be able

1. To understand the difference between incompressible and compressible flow.
2. To understand the concept of nozzle and diffuser in flow through variable area duct.
3. To know the concept of Fanno flow and Rayleigh flow.
4. To study the phenomenon of shock waves and its effect on flow.
5. To explain the knowledge about Jet and Rocket Propulsion.

Unit	Description	Instructional Hours
I	**COMPRESSIBLE FLOW – FUNDAMENTALS** Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, Effect of Mach number on compressibility.	9
II	**FLOW THROUGH VARIABLE AREA DUCT** Isentropic flow through variable area ducts, T-s,h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles	9
III	**FANNO AND RAYLEIGH FLOW** Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno equation, variation of flow properties, variation of Mach number with duct length. Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.	9
IV	**NORMAL SHOCK** Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl-Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock.	9
V	**PROPULSION** Aircraft propulsion- types of jet engines, study of turbojet engine components-diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbojet engines-thrust, thrust power, propulsive and overall efficiencies, Thrust augumentation. Rocket propulsion -Theory of rocket propulsion- performance study -rocket engine thrust equation- effective jet velocity, specific impulse - solid and liquid propellants.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Explain the effect of Mach number on compressibility.
CO2: Understand the compressible flow in nozzles and diffusers.
CO3: Solve problems in Fanno and Rayleigh flow for constant area duct.
CO4: Evaluate the kinds of normal shock phenomena while the deviation in flow properties.
CO5: Understand the knowledge about rocket and jet propulsion.

TEXT BOOK:

T1-Yahya.S.M., "Fundamentals of Compressible flow with aircraft Rocket propulsion", New Age International (P) Ltd., New Delhi, 5th Edition 2016.
T2-Anderson, J.D., Modern Compressible flow, McGraw Hill, 3rd Edition, 2012.

REFERENCES:

R1- Patrich.H.Oosthvizen, Willam E. Carscallen, "Compressible fluid flow", McGraw-Hill, 2006.
R2- Cohen.H.,Rogers R.E.CandSravanamutoo, "Gasturbinetheory", Addison Wesley Ltd.,2005.
R3- Ganesan.V., "Gas Turbines", Tata McGraw-Hill, New Delhi, 3rd Edition 2010.
R4 - Balachandran, P., "Fundamentals of Compressible Fluid Dynamics", Prentice-Hall of India,2007.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	1	2	2	2	1	2	2	3	2	1
CO2	3	1	2	2	1	2	2	2	1	1	1	3	2	1
CO3	3	1	2	2	1	2	3	2	2	2	1	2	2	3
CO4	3	1	2	2	1	2	3	2	2	1	1	3	1	3
CO5	2	1	2	2	1	3	2	2	2	3	1	3	1	3
Avg	2.8	1	2	2	1	2.2		2	1.6	1.8	1.2	2.8	1.6	2.2

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGINEERING & TECHNOLOGY ★ Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6305	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	3

Course Objective

The student should be able

1. To understand and analyze the energy data of industries.
2. To carryout energy auditing in industries.
3. To evaluate the economical feasibility of energy projects.
4. To propose energy saving procedures in industrial and commercial applications.
5. To utilize the available resources in optimal ways.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Energy scenario: National and world wide; National Energy consumption Data; Environmental aspects associated with energy utilization; Energy security; Energy Auditing: Need and Types; Role of Energy Managers; Instruments used for energy auditing	9
II	**ELECTRICAL SYSTEMS** Components of EB billing; HT and LT supply; Transformers; Cable Sizing; Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors. Lights: types, Illumination, lux, lumens, efficacy, LED Lighting and scope of energy conservation in lights.	9
III	**THERMAL SYSTEMS** Stoichiometry, Energy conservation in boilers, industrial furnaces and thermic fluid heaters. Steam: Distribution: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractory.	9
IV	**ENERGY CONSERVATION IN MAJOR UTILITIES** Energy conservation in Pumps, Fans, Blowers, Compressors, Cooling towers, Diesel generators and HVAC systems.	9
V	**ECONOMICS** Energy Economics: Discount Rate, Payback Period, Return on Investment; Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand and analyze the energy data of industries

CO2: Carryout energy auditing in industries.

CO3: Evaluate the economical feasibility of energy projects.

CO4: Energy saving procedures in industrial and commercial applications

CO5: Utilize the available resources in optimal ways.

TEXT BOOK:

T1 - Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

T2 - K. NagabhushanRaju, Industrial Energy Conservation Techniques: (concepts, Applications and Case Studies), Atlantic Publishers &Dist, 2007

REFERENCES:

R1 - Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.

R2 - Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford,1981. R3 - Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982.

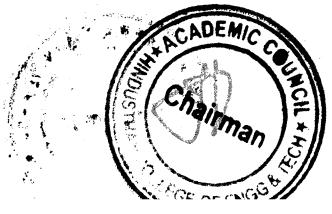
R4 - Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.

R5 - Murphy. W.R. and G. Mc KAY, "Energy Management", Butterworths. London 1987.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3			1			1		2	1
CO2	2	2	2	3	2	1		1					3	1
CO3	2	3	3	3	2								2	1
CO4	2	2	3	3	3		1	1					2	1
CO5	3	3	3	3	3					1			1	2
Avg	2.2	2.4	2.6	3	2.6	1	1	1		1	1		2	1.2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET



Dean – Academics

Dean (Academics)
HiCET

OPEN ELECTIVE

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6401	RENEWABLE ENERGY SOURCES	3	0	0	3

Course Objective

The student should be able

1. To know about different primary energy sources and renewable energy sources.
2. To study the solar energy measurement and designing of various solar energy utilized systems.
3. To study the principles of different non-conventional energy sources and their utilization.
4. To understand the applications of energy from waste and designing of bio gas plant.
5. To get an exposure in various direct energy conversion systems.

Unit	Description	Instructional Hours
I	**ENERGY AND ENVIRONMENT** Primary energy sources - world energy resources - energy cycle of the earth – environmental aspects of energy utilization, Emissions and Global warming – Renewable energy resources and their importance - Potential impacts of harnessing the different renewable energy resources.	9
II	**SOLAR ENERGY** Principles of solar energy collection - solar radiation - measurements - instruments - data and estimation- types of collectors - characteristics and design principles of different type of collectors, performance and testing of collectors - Solar water and air heaters - performance and applications - solar cooling - solar drying - solar ponds - solar tower concept - solar furnace.	9
III	**WIND, TIDAL AND GEO THERMAL ENERGY** General theory of windmills - types of windmills - design aspects of horizontal axis windmills – applications - Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants - Geothermal power plants. Principle of ocean thermal energy conversion (OTEC).	9
IV	**BIO ENERGY** Energy from bio mass and bio gas plant – types and design of biogas plants – applications – Energy from wastes - utilization of industrial, municipal and agricultural wastes. Emission norms: emission from renewable fuels and its effect on environment, study of environment protection norms ISO 14000, 16000 etc.	9
V	**DIRECT ENERGY CONVERSION SYSTEM 9 Hours** Magneto hydrodynamic systems (MHD) - thermoelectric generators – thermionic generators - Fuel cells and its classification; Transport mechanism in fuel cells and concept of energy conversion. Solid oxide fuel cells (SOFC); PEM fuel cells; Direct methanol fuel cells (DMFC), Molten carbonate fuel cell (MCFC)- solar cells - types, Emf generated, power output, losses and efficiency applications. Hydrogen conversion and storage systems.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Identify the various renewable energy sources and national and international scenario.
CO2: Calculate the performance of solar collectors.
CO3: Explain the working principle of renewable energy power plants and direct energy conversion systems.
CO4: Develop skills in bio energy.
CO5: Implement the energy conversion system.

TEXT BOOK:

T1 Rai G.D, "Non conventional Energy sources" 4th edition (24th Reprint), Khanna Publishers, New Delhi,2009.
T2 Kothari , "Renewable Energy Sources and Emerging Technologies", Eastern Economy Edition, 2009.

REFERENCES:

R1 Sukhatme, S.P., "Solar Energy, Principles of Thermal Collection and Storage", 3rd Edition. Tata MCGraw Hill, 2008.
R2 S.Rao and Parulehar, "Energy Technology – Non conventional, Renewable and Conventional, 3rd Edition, Khanna Publishers, 2009.
R3 Chetan Singh Solanki, Solar Photovoltaics, "Fundamentals, Technologies and Applications", PHI Learning Private Limited. New Delhi. David M. Mousdale – "Introduction to Biofuels", CRC Press, Taylor & Francis Group, USA2017.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	1	2	2	2	1	2	2	3	2	1
CO2	3	1	2	2	1	2	2	2	1	1	1	3	2	1
CO3	3	1	2	2	1	2	3	2	2	2	1	2	2	3
CO4	3	1	2	2	1	2	3	2	2	1	1	3	1	3
CO5	2	1	2	2	1	3	2	2	2	3	1	3	1	3
Avg	2.8	1	2	2	1	2.2	2.4	2	1.6	1.8	1.2	2.8	1.6	2.2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF

Dean – Academics

Dean (Academics)
HiCET

B E (Minor) MECHANICAL ENGINEERING

SYLLABUS

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6231	E VEHICLE DYNAMICS	3	0	0	3

Course Objective

1. To learn the structure of Electric Vehicle, Hybrid Electric Vehicle
2. To study about the EV conversion components
3. To know about the details and specifications for Electric Vehicles
4. To understand the concepts of Plug-in Hybrid Electric Vehicle
5. To model and simulate all types of DC motors

Unit	Description	Instructional Hours
I	**VEHICLE MECHANICS** Vehicle mechanics- Roadway fundamentals, Laws of motion, Vehicle Kinetics, Dynamics of vehicle motion, propulsion power, velocity and acceleration, Tire – Road mechanics, Propulsion System Design.	9
II	**VEHICLE ARCHITECTURE and SIZING** Electric Vehicle History, and Evolution of Electric Vehicles. Series, Parallel and Series parallel Architecture, Micro and Mild architectures. Mountain Bike - Motorcycle- Electric Cars and Heavy Duty EVs. -Details and Specifications	9
III	**POWER COMPONENTS AND BRAKES** Power train Component sizing- Gears, Clutches, Differential, Transmission and Vehicle Brakes. EV power train sizing, HEV Powertrain sizing, Example.	9
IV	**HYBRID VEHICLE CONTROL STRATEGY** Vehicle supervisory controller, Mode selection strategy, Modal Control strategies.	9
V	**PLUG-IN HYBRID ELECTRIC VEHICLE** Introduction-History-Comparison with electrical and hybrid electrical vehicle-Construction and working of PHEV-Block diagram and components-Charging mechanisms-Advantages of PHEVs.	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Summarize the History and Evolution of EVs, Hybrid and Plug-In Hybrid EVs
CO2: Describe the various EV components
CO3: Describe the concepts related in the Plug-In Hybrid Electric Vehicles
CO4: Analyse the details and Specifications for the various EVs developed.
CO5: Describe the hybrid vehicle control strategy.

TEXT BOOK:

T1.Mehrdad Ehsani, YiminGao, Sebastian E. Gay, Ali Emadi, 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design', CRC Press, 2004.
T2. Build Your Own Electric Vehicle,Seth Leitman , Bob Brant, McGraw Hill, Third Edition 2013.
T3. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, First edition 2017.

REFERENCES:

R1. The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles -- Includes EV Components, Kits, and Project Vehicles Mark Warner, HP Books, 2011.
R2. Heavy-duty Electric Vehicles from Concept to Reality, Shashank Arora. Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe, Kari Tammi, Elsevier Science, 2021
R3. Hybrid Electric Vehicles: A Review of Existing Configurations and Thermodynamic Cycles, Rogelio León , Christian Montaleza , José Luis Maldonado , MarCOs Tostado-Véliz and Francisco Jurado, Thermo, 2021, 1, 134–150. https://doi.org/10.3390/thermo1020010.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	2	2	3	2	3	2	-	3
CO2	-	1	-	-	-	-	-	1	2	2	3	3	1	1
CO3	-	-	-	-	-	-	-	2	3	3	3	3	1	1
CO4	-	-	-	-	-	-	-	2	3	3	3	3	2	2
CO5	-	-	-	-	-	-	-	1	2	2	3	3	1	1
Avg	0	0.2	0	0	0	0	0.4	1.6	2.6	2.4	3	2.8	1	1.6

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Ac... ...ics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6232	CELL AND BATTERY MANAGEMENT SYSTEM	3	0	0	3

Course Objective

1. To learn about batteries and its parameters
2. To Identify the requirements of Battery Management System
3. To know about Interpret the concept associated with battery charging / discharging process
4. To understand the various parameters of battery and battery pack
5. To Design the model of battery pack

Unit	Description	Instructional Hours
I	**Introduction:** Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging	9
II	**Battery Management System Requirement:** Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-ofcharge estimation, Cell total energy and cell total power,	9
III	**Battery State of Charge and State of Health Estimation, Cell Balancing:** Battery state of charge estimation (SOC), voltage-based methods to estimateSOC, Model-based state estimation, Battery Health Estimation, Lithium-ionaging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing	9
IV	**Modelling and Simulation:** Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage,Simulating battery packs,	9
V	**Design of battery BMS:** Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system	9
	Total Instructional Hours	45

Course Outcome

CO1: Interpret the role of battery management system
CO2: Identify the requirements of Battery Management System
CO3: Interpret the concept associated with battery charging / discharging process
CO4: Calculate the various parameters of battery and battery pack
CO5: Design the model of battery pack

TEXT BOOK:

T1. Plett, Gregory L. Battery management systems, Volume I: Battery modeling. Artech House, 2015.
T2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.
T3. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.

REFERENCES:

R1. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010
R2. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	2	2	3	2	3	2	-	3
CO2	-	1	-	-	-	-	-	1	2	2	3	3	1	1
CO3	-	-	-	-	-	-	-	2	3	3	3	3	1	1
CO4	-	-	-	-	-	-	-	2	3	3	3	3	2	2
CO5	-	-	-	-	-	-	-	1	2	2	3	3	1	1
Avg	0	0.2	0	0	0	0	0.4	1.6	2.6	2.4	3	2.8	1	1.6

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean – Academics
Dean (Academics)
HiCET

B E (HONS) MECHANICAL ENGINEERING

SYLLABUS

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6204	LEAN MANUFACTURING	3	0	0	3

Course Objective

The student should be able

1. To introduce the basics of 6 SIGMA
2. To learning about the lean manufacturing tools.
3. To study about the deeper understanding methodologies of Lean manufacturing.
4. To study the lean concepts and its elements.
5. To learn implementation and challenges of lean manufacturing.

Unit	Description	Instructional Hours
I	**BASICS OF 6 SIGMA** Introduction to 6 Sigma, basic tools of six sigma like problem solving approach, standard deviation, normal distribution, various sigma levels with some examples, value for the enterprise, Variation, and sources ofvariation, Mean and moving the mean, Various quality costs, cost of poor quality	9
II	**INTRODUCTION TO LEAN MANUFACTURING TOOLS** Process Capability Indices, Cause and Effect diagram, Control Charts, Introduction to FMEA, APQP, PPAP. 3 foundational 6 Sigma methodologies: DMAIC, DMEDI, and Process Management DMEDI for process creation, DMAIC for process improvement and PDCA for sustaining improvements.	9
III	**DEEPER UNDERSTADING METHODOLOGIES** What is a process, Why Process management, Keys to process management, Difference between process management and 6 Sigma, Introduction to Deming cycle, PDCA, DMAIC and continuous improvement, DMEDI for creation process, DMAIC Vs DMEDI with examples, Introduction to Toyota Production System, Six Sigma and Production System integration.	9
IV	**LEAN ELEMENTS** Introduction to Lean Concepts like In-Built Quality, Concept of Right Part at the Right Time, Lead Time reduction, Optimum utilization of Capital, Optimum utilization of People. Understanding the Zero-defect concept and Metrics, Focus on Human Resources, Quality, Delivery, Cost. Building Zero defect□capabilities, Cultural and Organizational aspects	9
V	**IMPLEMENTATION AND CHALLENGES** Implementing Checks and Balances in the process, Robust Information Systems, Dashboard, follow up and robust corrective and preventive mechanism. Concept of Audits, and continuous improvement from gap analysis, risk assessments etc.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Discuss the basics of 6 SIGMA

CO2: Elaborate the lean manufacturing tools.

CO3: Illustrate about the deeper understanding methodologies of Lean manufacturing.

CO4: Discuss lean concepts and its elements.

CO5: Describe the implementation and challenges of lean manufacturing.

TEXT BOOK:

T1. Quality Planning and Analysis- JM Juran& FM Gryna. Tata Mc Graw Hill

T2. Lean Manufacturing: Principles to Practice by Akhilesh N. Singh, Bibliophile SouthAsia

T3. The Toyota Way: 14 Management Principles

T4. Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy,Masaki Imai

REFERENCES:

R1. Quality Council of India https://qcin.org/ & its library. https://qcin.org/nbqp/knowledge_bank/

R2. International Society of Six Sigma Professionals: https://isssp.org/about-us/

R3. NPTEL / SWAYAM: https://nptel.ac.in/courses/110105123 : Six Sigma, Prof. Jitesh J Thakkar, IIT Kharagpur, Certification course. (Self- Learning).

R4. Older / Previous editions of AIAG manuals on APQP, FMEA and PPAP. These are great sources of information on Quality Planning and has basics of Project Management and required skills.

R5. Quality Management for Organizations Using Lean Six Sigma Techniques- Erick C Jones

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3			1			1		2	1
CO2	2	2	2	3	2	1		1					3	1
CO3	2	3	3	3	2								2	1
CO4	2	2	3	3	3		1	1					2	1
CO5	3	3	3	3	3					1			1	2
Avg	2.2	2.4	2.6	3	2.6	1	1	1		1	1		2	1.2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6205	Modern Robotics	3	0	0	3

Course Objective

1. To introduce definition, history of robotics and robot anatomy.
2. To learn the simulation of robot kinematics
3. To study the grasping and manipulation of robots.
4. To study about mobile robot and manipulation.
5. To study the applications of industrial, service, domestic robots.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Robot: Definition, History of Robotics, Robot Anatomy, Co-ordinate systems, types and classification, Configuration space and degrees of freedom of rigid bodies and robots, Configuration space topology and representation; configuration and velocity constraints; task space and workspace, Rigid-body motions, rotation matrices, angular velocities, and exponential coordinates of rotation, Homogeneous transformation matrices.	9
II	**SIMULATION OF ROBOT KINEMATICS** Robot kinematics, Forward and inverse kinematics (two three four degrees of freedom), Forward and inverse kinematics of velocity, Homogeneous transformation matrices, translation and rotation matrices Dennavit and Hartenberg (D-H) transformation, Dynamics of Open Chains, Trajectory Generation, motion planning, robot control: First- and second-order linear error dynamics, stability of a feedback control system.	9
III	**GRASPING AND MANIPULATION OF ROBOTS** Kinematics of contact, contact types (rolling, sliding, and breaking), graphical methods for representing kinematic constraints in the plane, and form-closure grasping, Coulomb friction, friction cones, graphical methods for representing forces and torques in the plane, End effectors, grippers, types of gripper, gripper force analysis, and examples of manipulation and grasping.	9
IV	**MOBILE ROBOTS** Mobile robot, Wheeled Mobile Robots: Kinematic models of omnidirectional and non-holonomic wheeled mobile robots, Controllability, motion planning, feedback control of non-holonomic wheeled mobile robots; odometry for wheeled mobile robots; and mobile manipulation. Reference Trajectory generation, feed forward control	9
V	**APPLICATIONS OF ROBOTS** Application of robotic: industrial robots, Service robots, domestic and house hold robots, Medical robots, military robots, agricultural robots, space robots, Aerial robotics Role of robots in inspection, assembly, material handling, underwater, space and healthcare	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Discuss the definition, history of robotics and robot anatomy.
CO2: Develop the simulation of robot kinematics
CO3: Describe the grasping and manipulation of robots.
CO4: Explain about mobile robot and manipulation.
CO5: Discuss the applications of industrial, service, domestic robots.

TEXT BOOK:

T1. Modern Robotics: Mechanics, Planning, and Control, by Kevin M. Lynch , Frank C. Park , Cambridge University Press; 1st edition (25 May 2017), ISBN-10 : 110715
T2. Modern Robotics: Mechanics, Systems and Control, by Julian Evans, Larsen and Keller Education (27 June 2019), ISBN-10 : 1641720751

REFERENCES:

R1. Modern Robotics: Designs, Systems and Control, by Jared Kroff, Willford Press (18 June 2019)ISBN-10 : 1682856763
R2. Advanced Technologies in Modern Robotic Applications, by ChenguangYang , Hongbin Ma , Mengyin Fu, Springer; Softcover reprint of the original 1st ed. 2016 edition (30 May 2018), ISBN-10 : 981109263X
R3. Modern Robotics: Building Versatile Machines, by Harry Henderson, Facts On File Inc; Illustrated edition (1 August 2006), ISBN-10 : 0816057451
R4. Artificial Intelligence for Robotics, by Francis X. Govers, Packt Publishing Limited; Standard Edition (30 August 2018), ISBN-10 : 1788835441
R5. Modern Robotics Hardcover by Lauren Barrett (Editor), Murphy & Moore Publishing (1 March 2022), ISBN-10 : 1639873732

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	1	2				1			1	1	2
CO2	2	1	3	1	2				1			1	1	2
CO3	2	1	3	1	2				1			1	1	2
CO4	2	1	3	1	2				1			1	1	2
CO5	2	1	3	1	2				1			1	1	2
Avg	2	1	3	1	2	0	0	0	1	0	0	1	1	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6206	ENERGY CONSERVATION IN INDUSTRIES	3	0	0	3

Course Objective

The student should be able

1. To learn Quantifying the energy demand and energy supply scenario of nation and explaining the need for energy auditing for becoming environmentally benign.
2. To Analyzing factors behind energy billing and applying the concept of demand side management for lowering energy costs.
3. To learn Computing the stoichiometric air requirement for any given fuel and quantifying the energy losses associated with thermal utilities of industries.
4. To Diagnosing the causes for under performance of various electrical utilities and suggesting remedies for improving their efficiency.
5. To Applying CUSUM and other financial evaluation techniques to estimating the accruable energy savings/monetary benefits for any energy efficiency project.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Energy scenario of World, India and TN - Environmental aspects of Energy Generation – Material and Energy balancing - Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Basic instruments for Energy Auditing.	9
II	**ELECTRICAL SUPPLY SYSTEMS** Electricity Tariff structures – Typical Billing - Demand Side Management - HT and LT supply - Power Factor –Energy conservation in Transformers – Harmonics	9
III	**ENERGY CONSERVATION IN MAJOR THERMAL UTILITIES** Stoichiometry - Combustion principles. Energy conservation in: Boilers - Steam Distribution Systems -Furnaces - Thermic Fluid Heaters – Cooling Towers – D.G. sets. Insulation and Refractories - Waste Heat Recovery Devices.	9
IV	**ENERGY CONSERVATION IN MAJOR ELECTRICAL UTILITIES** Energy conservation in: Motors - Pumps – Fans – Blowers - Compressed Air Systems - Refrigeration and Air Conditioning Systems - Illumination systems	9
V	**ENERGY MONITORING, TARGETING, LABELLING AND ECONOMICS** Elements of Monitoring & Targeting System – CUSUM - Energy / Cost index diagram – Energy Labelling -Energy Economics – Cost of production and Life Cycle Costing - Economic evaluation techniques – Discounting and Non-Discounting - ESCO concept – PAT scheme	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Discuss Quantify the energy demand and energy supply scenario of nation and appreciate the need for energy auditing for becoming environmentally benign

CO2. Analyse factors behind energy billing and apply the concept of demand side management for lowering energy costs

CO3. Compute the stoichiometric air requirement for any given fuel and quantify the energy losses associated with thermal utilities of industries

CO4. Diagnose the causes for under performance of various electrical utilities and suggest remedies for improving their efficiency

CO5. Apply CUSUM and other financial evaluation techniques to estimate the accruable energy savings/monetary benefits for any energy efficiency project

TEXT BOOK:

T1. Guide book for National Certification Examination for "Energy Managers and Energy Auditors" (4 Volumes). Available at http://www.em-ea.org/gbook1.asp. This website is administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.

T2. K. Nagabhushan Raju, Industrial Energy Conservation Techniques: (concepts, Applications and Case Studies), Atlantic Publishers &Dist, 2007.

REFERENCES:

R1. Abbi Y P, Shashank Jain., Handbook on Energy Audit and Environment Management, TERI Press, 2006.

R2. Albert Thumann and Paul Mehta D, "Handbook of Energy Engineering", 7thEdition, The Fairmont Press, 2013.

R3. Murphy.W.R. and McKay.G, "Energy Management", Butterworth, London 1982.

R4. Paul W.O'Callaghan, Design and management for energy conservation: A handbook for energy managers, plant engineers, and designers. Pergamon Press, 1981.

R5. Steve Doty, Wayne Turner C, Energy Management Handbook 7th Edition, The Fairmont Press, 2009.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	2	2	1	1	2	1	2	1	1
CO2	2	2	2	1	2	2	2	1	1	2	2	2	2	1
CO3	2	2	2	1	2	2	2	1	1	2	2	2	3	2
CO4	2	2	2	1	2	2	3	1	1	2	2	2	2	3
CO5	2	2	-	-	2	1	2	1	1	1	2	2	2	3
Avg	2.2	2	2	1.25	1.8	1.8	2.2	1	1	1.8	1.8	2	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HiCET ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6207	ENERGY STORAGE DEVICES	3	0	0	3

Course Objective

The student should be able

1. To study the various types of energy storage devices and technologies and them comparison.
2. To learn the techniques of various energy storage devices and their performances.
3. To learn the basics of batteries and hybrid systems for EVs and other mobile applications.
4. To learn about the renewable energy storage systems and management systems.
5. To have an insight into other energy storage devices, hydrogen, and fuel cells.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ENERGY STORAGE** Need for Energy Storage – Types of Energy Storage – Various forms of Energy Storage – Mechanical–Thermal - Chemical– Electrochemical – Electrical - Other alternative energy storage technologies – Efficiency and Comparison.	9
II	**ENERGY STORAGE SYSTEMS** Pumped Air Energy Storage – Compressed Air Energy Storage – Flywheel – Sensible and Latent Heat Storage – Storage Materials – Performance Evaluation - Thermochemical systems – Batteries – Types- Charging and Discharging – Battery testing and performance.	9
III	**MOBILE AND HYBRID ENERGY STORAGE SYSTEMS** Batteries for electric vehicles - Battery specifications for cars, heart pacemakers, computer standby supplies – V2G and G2V technologies – HESS.	9
IV	**RENEWABLE ENERGY STORAGE AND ENERGY MANAGEMENT** Storage of Renewable Energy Systems –Solar Energy – Wind Energy – Energy Storage in Micro grid– Smart Grid – Energy Conversion Efficiency - Battery Management Systems – EVBMS – Energy Audit and Management	9
V	**OTHER ENERGY DEVICES** Superconducting Magnetic Energy Storage (SMES), Supercapacitors – MHD Power generation – Hydrogen Storage - Fuel Cells – Basic principle and classifications – PEMFC, AMFC, DMFC, SOFC,MCFC and Biofuel Cells – Biogas Storage.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Discuss the need and identify the suitable energy storage devices for applications.
CO2: Explain the working of various energy storage devices and their importance.
CO3: Explain the basic characteristics of batteries for mobile and hybrid systems.
CO4: Discuss the storage of renewable energies and management systems.
CO5: Explain the need for other energy devices and their scope for applications.

TEXT BOOK:

T1. Rober Huggins, "Energy Storage: Fundamentals, Materials and Applications", 2 nd Edition, Springer, 2015.
T2. Dell, Ronald M Rand, David A J, "Understanding Batteries", Royal Society of Chemistry, 2001

REFERENCES:

R1. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt," Energy Storage in Power Systems" Wiley Publication, 2016.
R2. Ibrahim Dincer and Mark A Rosen, "Thermal Energy Storage Systems and Applications", John Wiley & amp; Sons, 2002.
R3. Lindon David, "Handbook of Batteries", McGraw Hill, 2002.
R4. Aulice Scibioh M. and Viswanathan B, "Fuel Cells – principles and applications', University Press(India), 2006
R5. Ru-Shiliu, Leizhang, Sueliang Sun, "Electrochemical Technologies for Energy Storage and Conversion", Wiley Publications, 2012.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO2	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO3	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO4	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO5	3	2	1	1	1	-	2	-	-	-	-	-	1	2
Avg	3	2	1	1	1	0	2	0	0	0	0	0	1	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL
Chairman
HICET COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6208	ERGONOMICS IN DESIGN	3	0	0	3

Course Objective

The student should be able

1. To introduce to industrial design based on ergonomics.
2. To consider ergonomics concept in manufacturing
3. To apply ergonomics in design of controls and display.
4. To apply environmental factors in ergonomics design.
5. To develop aesthetics applicable to manufacturing and product

Unit	Description	Instructional Hours
I	**INTRODUCTION** An approach to industrial design, Elements of design structure for industrial design in engineering application in modern manufacturing systems- Ergonomics and Industrial Design: Introduction to Ergonomics, Communication system, general approach to the man-machine relationship, Human component of work system, Machine component of work system, Local environment-light, Heat, Sound.	9
II	**ERGONOMICS AND PRODUCTION** Introduction, Anthropometric data and its applications in ergonomic, working postures, Body Movements, Work Station Design, Chair Design. Visual Effects of Line and Form: The mechanics of seeing, Psychology of seeing, Figure on ground effect, Gestalt's perceptions - Simplicity, Regularity, Proximity, Wholeness. Optical illusions, Influences of line and form.	9
III	**DESIGN PRINCIPLES FOR DISPLAY AND CONTROLS** Displays: Design Principles of visual Displays, Classification, Quantitative displays, Qualitative displays, check readings, Situational awareness, Representative displays, Design of pointers, Signal and warning lights, colour coding of displays, Design of multiple displays Controls: Design considerations, Controls with little efforts – Push button, Switches, rotating Knobs. Controls with muscular effort – Hand wheel, Crank, Heavy lever, Pedals. Design of controls in automobiles, Machine Tools	9
IV	**ENVIRONMENTAL FACTORS** Colour: Colour and light, Colour and objects, Colour and the eye – after Image, Colour blindness, Colour constancy, Colour terms – Colour circles, Munsel colour notation, reactions to colour and colour combination – colour on engineering equipments, Colour coding, Psychological effects, colour and machine form, colour and style	9
V	**AESTHETIC CONCEPTS** Concept of unity, Concept of order with variety, Concept of purpose, Style and environment, Aesthetic expressions - Symmetry, Balance, Contrast, Continuity, Proportion. Style - The components of style, House style, Style in capital good. Introduction to Ergonomic and plant layout software's, total layout design.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Appreciate ergonomics need in the industrial design.
CO2. Apply ergonomics in creation of manufacturing system
CO3. Discuss on design of controls and display.
CO4. Consider environmental factors in ergonomics design.
CO5. Report on importance of aesthetics to manufacturing system and product

TEXT BOOK:

T1. Ergonomics in Design: Methods and Techniques (Human Factors and Ergonomics) by Marcelo M. Soares , Francisco Rebelo
T2. Ergonomics in Product Design by Send points Publishing Co. Ltd

REFERENCES:

R1. Benjamin W.Niebel, Motion and Time Study, Richard, D. Irwin Inc., 7thEdition, 2002
R2. Brain Shakel,"Applied Ergonomics Hand Book", Butterworth Scientific London 1988.
R3. Bridger, R.C., Introduction to Ergonomics, 2ndEdition, 2003, McGraw Hill Publications.
R4. Martin Helander, A Guide to human factors and Ergonomics, Taylor and Francis, 2006
R5. Mayall W.H. "Industrial design for Engineers", London Hiffee books Ltd., 1988.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	2	-	-	-	-	-	2	2	3	2
CO2	3	3	1	2	2	-	-	-	-	-	-	1	3	3
CO3	3	3	1	2	1	-	-	-	-	-	1	1	3	3
CO4	3	3	2	2	2	-	-	-	-	-	1	1	3	3
CO5	3	3	3	2	2	-	-	-	-	-	1	1	3	3
Avg	3	2.8	1.6	2	1.8	0	0	0	0	0	1	1.2	3	2.8

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL
Chairman
ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6209	Advances in Composite Materials	3	0	0	3

Course Objective

CO1.To understand the fundamentals of matrices and reinforcements.
CO2. Understanding the principles, matrices and characteristics of MMC.
CO3. Considerate the needs, principles and characteristics of CMC.
CO4. Appreciative the principles, fabricating types and characteristics of PMC.
CO5. Indulgent the importance of testing.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPOSITES** Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Functions and selection of matrix and reinforcement materials – Particle reinforced composites-Fiber reinforced composites- Rule of mixtures- Applications of various types of composites- Introduction to nano materials – Types of fibers.	9
II	**METAL MATRIX COMPOSITES** Metal Matrix, Reinforcements – particles – fibres, Effect of reinforcement - Volume fraction. Various types of Metal Matrix Composites, Characteristics of MMC, Alloy vs. MMC, Advantages and limitations of MMC –Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.	9
III	**CERAMIC MATRIX COMPOSITES** Engineering ceramic materials – Properties – Advantages – Limitations – Monolithic ceramics - Need for CMCs – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – Non oxide Ceramics – Aluminium oxide – Silicon nitride – Reinforcements – particles- fibres- whiskers.	9
IV	**POLYMER MATRIX COMPOSITES** Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non-woven random mats – Various types of fibres. Methods for producing PMC - Hand layup processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding	9
V	**TESTING OF COMPOSITES** Mechanical testing of composite – tensile testing – compressive testing-infra laminar shear testing, infra laminar shear testing, fracture testing.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:
CO 1: Explain role of matrices and reinforcements, different types of fibers, Applications of composites.
CO 2: Discuss the production and applications of metal matrix composites.
CO 3: Enumerate the various methods for producing ceramic matrix composites.
CO 4: Sketch and explain the polymer resin composite fabrication methods.
CO 5: Describe the various composite testing.

TEXT BOOK:

T1 - Sharma S.C., "Composite materials", Narosa Publications, 2004.
T2 - Autar.K.Kaw, "Mechanics of Composite Materials", CRC Press, 2006.

REFERENCES:

R1- Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall,
R2 - London, England, 2006.
R3 - Chawla K.K., "Composite materials",Springer –Verlag, 2012.
R4 - Strong A.B., "Fundamentals of Composite Manufacturing", SME, 2008.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	2	3	-	3	-	-	-	1	1	-	2
CO2	1	1	1	2	3	-	3	-	1	-	1	1	1	1
CO3	1	1	1	2	3	-	3	-	1	-	1	1	1	1
CO4	1	1	1	3	3	-	3	-	1	-	1	1	2	2
CO5	1	1	1	3	3	-	3	-	1	-	1	1	1	1
Avg	1	1.2	1	2.4	3	-	3	-	0.8		1	1	1	1.4

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6204	LEAN MANUFACTURING	3	0	0	3

Course Objective

The student should be able

1. To introduce the basics of 6 SIGMA
2. To learning about the lean manufacturing tools.
3. To study about the deeper understanding methodologies of Lean manufacturing.
4. To study the lean concepts and its elements.
5. To learn implementation and challenges of lean manufacturing.

Unit	Description	Instructional Hours
I	**BASICS OF 6 SIGMA** Introduction to 6 Sigma, basic tools of six sigma like problem solving approach, standard deviation, normal distribution, various sigma levels with some examples, value for the enterprise, Variation, and sources ofvariation, Mean and moving the mean, Various quality costs, cost of poor quality	9
II	**INTRODUCTION TO LEAN MANUFACTURING TOOLS** Process Capability Indices, Cause and Effect diagram, Control Charts, Introduction to FMEA, APQP, PPAP. 3 foundational 6 Sigma methodologies: DMAIC, DMEDI, and Process Management DMEDI for process creation, DMAIC for process improvement and PDCA for sustaining improvements.	9
III	**DEEPER UNDERSTADING METHODOLOGIES** What is a process, Why Process management, Keys to process management, Difference between process management and 6 Sigma, Introduction to Deming cycle, PDCA, DMAIC and continuous improvement, DMEDI for creation process, DMAIC Vs DMEDI with examples, Introduction to Toyota Production System, Six Sigma and Production System integration.	9
IV	**LEAN ELEMENTS** Introduction to Lean Concepts like In-Built Quality, Concept of Right Part at the Right Time, Lead Time reduction, Optimum utilization of Capital, Optimum utilization of People. Understanding the Zero-defect concept and Metrics, Focus on Human Resources, Quality, Delivery, Cost. Building Zero defect□capabilities, Cultural and Organizational aspects	9
V	**IMPLEMENTATION AND CHALLENGES** Implementing Checks and Balances in the process, Robust Information Systems, Dashboard, follow up and robust corrective and preventive mechanism. Concept of Audits, and continuous improvement from gap analysis, risk assessments etc.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Discuss the basics of 6 SIGMA

CO2: Elaborate the lean manufacturing tools.

CO3: Illustrate about the deeper understanding methodologies of Lean manufacturing.

CO4: Discuss lean concepts and its elements.

CO5: Describe the implementation and challenges of lean manufacturing.

TEXT BOOK:

T1. Quality Planning and Analysis- JM Juran& FM Gryna. Tata Mc Graw Hill

T2. Lean Manufacturing: Principles to Practice by Akhilesh N. Singh, Bibliophile SouthAsia

T3. The Toyota Way: 14 Management Principles

T4. Gemba Kaizen: A Commonsense Approach to a Continuous Improvement Strategy,Masaki Imai

REFERENCES:

R1. Quality Council of India https://qcin.org/ & its library. https://qcin.org/nbqp/knowledge_bank/

R2. International Society of Six Sigma Professionals: https://isssp.org/about-us/

R3. NPTEL / SWAYAM: https://nptel.ac.in/courses/110105123 : Six Sigma, Prof. Jitesh J Thakkar, IIT Kharagpur, Certification course. (Self- Learning).

R4. Older / Previous editions of AIAG manuals on APQP, FMEA and PPAP. These are great sources of information on Quality Planning and has basics of Project Management and required skills.

R5. Quality Management for Organizations Using Lean Six Sigma Techniques- Erick C Jones

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3			1			1		2	1
CO2	2	2	2	3	2	1		1					3	1
CO3	2	3	3	3	2								2	1
CO4	2	2	3	3	3		1	1					2	1
CO5	3	3	3	3	3					1			1	2
Avg	2.2	2.4	2.6	3	2.6	1	1	1		1	1		2	1.2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6205	Modern Robotics	3	0	0	3

Course Objective

1. To introduce definition, history of robotics and robot anatomy.
2. To learn the simulation of robot kinematics
3. To study the grasping and manipulation of robots.
4. To study about mobile robot and manipulation.
5. To study the applications of industrial, service, domestic robots.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Robot: Definition, History of Robotics, Robot Anatomy, Co-ordinate systems, types and classification, Configuration space and degrees of freedom of rigid bodies and robots, Configuration space topology and representation; configuration and velocity constraints; task space and workspace, Rigid-body motions, rotation matrices, angular velocities, and exponential coordinates of rotation, Homogeneous transformation matrices.	9
II	**SIMULATION OF ROBOT KINEMATICS** Robot kinematics, Forward and inverse kinematics (two three four degrees of freedom), Forward and inverse kinematics of velocity, Homogeneous transformation matrices, translation and rotation matrices Dennavit and Hartenberg (D-H) transformation, Dynamics of Open Chains, Trajectory Generation, motion planning, robot control: First- and second-order linear error dynamics, stability of a feedback control system.	9
III	**GRASPING AND MANIPULATION OF ROBOTS** Kinematics of contact, contact types (rolling, sliding, and breaking), graphical methods for representing kinematic constraints in the plane, and form-closure grasping, Coulomb friction, friction cones, graphical methods for representing forces and torques in the plane, End effectors, grippers, types of gripper, gripper force analysis, and examples of manipulation and grasping.	9
IV	**MOBILE ROBOTS** Mobile robot, Wheeled Mobile Robots: Kinematic models of omnidirectional and non-holonomic wheeled mobile robots, Controllability, motion planning, feedback control of non-holonomic wheeled mobile robots; odometry for wheeled mobile robots; and mobile manipulation. Reference Trajectory generation, feed forward control	9
V	**APPLICATIONS OF ROBOTS** Application of robotic: industrial robots, Service robots, domestic and house hold robots, Medical robots, military robots, agricultural robots, space robots, Aerial robotics Role of robots in inspection, assembly, material handling, underwater, space and healthcare	9
	Total Instructional Hours	**45**

Course Outcome

CO1: Discuss the definition, history of robotics and robot anatomy.
CO2: Develop the simulation of robot kinematics
CO3: Describe the grasping and manipulation of robots.
CO4: Explain about mobile robot and manipulation.
CO5: Discuss the applications of industrial, service, domestic robots.

TEXT BOOK:

T1. Modern Robotics: Mechanics, Planning, and Control, by Kevin M. Lynch , Frank C. Park , Cambridge University Press; 1st edition (25 May 2017), ISBN-10 : 110715
T2. Modern Robotics: Mechanics, Systems and Control, by Julian Evans, Larsen and Keller Education (27 June 2019), ISBN-10 : 1641720751

REFERENCES:

R1. Modern Robotics: Designs, Systems and Control, by Jared Kroff, Willford Press (18 June 2019)ISBN-10 : 1682856763
R2. Advanced Technologies in Modern Robotic Applications, by ChenguangYang , Hongbin Ma , Mengyin Fu, Springer; Softcover reprint of the original 1st ed. 2016 edition (30 May 2018), ISBN-10 : 981109263X
R3. Modern Robotics: Building Versatile Machines, by Harry Henderson, Facts On File Inc; Illustrated edition (1 August 2006), ISBN-10 : 0816057451
R4. Artificial Intelligence for Robotics, by Francis X. Govers, Packt Publishing Limited; Standard Edition (30 August 2018), ISBN-10 : 1788835441
R5. Modern Robotics Hardcover by Lauren Barrett (Editor), Murphy & Moore Publishing (1 March 2022), ISBN-10 : 1639873732

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	1	2				1			1	1	2
CO2	2	1	3	1	2				1			1	1	2
CO3	2	1	3	1	2				1			1	1	2
CO4	2	1	3	1	2				1			1	1	2
CO5	2	1	3	1	2				1			1	1	2
Avg	2	1	3	1	2	0	0	0	1	0	0	1	1	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6206	ENERGY CONSERVATION IN INDUSTRIES	3	0	0	3

Course Objective

The student should be able

1. To learn Quantifying the energy demand and energy supply scenario of nation and explaining the need for energy auditing for becoming environmentally benign.
2. To Analyzing factors behind energy billing and applying the concept of demand side management for lowering energy costs.
3. To learn Computing the stoichiometric air requirement for any given fuel and quantifying the energy losses associated with thermal utilities of industries.
4. To Diagnosing the causes for under performance of various electrical utilities and suggesting remedies for improving their efficiency.
5. To Applying CUSUM and other financial evaluation techniques to estimating the accruable energy savings/monetary benefits for any energy efficiency project.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Energy scenario of World, India and TN - Environmental aspects of Energy Generation – Material and Energy balancing - Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Basic instruments for Energy Auditing.	9
II	**ELECTRICAL SUPPLY SYSTEMS** Electricity Tariff structures – Typical Billing - Demand Side Management - HT and LT supply - Power Factor –Energy conservation in Transformers – Harmonics	9
III	**ENERGY CONSERVATION IN MAJOR THERMAL UTILITIES** Stoichiometry - Combustion principles. Energy conservation in: Boilers - Steam Distribution Systems -Furnaces - Thermic Fluid Heaters – Cooling Towers – D.G. sets. Insulation and Refractories - Waste Heat Recovery Devices.	9
IV	**ENERGY CONSERVATION IN MAJOR ELECTRICAL UTILITIES** Energy conservation in: Motors - Pumps – Fans – Blowers - Compressed Air Systems - Refrigeration and Air Conditioning Systems - Illumination systems	9
V	**ENERGY MONITORING, TARGETING, LABELLING AND ECONOMICS** Elements of Monitoring & Targeting System – CUSUM - Energy / Cost index diagram – Energy Labelling -Energy Economics – Cost of production and Life Cycle Costing - Economic evaluation techniques – Discounting and Non-Discounting - ESCO concept – PAT scheme	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Discuss Quantify the energy demand and energy supply scenario of nation and appreciate the need for energy auditing for becoming environmentally benign

CO2. Analyse factors behind energy billing and apply the concept of demand side management for lowering energy costs

CO3. Compute the stoichiometric air requirement for any given fuel and quantify the energy losses associated with thermal utilities of industries

CO4. Diagnose the causes for under performance of various electrical utilities and suggest remedies for improving their efficiency

CO5. Apply CUSUM and other financial evaluation techniques to estimate the accruable energy savings/monetary benefits for any energy efficiency project

TEXT BOOK:

T1. Guide book for National Certification Examination for "Energy Managers and Energy Auditors" (4 Volumes). Available at http://www.em-ea.org/gbook1.asp. This website is administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.

T2. K. Nagabhushan Raju, Industrial Energy Conservation Techniques: (concepts, Applications and Case Studies), Atlantic Publishers &Dist, 2007.

REFERENCES:

R1. Abbi Y P, Shashank Jain., Handbook on Energy Audit and Environment Management, TERI Press, 2006.

R2. Albert Thumann and Paul Mehta D, "Handbook of Energy Engineering", 7thEdition, The Fairmont Press, 2013.

R3. Murphy.W.R. and McKay.G, "Energy Management", Butterworth, London 1982.

R4. Paul W.O'Callaghan, Design and management for energy conservation: A handbook for energy managers, plant engineers, and designers. Pergamon Press, 1981.

R5. Steve Doty, Wayne Turner C, Energy Management Handbook 7th Edition, The Fairmont Press, 2009.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	2	2	1	1	2	1	2	1	1
CO2	2	2	2	1	2	2	2	1	1	2	2	2	2	1
CO3	2	2	2	1	2	2	2	1	1	2	2	2	3	2
CO4	2	2	2	1	2	2	3	1	1	2	2	2	2	3
CO5	2	2	-	-	2	1	2	1	1	1	2	2	2	3
Avg	2.2	2	2	1.25	1.8	1.8	2.2	1	1	1.8	1.8	2	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HiCET ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6207	ENERGY STORAGE DEVICES	3	0	0	3

Course Objective

The student should be able

1. To study the various types of energy storage devices and technologies and them comparison.
2. To learn the techniques of various energy storage devices and their performances.
3. To learn the basics of batteries and hybrid systems for EVs and other mobile applications.
4. To learn about the renewable energy storage systems and management systems.
5. To have an insight into other energy storage devices, hydrogen, and fuel cells.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ENERGY STORAGE** Need for Energy Storage – Types of Energy Storage – Various forms of Energy Storage – Mechanical–Thermal - Chemical– Electrochemical – Electrical - Other alternative energy storage technologies – Efficiency and Comparison.	9
II	**ENERGY STORAGE SYSTEMS** Pumped Air Energy Storage – Compressed Air Energy Storage – Flywheel – Sensible and Latent Heat Storage – Storage Materials – Performance Evaluation - Thermochemical systems – Batteries – Types- Charging and Discharging – Battery testing and performance.	9
III	**MOBILE AND HYBRID ENERGY STORAGE SYSTEMS** Batteries for electric vehicles - Battery specifications for cars, heart pacemakers, computer standby supplies – V2G and G2V technologies – HESS.	9
IV	**RENEWABLE ENERGY STORAGE AND ENERGY MANAGEMENT** Storage of Renewable Energy Systems –Solar Energy – Wind Energy – Energy Storage in Micro grid– Smart Grid – Energy Conversion Efficiency - Battery Management Systems – EVBMS – Energy Audit and Management	9
V	**OTHER ENERGY DEVICES** Superconducting Magnetic Energy Storage (SMES), Supercapacitors – MHD Power generation – Hydrogen Storage - Fuel Cells – Basic principle and classifications – PEMFC, AMFC, DMFC, SOFC,MCFC and Biofuel Cells – Biogas Storage.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Discuss the need and identify the suitable energy storage devices for applications.
CO2: Explain the working of various energy storage devices and their importance.
CO3: Explain the basic characteristics of batteries for mobile and hybrid systems.
CO4: Discuss the storage of renewable energies and management systems.
CO5: Explain the need for other energy devices and their scope for applications.

TEXT BOOK:

T1. Rober Huggins, "Energy Storage: Fundamentals, Materials and Applications", 2 nd Edition, Springer, 2015.
T2. Dell, Ronald M Rand, David A J, "Understanding Batteries", Royal Society of Chemistry, 2001

REFERENCES:

R1. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt," Energy Storage in Power Systems" Wiley Publication, 2016.
R2. Ibrahim Dincer and Mark A Rosen, "Thermal Energy Storage Systems and Applications", John Wiley & amp; Sons, 2002.
R3. Lindon David, "Handbook of Batteries", McGraw Hill, 2002.
R4. Aulice Scibioh M. and Viswanathan B, "Fuel Cells – principles and applications', University Press(India), 2006
R5. Ru-Shiliu, Leizhang, Sueliang Sun, "Electrochemical Technologies for Energy Storage and Conversion", Wiley Publications, 2012.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO2	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO3	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO4	3	2	1	1	1	-	2	-	-	-	-	-	1	2
CO5	3	2	1	1	1	-	2	-	-	-	-	-	1	2
Avg	3	2	1	1	1	0	2	0	0	0	0	0	1	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL
Chairman
HICET COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6208	ERGONOMICS IN DESIGN	3	0	0	3

Course Objective

The student should be able

1. To introduce to industrial design based on ergonomics.
2. To consider ergonomics concept in manufacturing
3. To apply ergonomics in design of controls and display.
4. To apply environmental factors in ergonomics design.
5. To develop aesthetics applicable to manufacturing and product

Unit	Description	Instructional Hours
I	**INTRODUCTION** An approach to industrial design, Elements of design structure for industrial design in engineering application in modern manufacturing systems- Ergonomics and Industrial Design: Introduction to Ergonomics, Communication system, general approach to the man-machine relationship, Human component of work system, Machine component of work system, Local environment-light, Heat, Sound.	9
II	**ERGONOMICS AND PRODUCTION** Introduction, Anthropometric data and its applications in ergonomic, working postures, Body Movements, Work Station Design, Chair Design. Visual Effects of Line and Form: The mechanics of seeing, Psychology of seeing, Figure on ground effect, Gestalt's perceptions - Simplicity, Regularity, Proximity, Wholeness. Optical illusions, Influences of line and form.	9
III	**DESIGN PRINCIPLES FOR DISPLAY AND CONTROLS** Displays: Design Principles of visual Displays, Classification, Quantitative displays, Qualitative displays, check readings, Situational awareness, Representative displays, Design of pointers, Signal and warning lights, colour coding of displays, Design of multiple displays Controls: Design considerations, Controls with little efforts – Push button, Switches, rotating Knobs. Controls with muscular effort – Hand wheel, Crank, Heavy lever, Pedals. Design of controls in automobiles, Machine Tools	9
IV	**ENVIRONMENTAL FACTORS** Colour: Colour and light, Colour and objects, Colour and the eye – after Image, Colour blindness, Colour constancy, Colour terms – Colour circles, Munsel colour notation, reactions to colour and colour combination – colour on engineering equipments, Colour coding, Psychological effects, colour and machine form, colour and style	9
V	**AESTHETIC CONCEPTS** Concept of unity, Concept of order with variety, Concept of purpose, Style and environment, Aesthetic expressions - Symmetry, Balance, Contrast, Continuity, Proportion. Style - The components of style, House style, Style in capital good. Introduction to Ergonomic and plant layout software's, total layout design.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Appreciate ergonomics need in the industrial design.
CO2. Apply ergonomics in creation of manufacturing system
CO3. Discuss on design of controls and display.
CO4. Consider environmental factors in ergonomics design.
CO5. Report on importance of aesthetics to manufacturing system and product

TEXT BOOK:

T1. Ergonomics in Design: Methods and Techniques (Human Factors and Ergonomics) by Marcelo M. Soares , Francisco Rebelo
T2. Ergonomics in Product Design by Send points Publishing Co. Ltd

REFERENCES:

R1. Benjamin W.Niebel, Motion and Time Study, Richard, D. Irwin Inc., 7thEdition, 2002
R2. Brain Shakel,"Applied Ergonomics Hand Book", Butterworth Scientific London 1988.
R3. Bridger, R.C., Introduction to Ergonomics, 2ndEdition, 2003, McGraw Hill Publications.
R4. Martin Helander, A Guide to human factors and Ergonomics, Taylor and Francis, 2006
R5. Mayall W.H. "Industrial design for Engineers", London Hiffee books Ltd., 1988.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	2	-	-	-	-	-	2	2	3	2
CO2	3	3	1	2	2	-	-	-	-	-	-	1	3	3
CO3	3	3	1	2	1	-	-	-	-	-	1	1	3	3
CO4	3	3	2	2	2	-	-	-	-	-	1	1	3	3
CO5	3	3	3	2	2	-	-	-	-	-	1	1	3	3
Avg	3	2.8	1.6	2	1.8	0	0	0	0	0	1	1.2	3	2.8

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL
Chairman
ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	21ME6209	Advances in Composite Materials	3	0	0	3

Course Objective

CO1.To understand the fundamentals of matrices and reinforcements.
CO2. Understanding the principles, matrices and characteristics of MMC.
CO3. Considerate the needs, principles and characteristics of CMC.
CO4. Appreciative the principles, fabricating types and characteristics of PMC.
CO5. Indulgent the importance of testing.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO COMPOSITES** Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Functions and selection of matrix and reinforcement materials – Particle reinforced composites-Fiber reinforced composites- Rule of mixtures- Applications of various types of composites- Introduction to nano materials – Types of fibers.	9
II	**METAL MATRIX COMPOSITES** Metal Matrix, Reinforcements – particles – fibres, Effect of reinforcement - Volume fraction. Various types of Metal Matrix Composites, Characteristics of MMC, Alloy vs. MMC, Advantages and limitations of MMC –Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.	9
III	**CERAMIC MATRIX COMPOSITES** Engineering ceramic materials – Properties – Advantages – Limitations – Monolithic ceramics - Need for CMCs – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – Non oxide Ceramics – Aluminium oxide – Silicon nitride – Reinforcements – particles- fibres- whiskers.	9
IV	**POLYMER MATRIX COMPOSITES** Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non-woven random mats – Various types of fibres. Methods for producing PMC - Hand layup processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding	9
V	**TESTING OF COMPOSITES** Mechanical testing of composite – tensile testing – compressive testing-infra laminar shear testing, infra laminar shear testing, fracture testing.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:
CO 1: Explain role of matrices and reinforcements, different types of fibers, Applications of composites.
CO 2: Discuss the production and applications of metal matrix composites.
CO 3: Enumerate the various methods for producing ceramic matrix composites.
CO 4: Sketch and explain the polymer resin composite fabrication methods.
CO 5: Describe the various composite testing.

TEXT BOOK:

T1 - Sharma S.C., "Composite materials", Narosa Publications, 2004.
T2 - Autar.K.Kaw, "Mechanics of Composite Materials", CRC Press, 2006.

REFERENCES:

R1- Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall,
R2 - London, England, 2006.
R3 - Chawla K.K., "Composite materials",Springer –Verlag, 2012.
R4 - Strong A.B., "Fundamentals of Composite Manufacturing", SME, 2008.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	2	3	-	3	-	-	-	1	1	-	2
CO2	1	1	1	2	3	-	3	-	1	-	1	1	1	1
CO3	1	1	1	2	3	-	3	-	1	-	1	1	1	1
CO4	1	1	1	3	3	-	3	-	1	-	1	1	2	2
CO5	1	1	1	3	3	-	3	-	1	-	1	1	1	1
Avg	1	1.2	1	2.4	3	-	3	-	0.8		1	1	1	1.4

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL Chairman

Dean – Academics

Dean (Academics)
HiCET

CURRICULUM
R2019

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.E. MECHANICAL ENGINEERING REGULATION-2019 (Revised on July 2021)

(For the students admitted during the academic year 2020-2021 and onwards)

SEMESTER I – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	19PH1101	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1101	Engineering Chemistry	BS	2	0	2	3	50	50	100
5	19CS1151	Problem Solving and Python Programming	ES	2	0	2	3	50	50	100
6	19ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	19HE1001	Language Competency Enhancement Course - I	HS	0	0	1	1	100	0	100
MANDATORY										
8	19MC1191	Induction Program	MC	0	0	0	0	0	0	0
9	*19HE1072*	*Career Guidance –Level I*	*EEC*	*1*	*0*	*0*	*0*	*100*	*0*	*100*
10	*19HE1073*	*Entrepreneurship & Innovation*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				15	2	11	20	550	350	900

SEMESTER II – 22 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
3	19PH2151	Materials Science	BS	2	0	2	3	25	75	100
4	19CY2151	Environmental Sciences	BS	2	0	2	3	25	75	100
5	19EE2103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
6	19ME2101	Engineering Mechanics	ES	3	0	0	3	25	75	100
PRACTICAL										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2071/ 19HE2071R	Language Enhancement Course-II	HS	1	0	0	1	100	0	100
9	*19HE2072*	*Career Guidance – Level II*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				18	2	8	22	400	500	900

SEMESTER III – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3101	Fourier Series and Statistics	BS	3	1	0	4	25	75	100
2	19ME3201	Manufacturing Technology-I	PC	3	0	0	3	25	75	100
3	19ME3202	Engineering Thermodynamics	PC	3	0	0	3	25	75	100
4	19ME3203	Engineering Materials and Metallurgy	PC	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
5	19ME3251	Fluid Mechanics and Machinery	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19ME3001	Manufacturing Technology Lab – I	PC	0	0	3	1.5	50	50	100
7	19ME3002	Computer Aided Drawing Lab	PC	0	0	3	1.5	50	50	100
MANDATORY										
8	19AC3191	India Constitution	AC	2	0	0	0	0	0	0
9	*19HE3071*	*Career Guidance Level – III*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
10	*19HE3073*	*Leadership Management Skills*	*EEC*	*1*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				20	1	8	20	450	450	900

SEMESTER IV – 21 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA4101	Numerical Methods	BS	3	1	0	4	25	75	100
2	19ME4201	Manufacturing Technology – II	PC	3	0	0	3	25	75	100
3	19ME4202	Thermal Engineering	PC	3	0	0	3	25	75	100
4	19ME4203	Kinematics of Machinery	PC	3	1	0	4	25	75	100
THEORY & LAB COMPONENT										
5	19ME4251	Strength of Materials	PC	3	0	2	4	50	50	100
PRACTICAL										
6	19ME4001	Manufacturing Technology Lab–II	PC	0	0	3	1.5	50	50	100
7	19ME4002	Thermal Engineering Lab	PC	0	0	3	1.5	50	50	100

MANDATORY										
8	19AC4191	Value Education - Essence of Indian Traditional Knowledge	AC	2	0	0	0	0	0	0
9	*19HE4072*	*Career Guidance Level – IV*	*EEC*	*2*	*0*	*0*	*0*	*100*	*0*	*100*
10	*19HE4073*	*Ideation Skills*	*EEC*	*1*	*0*	*0*	*0*	*100*	*0*	*100*
Total Credits				20	2	8	21	450	450	900

SEMESTER V – 24 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19ME5201	Dynamics of Machines	PC	3	0	0	3	25	75	100
2	19ME5202	Heat and Mass Transfer	PC	3	1	0	4	25	75	100
3	19ME5203	Design of Machine Elements	PC	3	0	0	3	25	75	100
4	19ME5204	Automobile Engineering	PC	3	0	0	3	25	75	100
5	19ME53XX	**Professional Elective – I**	PE	3	0	0	3	25	75	100
THEORY & LAB COMPONENT										
6	19ME5251	Machine Drawing	PC	2	0	2	3	50	50	100
PRACTICAL										
7	19ME5001	Dynamics Lab	PC	0	0	3	1.5	50	50	100
8	19ME5002	Heat Transfer Lab	PC	0	0	3	1.5	50	50	100
9	*19HE5071*	*Soft Skills - I*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
10	*19HE5072*	*Design Thinking*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
Total Credits				19	1	8	24	350	525	1000

SEMESTER VI – 24 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19ME6181	Principles of Management	HS	3	0	0	3	25	75	100
2	19ME6201	CAD/CAM	PC	3	0	0	3	25	75	100
3	19ME6202	Metrology and Quality Control	PC	3	0	0	3	25	75	100
4	19ME6203	Design of Transmission Systems	PC	3	0	0	3	25	75	100
5	19ME63XX	**Professional Elective - II**	PE	3	0	0	3	25	75	100
6	19XX64XX	**Open Elective –I**	OE	3	0	0	3	25	75	100
PRACTICAL										
7	19ME6001	CAD/CAM Lab	PC	0	0	3	1.5	50	50	100
8	19ME6002	Metrology and Measurements Lab	PC	0	0	3	1.5	50	50	100
9	*19HE6071*	*Soft Skill-II*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
10	*19HE6072*	*Intellectual Property Rights (IPR)*	*EEC*	*1*	*0*	*0*	*1*	*100*		*100*
11	19ME6701	Internship / Industrial Training	EEC	0	0	0	1	0	100	100
Total Credits				20	0	6	24	450	650	1000

SEMESTER VII – 20 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19ME7201	Finite Element Analysis	PC	3	0	0	3	25	75	100
2	19ME7202	Power Plant Engineering	PC	3	0	0	3	25	75	100
3	19XX74XX	Open Elective -II	OE	3	0	0	3	25	75	100
4	19ME73XX	Professional Elective – III	PE	3	0	0	3	25	75	100
5	19ME73XX	Professional Elective- IV	PE	3	0	0	3	25	75	100
PRACTICAL										
6	19ME7001	Computer Aided Analysis Lab	PC	0	0	3	1.5	50	50	100
7	19ME7002	Comprehension Lab	PC	0	0	3	1.5	50	50	100
8	19ME7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
Total Credits				15	0	10	20	275	525	800

SEMESTER VIII – 14 Credits

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19ME8201	Engineering Economics and Cost Estimation	PC	3	0	0	3	25	75	100
2	19ME8XXX	**Professional Elective- V**	PE	3	0	0	3	25	75	100
PRACTICAL										
3	19ME8901	Project Work – Phase II	EEC	0	0	12	8	100	100	200
Total Credits				6	0	12	14	150	250	400

LIST OF PROFESSIONAL ELECTIVES

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	19ME5301	Advanced Foundry Technology	PE	3	0	0	3	25	75	100
2	19ME5302	Advanced Welding Technology	PE	3	0	0	3	25	75	100
3	19ME5303	CNC Technology	PE	3	0	0	3	25	75	100
4	19ME5304	Unconventional Machining Processes	PE	3	0	0	3	25	75	100
5	19ME5305	Hydraulic and Pneumatic systems	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE II

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME6301	Refrigeration and Air Conditioning	PE	3	0	0	3	25	75	100
2	19ME6302	Advanced I.C. Engines	PE	3	0	0	3	25	75	100
3	19ME6303	Design of Heat Exchangers	PE	3	0	0	3	25	75	100
4	19ME6304	Gas Dynamics and Jet Propulsion	PE	3	0	0	3	25	75	100
5	19ME6305	Energy Conservation and Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE III

S.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME7301	Design of Jigs, Fixtures and Press Tools	PE	3	0	0	3	25	75	100
2	19ME7302	Tool and Die Design	PE	3	0	0	3	25	75	100
3	19ME7303	Mechatronics	PE	3	0	0	3	25	75	100
4	19ME7304	Composite materials	PE	3	0	0	3	25	75	100
5	19ME7305	Industrial Robotics and Expert Systems	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE IV

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME7306	Operations Research	PE	3	0	0	3	25	75	100
2	19ME7307	Industrial Engineering	PE	3	0	0	3	25	75	100
3	19ME7308	Industrial Safety Engineering	PE	3	0	0	3	25	75	100
4	19ME7309	Maintenance Engineering	PE	3	0	0	3	25	75	100
5	19ME7310	Metrology and Non Destructive Testing	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V

.No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME8181	Total Quality Management	HS	3	0	0	3	25	75	100
2	19ME8182	Entrepreneurship Development and Business Concepts	HS	3	0	0	3	25	75	100
3	19ME8183	Logistics and Supply Chain Management	HS	3	0	0	3	25	75	100
4	19ME8301	Production Planning and Control	PE	3	0	0	3	25	75	100
5	19ME8302	Heating, Ventilation and Air Conditioning Systems	PE	3	0	0	3	25	75	100

OPEN ELECTIVES

S. No	Course Code	Name of the Course	Course Category	L	T	P	C	CIA	ESE	TOTAL
1	19ME6401	Renewable Energy Sources	OE	3	0	0	3	25	75	100
2	19ME7401	Additive Manufacturing Techniques	OE	3	0	0	3	25	75	100

List of Life Skill Courses under Open Elective									
S. No	Course Code	Course Name	L	T	P	C	CIA	ESE	Total
1	19LSZ401	General Studies for Competitive Examinations	3	0	0	3	25	75	100
2	19LSZ402	Human Rights, Women Rights and Gender Equality	3	0	0	3	25	75	100
3	19LSZ403	Indian Ethos and Human Values	3	0	0	3	25	75	100
4	19LSZ404	Indian Constitution and Political System	3	0	0	3	25	75	100
5	19LSZ405	Yoga for Human Excellence	3	0	0	3	25	75	100

(Note: Z Stands for semester, students can't choose twice the course)

ADDITIONAL CREDIT COURSE FOR MECHANICAL ENGINEERING

S. No.	Sem. No	Course Code	Course Title	L	T	P	C	CIA	ESE	TOTAL
1	IV	19ME4071	Geometric dimensioning and tolerance	2	0	0	1	100	-	100
2	V	19ME5071	Tool and Die Design	2	0	0	1	100	-	100
3	VI	19ME6071	Servicing of Refrigeration and Air Conditioning Equipment's	2	0	0	1	100	-	100
4	VII	19ME7071	Energy Auditing Practices	2	0	0	1	100	-	100

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	24	24	20	14	165

Chairman, BoS

Chairman - BoS
MECH - HiCET

Dean Academics

Dean (Academics)
HiCET

Principal

PRINCIPAL
Hindusthan College of Engineering & Technology
COIMBATORE - 641 032

SYLLABUS

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7201	FINITE ELEMENT ANALYSIS (Common to mechanical and Automobile Engineering)	3	0	0	3

Course Objective

The student should be able

1. To equip the students with the finite element analysis fundamentals
2. To enable the students to formulate the design problems using Finite Element Analysis
3. To acquire knowledge on solving 2-D structural and thermal problems.
4. To develop proficiency in the application of FEM to realistic axisymmetric engineering problems.
5. To enable the students to solve Isoparametric elements

Unit	Description	Instructional Hours
I	**I INTRODUCTION** Historical background – Matrix approach – Application to the continuum – Discretization – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM– Weighted residual method – Ritz method.	9
II	**II ONE DIMENSIONAL PROBLEMS** Finite element modeling –shape functions- Potential energy approach – Galerkin approach –Assembly of stiffness matrix and load vector – General form of finite element equations –linear bar element– Quadratic shape function- Applications to plane trusses - Beam elements - one dimensional steady state conduction and convective heat transfer problems.	9
III	**III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS** Introduction – Finite element modeling – Scalar valued problem – Poisson equation –Triangular elements – Element stiffness matrix – Force vector – Galerkin approach - Stress calculation – Temperature effects-Heat transfer problems.	9
IV	**IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS** Axisymmetric formulation – Element stiffness matrix and force vector – Galerkin approach – Body forces and temperature effects – Stress calculations – Boundary conditions – Applications to cylinders under internal or external pressures.	9
V	**V ISOPARAMETRIC FORMULATION** Natural coordinate systems - Isoparametric elements-The four-node quadrilateral element– Shape functions for isoparametric elements – Element stiffness matrix and force vector – Lagrangean and serendipity elements – Numerical integration - Stiffness integration – Stress calculations – Four node quadrilateral for axisymmetric problems.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course Student will be able to:

CO1: Develop the mathematical model for solution of engineering design problems

CO2: Determine the solution for real time 1D structural problems and heat transfer problems.

CO3: Solve heat transfer and structural problems using 2D elements

CO4: Explain the stages in solving engineering problems under axisymmetric condition

CO5: Analyse and solve the real time problems using iso-parametric elements

TEXT BOOK:

T1 Seshu P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2012.

T2 Hutton D.V., "Fundamentals of Finite Element Analysis", McGraw Hill, International Edition,2017.

REFERENCES:

R1 Rao S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2011

R2 Logan D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7202	POWER PLANT ENGINEERING	3	0	0	3

Course Objective

The student should be able

1. To learn the working principle of steam power plants.
2. To study the need of captive power generation system.
3. To gain knowledge about the environmental benefits of nuclear power plant.
4. To learn the benefits of various renewable energy sources.
5. To evaluate cost of energy.

Unit	Description	Instructional Hours
I	**STEAM POWER PLANTS** Review of basic vapour power cycles. Layout of steam power plant: components-types of boilers, turbines, condensers and cooling towers. Coal and ash handling of steam power plant, draught system and ash disposal in coal power plants. Feed water treatment. Cogeneration systems.	9
II	**DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS** Components of diesel and gas Turbine Power plants. Combined gas turbine cycle power plants. Integrated gasifier based combined cycle systems. Cycle analysis.	9
III	**NUCLEAR POWER PLANTS** Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors: Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), Canadian deuterium uranium reactor (CANDU), Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants and disposal of nuclear waste.	9
IV	**RENEWABLE ENERGY POWER PLANTS** Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas, Fuel Cell power systems, MHD Power plants.	9
V	**ENERGY ECONOMICS** Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:
CO1: Understand the operation and maintenance of steam power plants.
CO2: Identify the environmental impacts of captive power plants.
CO3: Understand the working principle of nuclear power plants.
CO4: Understand the environmental benefits of renewable energy power plants.
CO5: Analyze the energy utilization and energy demand forecasting.

TEXT BOOK:

T1 - Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.
T2 - Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.

REFERENCES:

R1 - El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010. R2 - Black & Veatch, Springer, "Power Plant Engineering", 1996.
R3 - Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
R4 -N.K. Bansal, Non-Conventional Energy Resources, Vikas Publishing House, 2014.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7001	COMPUTER AIDED ANALYSIS LABORATORY	0	0	3	1.5

Course Objective

The student should be able

1. To develop the student's skills in proper modeling, meshing, and setting up material properties, loads, and constraints for computer simulation and analysis.
2. To expose the student's to different applications of simulation and analysis tools and then solves the problem using software packages.
3. To provide the student's with some knowledge in multi-physics analysis –interaction between structure and thermal.

Description of the Experiments

A Analysis (Using Software)

1. Stress analysis of beams.
2. Stress analysis of a plate with a circular hole.
3. Stress analysis of rectangular L – bracket.
4. Stress analysis of an Axi-symmetric component.
5. Modal analysis of beams.
6. Modal analysis of a 2D component.
7. Harmonic analysis of a 2D component.
8. Thermal stress analysis of a 2D component.
9. Conductive heat transfer analysis of a 2Dcomponent.
10. Convective heat transfer analysis of a 2Dcomponent.

Total Instructional Hours 45

Course Outcome

The Students will be able to

CO1: Determine engineering design problem that involves interaction between heat and stress, generate the model using a proper element type, and then solve the problem.

CO2: Solve linear and non-linear structural, thermal, and flow problems using software packages.

CO3: Analyze and display the results such as von-Mises stress, displacement, temperature, pressure, and velocity etc. obtained from computer analysis.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7002	COMPREHENSION LAB	0	0	3	1.5

Course Objective

The student should be able

To provide opportunity and encourage the student to apply the knowledge acquired during the earlier semesters to real life problems which he / she may have to face in future as an engineer through periodic exercise.

METHOD OF EVALUATION

- The problems given to the students should be of real, like industrial problems selected by the faculty members of the concerned course.
- While learning as how to solve the real time problems, student will receive guidance from the faculty and also review various courses learnt earlier.
- The students work individually and as a group to solve a variety of problems given to them.
- Further this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including design, materials, manufacturing, process, product and process control, computer integrated manufacture and quality.
- The evaluation is based on continuous assessment by the Faculty Member constituted by the professor in-charge of the course.
- The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics.

Total Instructional Hours **45**

Course Outcome

The Students will be able to

CO1: Understand and comprehend any given problem related to mechanical engineering field.

CO2: Apply knowledge to real time industrial solutions.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7901	PROJECT PHASE - I	0	0	4	2

Course Objective

The student should be able

1. To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
2. To develop the methodology to solve the identified problem.
3. To train the students in preparing project reports and to face reviews and viva-voce examination.

Project work assignment

- Enable the students to form a convenient group with not more than four students.
- The project groups are assigned with a supervisor who is the faculty member of the respective department.
- In the case of industrial projects, one additional supervisor may be assigned as external supervisor.
- The students have to identify a technical problem related to the Mechanical Engineering based onthe technical knowledge gained during the period of study.
- Four hours per week have been allotted in the time table.
- During project works, students can get the guidance from the supervisor(s), visiting library for literature review, conducting experiments related to the project work, computer simulation studies, field work, visiting industries (in the case of industry sponsored project works), case studies or basic research and development work assigned by the supervisor.
- The student has to make two presentations based on their project works.
- The solutions provided by the students should be technically, economically and environment friendly feasible.
- The project evaluation committee (constituted by the Head of Department) has evaluated the problem identification.
- The students has to consolidate the work as project report, which includes Introduction, Literature review, Modeling or simulation details, Experimental details, Results and discussions and Conclusions.
- The student should follow the guidelines for preparing the project work.

Course Outcome

The Students will be able to

- At the end of the course the students will have a clear idea of their area of work and they will be in a position to carry out the remaining phase II work in a systematic way.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

PROFESSIONAL ELECTIVE – III

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7301	DESIGN OF JIGS, FIXTURES AND PRESS TOOLS (Common to mechanical and AutomobileEngineering)	3	0	0	3

Course Objective

The student should be able

1. To understand the functions and design principles of Jigs, fixtures and press tools Study important methods of analysis of in chromatography.
2. To gain proficiency in the development of required views of the final design.
3. To impart knowledge in Jigs and fixtures, and various kinds of locating devices.
4. To understand the Principles of jigs and fixtures.
5. To know the important considerations while designing Jigs and Fixtures.

Unit	Description	Instructional Hours
I	**PURPOSE TYPES AND FUNCTIONS OF JIGS AND FIXTURES** Tool design objectives - Production devices–inspection devices, Materials used in Jigs and Fixtures – Types of Jigs - Types of Fixtures-Mechanical, pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis, Poka Yoke.	**9**
II	**JIGS** Drill bushes–different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Automatic drill jigs-Rack and pinion operated. Air operated Jig components. Design and development of Jigs for given components.	9
III	**FIXTURES** General principles of boring, lathe, milling and broaching fixtures- Grinding, planning and shaping fixtures assembly, Inspection and welding fixtures- Modular fixtures. Design and development of fixtures for given components.	9
IV	**PRESS WORKING TERMINOLOGIES AND ELEMENTS OF DIES AND STRIP LAY OUT** Press working terminology-Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive combination and compound dies: Die block-die shoe. Bolster plate-punch plate- punch holder-guide pins and bushes – strippers – knockouts-stops –pilots- Selection of standard die sets strip layout-strip lay out calculations.	9
V	**DESIGN AND DEVELOPMENT OF DIES** Design and development of progressive and compound dies for Blanking and piercing operations. Bending dies – development of bending dies-forming and drawing dies-Development of drawing dies. Design considerations in forging, extrusion, casting and plastic dies.	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course Student will be able to:
CO1: demonstrate and analyze the types and functions of jigs and fixtures.
CO2: design, specify and analyze the jigs for various applications.
CO3: demonstrate and design the fixtures for various applications.
CO4: demonstrate and analyze the press working terminologies of die and strip layout.
CO5: design and development of dies for different applications.

TEXT BOOK:

TEXT BOOKS:

T1 - Edward G. Hoffman, —Jigs & Fixture Design, 6th Edition, Thomson-Delmar Learning, Singapore, 2014.
T2 - Donaldson C, —Tool Design, 5th Edition, Tata McGraw-Hill, 2010.

REFERENCES:

R1 - Joshi P.H., —Jigs & Fixtures, 5nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2014.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7302	TOOL AND DIE DESIGN	3	0	0	3

Course Objective

The student should be able

1. To understand the fundamentals of work holding devices.
2. To impart knowledge in design tools, dies, jigs and fixtures.
3. To analyze and optimize an existing jig and fixture.
4. To gain proficiency when design of dies for press work and forging.
5. To design tools to maintain precision accuracy of the component produced.

Unit	Description	Instructional Hours
I	**DESIGN OF CUTTING TOOLS** Metal cutting process - Selection of tool materials - Design of single point and multipoint cutting tool - Form tools, Drills, Milling cutters, broaches and chip breakers – Problems on design of single point cutting tools only.	9
II	**LOCATING AND CLAMPING METHODS** Basic Principles of Location - Locating methods and devices - Principles of clamping - Mechanical, Pneumatic and Hydraulic actuation - Clamping force analysis – Design problems.	9
III	**DESIGN OF JIGS AND FIXTURES** Types of drill jigs - General considerations in the design of drill jigs - Drill bushings - Types, methods of construction - Simple designs of Plate, Channel, Boxes, Post, Angle plate, Turnovers and Pot Jigs. Types of fixtures - Fixtures for machine tools: Lathe, Milling, Boring, Broaching and grinding - Assembly fixtures - Inspection and Welding fixtures.	9
IV	**DESIGN OF DIES** Press tools - Fundamentals of die-cutting operations - Cutting action in punch and die operations - Die clearance - Blanking and Piercing Die construction – Pilots - Strippers and Pressure Pads.	9
V	**PRESS WORK MATERIALS AND MOULD DESIGN** Strip layout - Design of simple progressive and compound die sets - Forging Die – Flow lines, V parting lines, open and close die forging; Materials for die block. General mould construction. Design of ejection, feed and cooling systems. Parting surface design. Side cores and side cavities. Product design for die casting and injection molding.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Identify the importance of work holding device.

CO2: Design jigs and fixtures.

CO3: Calculate the required specifications of a press for required operations.

CO4: Design tools and dies for required operations.

CO5: Design, specify and analyze the dies for different application

TEXT BOOK:

T1 - Donaldson C., Lecain G.H. and Goold V.C. (2007), Tool Design, 3rd edition, Tata McGraw- Hill Publishing Company Ltd., New Delhi.

T2 - Jeff Lantrip, David A. Smith and John G. Nee, (2003) Fundamentals of Tool Design, 5th Edition, Society of Manufacturing Engineers.

REFERENCES:

R1 - Joshi P. H., "Jigs and Fixtures", 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.

R2 - Edward G. Hoffman, "Jigs and Fixtures Design", Thomson - Delmar Learning Series, Singapore,2004.

R3 – Nagpal G. R., "Metal Forming Processes", Khanna Pub., New Delhi, 2000.

R4 – Sadhu Singh, "Theory of plasticity and Metal Forming Processes", Khanna Publishers, 2005.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7303	MECHATRONICS	3	0	0	3

Course Objective

The student should be able

1. To learn interdisciplinary applications.
2. To impart knowledge of Microprocessor and Microcontroller.
3. To Study the Programmable Peripheral Interface and Architecture.
4. To learn PLC architecture, programming and applications.
5. To impart knowledge in various Actuators and Mechatronics system design.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors.	**9**
II	**MICROPROCESSOR AND MICROCONTROLLER** Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes – Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram.	9
III	**PROGRAMMABLE PERIPHERAL INTERFACE** Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.	9
IV	**PROGRAMMABLE LOGIC CONTROLLER** Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.	9
V	**ACTUATORS AND MECHATRONIC SYSTEM DESIGN** Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1- Understand interdisciplinary applications of Electronics, Electrical, Mechanical and Computer Systems for the Control of Mechanical, Electronic Systems and sensor technology.

CO2- Gain knowledge in architecture of Microprocessor and Microcontroller.

CO3- Understand the Programmable Peripheral Interface and Architecture

CO4- Gain knowledge in programming and application of programmable logic controllers.

CO5- Know the various Actuators and Mechatronics system design

TEXT BOOK:

T1. Bolton, “Mechatronics”, Prentice Hall, 2008

T2. Ramesh S Gaonkar, “Microprocessor Architecture, Programming, and Applications with the 8085”, 5th Edition, Prentice Hall, 2008

REFERENCES:

R1.Bradley D.A, Dawson D, Buru N.C and Loader A.J, “Mechatronics”, Chapman and Hall, 1993.

R2.Clarence W, de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

R3.Devadas Shetty and Richard A. Kolk, “Mechatronics Systems Design”, PWS publishing company, 2007.

R4.Krishna Kant, “Microprocessors & Microcontrollers”, Prentice Hall of India, 2007.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7304	COMPOSITE MATERIALS FOR ENGINEERING	3	0	0	3

Course Objective

The student should be able

1. To understand the fundamentals of composite material strength and its mechanical behavior.
2. Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
3. Study of residual stresses in Laminates during processing.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Definition, Need, General characteristics, Applications, Fibers-Glass, Carbon, Ceramic and Aramid fibers, Polymer Matrix Composite (PMC), Ceramic Matrix Composite (CMC), Metal Matrix Composite (MMC), Characteristics of fibers and matrices, Smart materials, types and Characteristics.	**9**
II	**MECHANICS AND PERFORMANCE** Characteristics of fiber reinforced Lamina, Laminates, Inter-laminar stresses, Static Mechanical Properties, Fatigue and Impact properties, Environmental effects, Fracture Behavior and Damage Tolerance.	9
III	**MANUFACTURING** Bag Moulding, Compression moulding, Filament winding, Other Manufacturing Processes, Quality Inspection method.	9
IV	**ANALYSIS** Analysis of an orthographic lamina, Hooke's law, stiffness andcompliance matrices, Strengths of orthographic lamina, Stress analysis of laminated composite Beams, plates, shells and etc, Free vibration	9
V	**DESIGN** Failure predictions in a Unidirectional Lamina, Failure predictions for Un-notched Laminates, Laminated Design Consideration, Bolted and Bonded Joints, Design examples.	**9**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to

CO1: Demonstrate the knowledge on the fundamentals of fibers, matrices and composites.

CO2: Understand the various manufacturing processes involved in the fabrication of composite material.

CO3: Demonstrate knowledge on the performance of composite materials.

CO4: Understand and solve problems concerning the mechanics of composite materials.

CO5: Understand the design calculations for the development of fiber reinforced matrics.

TEXT BOOK:

T1 Mallick P.K., ―Fiber Reinforced Composites: Materials, Manufacturing and Design, 3rd Edition, Taylor and Francis, 2008.

T2 Autar K. Kaw, ―Mechanics of Composite Materials‖, 2nd Edition, CRC Press, 2006.

REFERENCES:

R1 Bhagwan D. Agarwal, Lawrence J. Broutman, Chandrashekhar K., ―Analysis and Performance of Fiber Composites‖, 3rd Edition, John Wiley & Sons, New York, 2006.

R2 Gibson R.F., ―Principles of Composite Material Mechanics", 3rd Edition, CRC Press, 2011.

R3 Chawla K.K., ―Composite Materials‖, 3rd Edition, Springer Verlag, Boston, 2012.

R4 Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw Hill, 1998.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7305	INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS	3	0	0	3

Course Objective

The student should be able

1. To learn the functions of the basic components of a Robot.
2. To study the use of various types of End Effectors and Sensors.
3. To impart knowledge in Robot Kinematics and Programming.
4. To learn Robot safety issues and economics.
5. To impart knowledge in Robot cell design.

Unit	Description	Instructional Hours
I	**INTRODUCTION AND ROBOT KINEMATICS** Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.	**10**
II	**ROBOT DRIVES AND CONTROL** Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing ofend effectors – Vacuum, magnetic and air operated grippers.	9
III	**ROBOT SENSORS** Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing – Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.	9
IV	**ROBOT CELL DESIGN AND APPLICATION** Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.	9
V	**ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS** Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.	**8**
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the functions of the basic components of a Robot.
CO2: Know the use of various Robot drives and End Effectors.
CO3: Gain knowledge of Robot sensors.
CO4: Understand the Robot cell design and applications.
CO5: Understand the robot programming and AI.

TEXT BOOK:

T1 – Fu.K.S., R.C. Gonzalez and C.S.G. Lee, "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill, 1987.
T2 - YoramKoren," Robotics for Engineers' Mc Graw-Hill, 1987.

REFERENCES:

R1 - Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey," Industrial Robotics Technology, Programming and Applications", Mc Graw-Hill, Int. 1986.
R2 - Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, "Robotics Engineering - An Integrated Approach", Prentice-Hall of India Pvt. Ltd., 1984.
R3 - Deb, S.R." Robotics Technology and Flexible Automation", Tata Mc Graw-Hill, 1994.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7306	OPERATIONS RESEARCH	3	0	0	3

Course Objective

The student should be able

1. To provide students the knowledge of optimization techniques and approaches.
2. To enable the students, apply mathematical and computational skills needed for the practical utility of Operations Research.
3. To explore the industrial applications of Transportation and Assignment models.
4. To teach students about networking, Inventory, decision, replacement models and queuing theory
5. To introduce students to research methods and current trends in Operations Research.

Unit	Description	Instructional Hours
I	**LINEAR PROGRAMMING** The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex.	9
II	**SEQUENCING AND NETWORKS MODEL** Sequencing –Problem with N jobs and 2 machines - 3 machines and „M‟ machines. Network models – Basic Concepts – Construction of Networks – Project Network – CPM and PERT - Critical Path Scheduling – Crashing of Network.	9
III	**TRANSPORTATION AND ASSIGNMENT PROBLEM** Transportation model – Initial solution by North West corner method – least Cost method – VAM. Optimality test – MODI method and stepping stone method. Assignment model – formulation – balanced and unbalanced assignment problems.	9
IV	**INVENTORY MODELS** Inventory models – Various Costs and Concepts–EOQ–Deterministic inventory models – Production models – Stochastic Inventory models – Buffer stock.	9
V	**REPLACEMENT MODEL AND QUEING THEORY** Replacement models – Items that deteriorate with time - When money value changes – Items that fail completely – Individual replacement and Group replacement. Queuing models – Poisson arrivals and Exponential service times – Single channel models and Multi-channel models.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Apply operations research techniques like Linear Programming problems in industrial optimization problems.

CO2: Apply the concepts of PERT and CPM for decision making and optimally managing projects.

CO3: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results.

CO4: Analyze and apply appropriate inventory techniques in domain specific situations.

CO5: Analyze the replacement model techniques and to apply appropriate queuing theories in domain specific situations.

TEXT BOOK:

T1- Mittal, K. V. and Mohan, C. "Optimization Methods in Operations Research and Systems Analysis", 4th Edition, New Age, 2016.

T2- Taha, H. A, "Operations Research - An Introduction", Pearson, 9th Edition, 2014.

REFERENCES:

R1- Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2015.

R2 Ravindran, A , Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2014.

R3-Hadley G - ‘Linear Programming’ - Narosa Book Distributors Private Ltd. – 2006.

R4-Wagner,”Operations Research”, Prentice Hall of India, 2000.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7307	INDUSTRIAL ENGINEERING	3	0	0	3

Course Objective

The student should be able

1. To introduce the concepts, principles and framework of contents of Industrial Engineering.
2. To introduce the principles of work study and Method study.
3. To introduce the concepts and frame work of work measurements.
4. To introduce the concepts of various facility design, material handlings & Ergonomic work design.
5. To introduce concepts of various cost accounting and financial management & acquaint the students with different aspects of Industrial Safety rules.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO INDUSTRIAL ENGINEERING AND PRODUCTIVITY** Introduction - Definition and Role of Industrial Engineering, Contribution of Taylor and Gilbreth, Organization, organizational structure, organization charts; Types of organization. - Formal line, military organization, functional organization, line & staff organization, Productivity: Definition of productivity, Productivity of materials, land, building, machine and power. Measurement of productivity: factors affecting the productivity.	**9**
II	**METHOD STUDY** Work Study: Definition, objectives and scope of work-study. Human factors in work-study. Method Study: Definition, objective and scope of method study, SIMO chart, and micro motion study. Definition and installation of the improved method, brief concept about synthetic motion studies. (Numerical); Introduction to Value Engineering and Value Analysis.	9
III	**WORK MEASUREMENTS** Work Measurements: Definition, objectives and uses; Work measurement techniques. Work sampling - need, confidence levels, sample size determinations, random observation conducting study with the simple problems. Time study: Definition, time study equipment, selection of job, steps in time study. scales of rating, factors affecting rate of working, allowances and standard time determination; Introduction to PMTS and MTM. (Numerical), Introduction to MOST.	9
IV	**FACILITY DESIGN &ERGONOMICS** Facility location Factors and Evaluation of Alternate Locations; Types of Plant Layout; Computer Aided Layout Design Techniques; Assembly Line Balancing (Numerical); Material Handling: Principles, Types of Material Handling Devices; Ergonomic Design Standards- Study of development of stress in human body and their consequences. Case Studies.	9
V	**ENGINEERING ECONOMY AND INDUSTRIAL SAFETY** Engineering Economy and Costing: Elementary Cost Accounting and Methods of Depreciation; Break-Even Analysis (Numerical); Introduction to Debit and Credit Note, Financial Statements (Profit and Loss Account and Balance Sheet), Techniques for Evaluation of Capital Investments. Industrial Safety: Safety Organization, Safety Programme, General Safety Rules.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Apply the Industrial Engineering concepts in the industrial environment.

CO2: Manage and implement different concepts involved in methods study and understanding of work content in different situations. Undertake project work based on the course content.

CO3: Describe different aspects of work measurement system design and standards.

CO4: Identify various facilities design pertinent to manufacturing industries& working comfortability in industries.

CO5: Identify various cost accounting and financial management practices widely applied in industries and different safety rules followed in industries.

TEXT BOOK:

T1 - MartendTelsang, Industrial Engineering, S. Chand Publication.

T2 - Banga and Sharma, Industrial Organization & Engineering Economics, Khanna publication.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7308	INDUSTRIAL SAFETY ENGINEERINGAND ENVIRONMENT	3	0	0	3

Course Objective

The student should be able

1. To provide in depth knowledge in Principles of safety and Prevention of accident in various fields.
2. To understand the basics on safety organization.
3. To expose the students to the basics in Human safety and hazard management.
4. To learn about human safety.
5. To study about Industrial Hygiene and Hazards.

Unit	Description	Instructional Hours
I	**ACCIDENT PREVENTION** Definitions and theories of accident, injury, unsafe act, unsafe condition and dangerous occurrence - Theories and principles of accident causation - Cost of accidents, Accident reporting and investigations, Safety committees and their need, types and advantages - Safety education and training and their importance - Various training methods - Accident prevention and Motivating factors of safety - suggestion schemes, Safety performance - Definitions connected with measuring safety performance as per Indian and International standards.	9
II	**SAFETY IN MATERIAL HANDLING** General safety consideration in material handling, Ropes, Chains, Sling, Hoops, Clamps, Arresting gears and Prime movers - Ergonomic consideration in material handling, Design, installation, operation and maintenance of conveying equipments, Hoisting, traveling and slewing mechanisms, Selection, operation and maintenance of industrial trucks, Mobile cranes and Tower crane.	9
III	**SAFETY IN CHEMICAL INDUSTRIES** Safety in the design process of chemical plants - Safety in operational and maintenance of chemical plants Exposure of personnel - Operational activities and hazards, Safety in storage and handling of chemicals and gases, Hazards during transportation and Pipeline transport - Safety in chemical laboratories Specific safety consideration for cement, paper and pharmaceutical, Specific safety consideration for petroleum, petro - chemical, rubber, fertilizer and distilleries.	9
IV	**ENVIRONMENTAL IMPACT ASSESSMENT** Evolution, Concepts, Methodologies, Screening, Scoping and Checklist of EIA Rapid and Comprehensive EIA Legislative and environmental clearance procedure in India - Prediction tools for EIA Assessment of Impact of air, water, soil, noise, biological and Socio cultural environment Public participation Resettlement and Rehabilitation Documentation of EIA.	9
V	**REGULATIONS FOR HEALTH, SAFETY AND ENVIRONMENT** Factories act and rules - Indian explosive act - Gas cylinder rules, Environmental pollution act, Indian petroleum act and rules, Oil industry safety directorate (OISD), Indian Electricity act and rules, Mines act and rules, Indian motor vehicles act and rules.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Apply the philosophies behind industrial accidents

CO2: Apply the hierarchical levels in a safety organization

CO3: Understand the concept of industrial process safety

CO4: Understand the safety procedures for human and apply Industries.

CO5: Apply the types of industrial hazards and preventive measures.

TEXT BOOK:

T1- Handlin. W, “Industrial Hand Book”,McGraw-Hill, 2000.

T2 - Anton. T.J, “Occupational Safety and Health Management”, 2nd Edition, New York, McGraw Hill, 1989.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7309	MAINTENANCE ENGINEERING	3	0	0	3

Course Objective

The student should be able

1. To study the principles and functions of maintenance planning.
2. To learn the types of maintenance.
3. Gain knowledge about condition monitoring.
4. Understand the repair methods for machine elements.
5. Understand the repair methods for material handling equipments.

Unit	Description	Instructional Hours
I	**PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING** Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.	**9**
II	**MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE** Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repair cycle - Principles and methods of lubrication – TPM.	9
III	**CONDITION MONITORING** Condition Monitoring – Cost comparison with and without CM – On-load testing and offload testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear- debris analysis.	9
IV	**REPAIR METHODS FOR BASIC MACHINE ELEMENTS** Repair methods for beds, slide ways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location.	9
V	**REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT** Repair methods for Material handling equipment - Equipment records –Job order systems -Use of computers in maintenance	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the maintenance planning functions.
CO2: Identify maintenance policies and types.
CO3: Gain knowledge about methods and instruments for CM.
CO4: To analyze failure of machine parts.
CO5: Implement failure analysis in material handling equipments

TEXT BOOK:

T1 - Srivastava S.K., “Industrial Maintenance Management”, S. Chand and Co., 1981.
T2 - Venkataraman .K “Maintancence Engineering and Management”, PHI Learning, Pvt. Ltd., 2007.

REFERENCES:

R1 - Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995.
R2 - White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.
R3 - Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.
R4 - L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005.

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics
Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7310	METROLOGY AND NON DESTRUCTIVE TESTING	3	0	0	3

Course Objective

The student should be able

1. To impart the knowledge of quality assurance and inspection techniques.
2. To familiarize with the various inspection and measurement techniques like contact and non-contact measurement by adapting Computer Aided Inspection.
3. To impart the knowledge of working principles and calibration of various Systems.
4. To study and understand the various non-destructive evaluation and testing methods, theory and their industrial applications.
5. To provide exposure to the students on various advanced measuring methods and nondestructive testing techniques.

Unit	Description	Instructional Hours
I	**MEASURING MACHINES** Tool Maker's microscope - Co-ordinate measuring machines - Universal measuring machine – Image shearing microscope -Laser viewers for production profile checks - Use of computers in metrology- Machine vision technology - Microprocessors in metrology.	9
II	**STATISTICAL QUALITY CONTROL** Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits - Control charts for variables and for fraction defectives - Theory of probability - Sampling – ABC standard, Reliability and life testing	9
III	**LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS** Non destructive testing: Visual inspection, principles and operation of Liquid penetration inspection, Characteristics of liquid Penetrants - Different washable systems - Developers - Applications – Methods of production of magnetic fields - Principles of operation of Magnetic particle test - Applications - Advantages and Limitations.	9
IV	**RADIO GRAPHY** Sources of x-ray production - properties of x rays - film characteristics – Exposure charts - contrasts - operational characteristics of x ray equipment - Applications.	9
V	**ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES** Production of ultrasonic waves - Types, characteristics of ultrasonic waves - pulse echo method - A, B, C scans - Principles of Acoustic emission techniques – Advantages and limitations –Instrumentation - Applications.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the concept of Laser Metrology and Computer Integrated Machining Machine.

CO2: Understand the techniques used in statistical quality control.

CO3: Analyse the materials characteristics through various non-destructive tests.

CO4: Understand the knowledge various radiography characteristics and operations.

CO5: Understand the knowledge of ultrasonic and Acoustic emission techniques.

TEXT BOOK:

T1. Jain, R.K. “Engineering Metrology ", Khanna Publishers, 1997.

T2. Barry Hull and Vernon John, "Non Destructive Testing ", MacMillan, 1988.

REFERENCES:

R1. American Society for Metals, “Metals Hand Book ", Vol.II, 1976.

R2. Progress in Acoustic Emission, “Proceedings of 10th International Acoustic Emission Symposium ", Japanese Society for NDI, 1990.

R3.Halmshaw, “Non-destructive testing”, 2nd edition, Edward Arnold, 1991.

R4. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

OPEN ELECTIVE

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME7401	ADDITIVE MANUFACTURING TECHNIQUES	3	0	0	3

Course Objective

The student should be able

1. To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Rapid Prototyping technologies.
2. To acquire knowledge of solid and liquid based Rapid prototyping system.
3. To provide information about Power based prototyping system.
4. To be familiar with the characteristics of the different materials those are used in lean Manufacturing.
5. To impart knowledge of characteristics and issues of Just in time.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications – Digital prototyping – Virtual prototyping.	7
II	**REVERSE ENGINEERING AND CAD MODELING** Basic concept - Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – Data formats - Data interfacing - Part orientation and support generation - Support structure design - Model Slicing and contour data organization - Direct and adaptive slicing - Tool path generation	10
III	**SOLID AND LIQUID BASED ADDITIVE MANUFACTURINGSYSTEMS** Stereo lithography Apparatus (SLA), Fused deposition Modeling (FDM), Laminated object manufacturing (LOM), three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.	9
IV	**POWDER BASED ADDITIVE MANUFACTURING SYSTEMS** Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Three-Dimensional Printing, Laser Engineered Net Shaping (LENS), Processes, materials, products, advantages, applications and limitations – Case Studies.	9
V	**OTHER ADDITIVE MANUFACTURING SYSTEMS** Introduction - basic process of Shape Deposition Manufacturing (SDM) and its applications. Selective Laser Melting (SLM), Electron Beam Melting (EBM) – Rapid Manufacturing.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the basics of additive manufacturing techniques in manufacturing.

CO2: Understand the concepts of modeling, data processing and reverse engineering in additive Manufacturing.

CO3: Apply the liquid and solid based additive manufacturing system in suitable applications.

CO4: Apply powder based additive manufacturing system in suitable applications.

CO5: Apply the new technologies in additive manufacturing for various applications.

TEXT BOOK:

T1 Ian Gibson, David W. Rosen, Brent Stucker, Springer (2010). Additive Manufacturing Technologies Rapid prototyping: Direct Digital Manufacturing.

T2 Hopkinson, N., R. Hague and P. Dickens, (2006) Rapid Manufacturing: An Industrial Revolution for the Digital Age, John Wiley, New York.

REFERENCES:

R1 Chua C.K, Leong K.F and Lim C.S, “Rapid Prototyping: Principles and Applications”, World Scientific, 2003.

R2 RafiqI.Noorani, “Rapid Prototyping: Principles and Applications”, Wiley & Sons, 2006.

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Semester – VII

Course Code & Name : 19ME7201 Finite Element Analysis

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO2	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO3	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO4	3	1	1	2	-	1	2	-	-	1	1	2	1	1
CO5	3	2	2	2	-	1	2	-	-	2	1	2	1	1
Avg	3	2.2	2.2	2	0	1	2	0	0	2.2	1	2	1	1

Course Code & Name : 19ME7202 Power Plant Engineering

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	2	2	1	2	2	2	1	2	2	3	2	1
CO2	3	1	2	2	1	2	2	2	1	1	1	3	2	1
CO3	3	1	2	2	1	2	3	2	2	2	1	2	2	3
CO4	3	1	2	2	1	2	3	2	2	1	1	3	1	3
CO5	2	1	2	2	1	3	2	2	2	3	1	3	1	3
Avg	2.8	1	2	2	1	2.2	2.4	2	1.6	1.8	1.2	2.8	1.6	2.2

Course Code & Name : 19ME7302 Tool and Die Design

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	1	2	1	1	1	1	1	1	1	1	1	2	1
CO2	1	1	3	1	1	1	1	1	1	1	1	1	3	1
CO3	1	1	2	2	1	1	1	1	1	1	1	1	2	1
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	1
CO5	1	1	1	1	1	3	2	1	1	3	1	1	1	2
Avg	**1.4**	**1**	**1.8**	**1.2**	**1.2**	**1.4**	**1.2**	**1**	**1**	**1.4**	**1**	**1**	**2**	**1.2**

Course Code & Name : 19ME7305-Industrial Robotics and Expert Systems

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO2	3	3	2	-	1	-	-	-	-	-	-	-	1	1
CO3	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO4	3	2	3	-	1	-	-	-	-	-	-	-	1	1
CO5	3	2	3	-	1	-	-	-	-	-	-	-	1	1
Avg	3	2.2	2.4	-	1	-	-	-	-	-	-	-	1	1

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics
Dean (Academics)
HiCET

Course Code & Name : 19ME7306 Operations Research

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	1	3				2		2			2	1
CO2	3	1	2	1				1		1			2	
CO3	3	1	1	1				1		1			2	1
CO4	2	1	1										1	
CO5	3	2	1										2	
Avg	3	3	1	3				2		2			2	1

Course Code & Name : 19ME7308 Industrial Safety Engineering

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	2	2	3	3			1			1		2	1
CO2	2	2	2	3	2	1		1					3	1
CO3	2	3	3	3	2								2	1
CO4	2	2	3	3	3		1	1					2	1
CO5	3	3	3	3	3					1			1	2
Avg	2.2	2.4	2.6	3	2.6	1	1	1		1	1		2	1.2

Course Code & Name : 19ME7310 Metrology And Nondestructive Testing

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	1	1	1	1	-	-	-	-	1	-	1	-	1
CO2	3	1	1	2	1	-	-	-	-	1	-	1	-	1
CO3	3	2	2	2	1	-	-	-	-	1	-	1	-	1
CO4	3	1	1	1	2	-	-	-	-	2	-	1	3	1
CO5	3	1	2	1	2	-	-	-	-	2	-	1	3	1
Avg	3	1.2	1.4	1.4	1.4	0	0	0	0	1.4	0	1	3	1

Course Code & Name : 19ME7401 Additive Manufacturing Techniques (OE)

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO2	3	3	2	-	1	-	-	-	-	-	-	-	1	1
CO3	3	2	2	-	1	-	-	-	-	-	-	-	1	1
CO4	3	2	3	-	1	-	-	-	-	-	-	-	1	1
CO5	3	2	3	-	1	-	-	-	-	-	-	-	1	1
Avg	3	2.2	2.4	-	1	-	-	-	-	-	-	-	1	1

Chairman, Board of Studies
Chairman - BoS
MECH - HiCET

Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics
Dean (Academics)
HiCET

Course Code & Name : 19ME7001 Computer Aided Analysis Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	2	-	-	-	3	-	-	-	-	2	-	2	3	1
CO2	2	-	-	-	3	-	-	-	-	2	-	2	3	1
CO3	2	-	-	-	3	-	-	-	-	2	-	2	3	1
CO4	2				3					2		2	3	1
CO5	2				3					2		2	3	1
Avg	2	-	-	-	3	-	-	-	-	2	-	2	3	1

Course Code & Name : 19ME7002 Comprehension Lab

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	3	3	3	3	-	1	-	2	-	-	-	2	1
Avg	3	3	3	3	3	-	1	-	2	-	-	-	2	1

Course Code & Name : 19ME7901 Project Work – Phase I

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO12
CO1	3	2	2	-	-	-	-	-	-	-	1	3	2	2
CO2	3	2	3	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	-	-	-	-	-	-	-	1	3	2	2
Avg	3	2.3	2.6	-	-	-	-	-	-	-	1.3	3	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME8201	ENGINEERING ECONOMICS AND COSTESTIMATION	3	0	0	3

Course Objective

The student should be able

1. To study the principles and concepts of engineering economics and cost analysis
2. To educate students about the importance of value engineering
3. To learn about organizing the cash flow and its various methods
4. To provide knowledge about replacement and maintenance analysis
5. To equip students with different types of depreciation methods

Unit	Description	Instructional Hours
I	**INTRODUCTION TO ECONOMICS** Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product, Design selection for a product, Process planning.	9
II	**VALUE ENGINEERING** Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- Equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.	9
III	**CASH FLOW** Methods of comparison of alternatives – Present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated and cost dominated cash flow diagram).	9
IV	**REPLACEMENT AND MAINTENANCE ANALYSIS** Replacement and Maintenance analysis – Types of maintenance, Types of replacement problem, Determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender	9
V	**DEPRECIATION** Depreciation- Introduction, Straight line method of depreciation, Declining balance method of Depreciation-Sum of the year's digits method of depreciation, Dinking fund method of depreciation- Annuity method of depreciation, Service output method of depreciation.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course Student will be able to:

CO1: Apply knowledge of mathematics, economics, and engineering principles to solve engineering problems.

CO2: understand the concept of value engineering and time value of money using engineering economy factors and formulas

CO3: Recognize, formulate, analyze and solve cash flow problems

CO4: Apply engineering economic techniques on solving problems for replacement and maintenance analysis

CO5: Develop the ability to solve problems based on depreciation.

TEXT BOOK:

T1. PanneerSelvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.
T2. Khan MY and Jain PK, "Financial Management" McGraw – Hill Publishing Co Ltd., 2006.

REFERENCES:

R1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.
R2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
R3. Degarmo, E.P., Sullivan. W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011. R4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2							3			2	1	2
CO2	2		2						3			2		1
CO3	3		3	2					3				1	1
CO4	3				2				3					
CO5	3			2					3			2	1	
Avg	3	2	2.5	2	2				3			2	1	1.3

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL
Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME8901	PROJECT PHASE - II	0	0	12	6

Course Objective

The student should be able

1. To learn the practical knowledge and skills in the field of Mechanical Engineering.
2. To get an experience and confidence level in a particular domain.
3. To train the students in preparing a project reports to face the reviews and viva examinations.

Description

Project work assignment:

- Enable the students to form a convenient group of not more than four students and assigning them in a task involving theoretical and experimental studies related to Mechanical Engineering.
- The project groups are assigned with a supervisor who is the faculty member of the respective department. In the case of industrial projects, one additional supervisor may be assigned as external supervisor.
- Twelve hours per week have been allotted in the time table. The students can get the guidance from the supervisor(s), visiting library for literature review, conducting experiments related to the project work, computer simulation studies, field work, visiting industries (in the case of industry sponsored project works), case studies or basic research and development work assigned by the supervisor. Moreover, the student has to present three seminars based on the progress of their project works.
- The student has to apply his/her knowledge and skills to identify a suitable problem in the field of Mechanical Engineering and has to provide solutions, which are technically, economically and environment friendly feasible solution.
- The project evaluation committee (constituted by the Head of Department) has evaluated the project progress based on three reviews.
- The students has to consolidate the comprehensive review report, which includes Introduction (An Overview, Background and motivation, Objectives and methodology), Literature review (the studies reported during last ten years, problem identification and solution), Modeling or simulation details (equations used in the modeling, assumptions, specifications, details of the project work etc.), Experimental details (Description of experimental setup, instrumentation, experimental procedure), Results and discussions (comprehensive summary of experimental observations and discussions on improvements observed) and Conclusions (comprehensive summary of the major outcomes observed in the project work). The student should follow the guidelines for preparing the project work.

Total Instructional Hours 45

Course Outcome On completion of the project work students will be in a position to take up any challenging practical problem in the field of engineering design and find better solutions to it.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	1	3	2	2
CO2	3	2	3	-	-	-	-	-	-	-	2	3	2	2
CO3	3	3	3	-	-	-	-	-	-	-	1	3	2	2
Avg	3	2.3	2.6	-	-	-	-	-	-	-	1.3	3	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL * VINAYAKA MISSIONS * KIRUVI COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME8181	TOTAL QUALITY MANAGEMENT (Common to Mechanical, Mechatronics and Automobile Engineering)	3	0	0	3

Course Objective

The student should be able

1. Acquire knowledge on TQM concepts.
2. To Acquire knowledge on customer satisfaction, motivation etc.
3. Develop skills to use TQM tools for domain specific applications.
4. To explore industrial applications of Quality function deployment and taguchi quality concepts.
5. To impart detail exposure to students on various quality systems like ISO and its standards.

Unit	Description	Instructional Hours
I	**INTRODUCTION** Introduction - Definition of quality - Dimensions of quality - Basic concepts of TQM – TQM Framework – Gurus of TQM - Contributions of Deming, Juan and Crosby - Barriers to TQM Implementation– Principles of TQM- Quality statements - Quality Council - Quality circle- Costs of Quality- Leadership.	9
II	**TQM PRINCIPLES** Customer satisfaction - Strategic quality planning - Customer complaints, Customer retention- Employee involvement - Motivation, Empowerment – Teams - Recognition and Reward, Performance appraisal - PDSA Cycle, 5S, Kaizen - Supplier Partnership - Partnering, Supplier selection, Supplier Rating – Supplier Certification	9
III	**STATISTICAL PROCESS CONTROL** The seven traditional tools of Quality - New Seven Management tools – Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample - Control Charts - Concept of Six sigma- Process capability - Bench marking - Reason to bench mark, Bench marking process	9
IV	**TQM TOOLS** Quality Function Deployment (QFD) -Taguchi quality loss function – Total Productive Maintenance (TPM) - Concepts, improvement needs - Performance measures – FMEA Stages, Types.	9
V	**QUALITY SYSTEMS** Need for ISO 9000 and other Quality System - ISO 9001-2008 Quality System – Elements - Implementation of Quality System - Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand quality concepts and philosophies of TQM.

CO2: Apply TQM principles and concepts of continuous improvement.

CO3: Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality.

CO4: Understand the TQM tools as a means to improve quality.

CO5: Remember and understand the ISO quality systems and procedures adopted

TEXT BOOK:

T1 - Dale H. Bester filed, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2011.

T2-Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

REFERENCES:

R1 - James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Engage Learning, 2012.

R2 - Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall. (India) Pvt. Ltd., 2006.

R3-L.S.Srinath,(2011) Reliability Engineering, Affiliated East West Press, New Delhi, 2009. R4 - Joel.E. Ross, "Total Quality Management – Text and Cases",Routledge.,2017.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	2	2	3	2	3	2	-	3
CO2	-	1	-	-	-	-	-	1	2	2	3	3	1	1
CO3	-	-	-	-	-	-	-	2	3	3	3	3	1	1
CO4	-	-	-	-	-	-	-	2	3	3	3	3	2	2
CO5	-	-	-	-	-	-	-	1	2	2	3	3	1	1
Avg	0	0.2	0	0	0	0	0.4	1.6	2.6	2.4	3	2.8	1	1.6

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME8182	ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS CONCEPTS	3	0	0	3

Course Objective

The student should be able

1. To understand of the scope of an entrepreneur, key areas of development.
2. To motivate the entrepreneurial instinct.
3. To give a clear picture about the process and procedures involved in setting up a small scale Industrial unit or a bigger unit.
4. To develop various businesses related skills of marketing, quality management production, distribution and human resource management etc.
5. To develop and strengthen basic entrepreneurial skills and understanding to run a business efficiently and effectively.

Unit	Description	Instructional Hours
I	ENTREPRENEURSHIP CONCEPTS Meaning and concept of entrepreneurship, Role of Entrepreneurship in Economic Development. Factors affecting Entrepreneurship – Creativity, Innovation and Entrepreneurship, Intrapreneurship.	9
II	ENTREPRENEUR Definition, Entrepreneurial Motivation, Characteristics of Entrepreneurs, Distinction between an Entrepreneur and a Manager, Women Entrepreneur, Modern entrepreneur, Global Indian Entrepreneur.	9
III	ENTREPRENEURIAL ECO SYSTEM Forms of Business Ownership, Sources of Finance, Institutional Support to Entrepreneurs. Financial institutions.	9
IV	BUSINESS PLAN Objectives of a Business Plan, Business Planning Process, Opportunity Identification and Selection, Contents of a Business Plan, Functional Plans, Preparation of feasibility report.	9
V	SMALL BUSINESS MANAGEMENT Definition of Small Scale Industries, Strengths and Weaknesses of Small Business, Growth Strategies in Small Scale Enterprises, Sickness in Small Enterprises – Symptoms, Causes and Consequences.	9
	Total Instructional Hours	**45**

Course Outcome

On completion of the course the students will be able to

CO1: Understand the concepts of entrepreneurship and its importance.

CO2: Understand the traits of an entrepreneur and the sources of his motivation.

CO3: Demonstrate knowledge of various sources of finance and institutions supporting entrepreneurship.

CO4: Understand the components of a business plan.

CO5: Understand the nature of small business and causes of industrial sickness.

TEXT BOOK:

T1 - Khanka.S.S., "Entrepreneurial Development", 5th Edition, S.Chand& Company Ltd., 2016.
T2 - MadhurimaLall and ShikhaSahai, "Entrepreneurship", 2nd Edition, Excel Books, New Delhi, 2008.

REFERENCES:

R1 - Raj Shankar, —Entrepreneurship, Theory and Practice, Vijay Nicole Imprints Pvt. Ltd., Chennai 2012. R2 - Barringer and Ireland, —Entrepreneurship, 3rd Edition, Pearson Education, 2012.
R3 - Zimmer and Scarborough, —Essentials of Entrepreneurship and Small Business Management, 5th Edition, PHI Learning Pvt. Ltd., 2009.
R4 - Charantimath,P.M., "Entrepreneurship Development and Small Business Enterprises, Pearson, 2006.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO2	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO3	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO4	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO5	3	1	2	-	2	1	2	1	-	1	2	3	2	2
Avg	3	1	2	0	2	1	2	1	0	1	2	3	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG ★ Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME8183	LOGISTICS AND SUPPLY CHAIN MANAGEMENT	3	0	0	3

Course Objective

The student should be able

1. To make students understand the importance of Logistics and Supply Chain operations in the industrial and business systems.
2. To acquire knowledge on Supply chain integration.
3. To familiarize the best practices of supply chain management.
4. To provide information of procurement and outsourcing strategies.
5. To enable the students about customer relationship management.

Unit	Description	Instructional Hours
I	**LOGISTICS & SUPPLY CHAIN MANAGEMENT** Introduction to logistics and its concepts, Logistics definitions and approaches, Factors influencing logistics, Classification of Logistics Applications, Total logistics cost, Logistics to Supply Chain Management focus, Objectives of Supply Chain Management, Key factors (Drivers and Obstacles) of SCM, Size and potential of SCM market in India, Framework for supply chain planning and decision making, Strategic aspects and managing uncertainty.	9
II	**DYNAMICS OF SCM** Alignment processes with customer order- management system, Supply chain integration through push-pull mechanism, Bullwhip effect mechanism.	9
III	**WORLD-CLASS BEST PRACTICES IN SCM** Supplier tierization, Reverse logistics, Vendor-managed inventory, Milk round system, Hub and spoke, Third and Fourth party logistics (3PL and 4PL), Cross docking, Drop shipping, Trans-shipment, Risk-pooling, RFID, Lean operations.	9
IV	**PROCUREMENT AND OUTSOURCING STRATEGIES** Operational decisions and trends, Strategic outsourcing and partnerships, Bidding and negotiation processes, Vendor rating and development, e-procurement, Vendor Quality Assurance system.	9
V	**CUSTOMER RELATIONSHIP MANAGEMENT AND INFORMATION TECHNOLOGY IN SCM** Concept of CRM and its linkage with SCM, Marketing implications such as value added services, New product development, Strategic pricing, Need and role of IT in SCM, ERP and SCM, Implementing SCM, Performance Measurement of SCM.	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the concept of logistics and supply chain management.

CO2: Appreciate the importance of logistics function in overall success of any business and industrial sector.

CO3: Apply world-class best practices in supply chain management.

CO4: Execute Vendor Quality Assurance systems.

CO5: Implement very good customer relationship methods.

TEXT BOOK:

T1- D.K.Agrawal"Textbook Of Logistics And Supply Chain Management Macmillan Publishing House , 2003.

T2- Martin Christoper, "Logistics And Supply Chain Management", 4th Edition. 2011.

REFERENCES:

R1. R.B. Handfield And E.L. Nochols, Jr. Introduction To Supply Chain Management. Prentice Hall, 1999.

R2. Sunil Chopra And Peter Meindel. Supply Chain Management: Strategy, Planning,AndOperation,Prentice Hall Of India,2002.

R3. Joseph J, Massie, 'Essentials of Management' Prentice Hall of India Pvt. Ltd., 1985.

R4. Koontz. H. and Weihrich. H., Essentials of Management: An International Perspective, 8thEdition, Tata McGrawhill, New Delhi, 2010.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3			1			1		2	1
CO2	2	2	2	3	2	1		1					3	1
CO3	2	3	3	3	2								2	1
CO4	2	2	3	3	3		1	1					2	1
CO5	3	3	3	3	3					1			1	2
Avg	2.2	2.4	2.6	3	2.6	1	1	1		1	1		2	1.2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME8301	PRODUCTION PLANNING AND CONTROL	3	0	0	3

Course Objective

The student should be able

1. To provide students knowledge about various types of productions like job, batch, continuous etc
2. To know the qualitative and quantitative forecasting techniques and their influence on production planning and control.
3. To enable the students to acquire the knowledge of value analysis, value engineering and break even analysis
4. To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).
5. To familiarize students with operation scheduling and ERP systems

Unit	Description	Instructional Hours
I	**INTRODUCTION** Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration.	9
II	**FORECASTING AND WORK STUDY** Forecasting - Subjective estimate - survey - Delphi method - Regression models - Single variable model Two variable model -Econometric models - Input-output model. Method study, Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling.	9
III	**SHOP FLOOR CONTROL, JUST IN TIME AND MASTER PRODUCTION SCHEDULING** Shop Floor Control Techniques – Basic Shop floor control concepts – Gantt charts. Just in Time – Major elements of JIT – JIT corner stones and the linkages to MPC, Master production scheduling techniques, Bill of material structuring for the MPS.	9
IV	**PRODUCTION SCHEDULING** Frame work for the MPC system - the system and the frame work, Material flows, Individual firm. MRP in MPC: MRP and MRP II: Basic MRP record, Linking MRP records, Scheduled receipts versus planned order releases, MRP planner, MRP system output, MRP Database.	9
V	**INVENTORY CONTROL AND RECENT TRENDS IN PPC** Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems	9
	Total Instructional Hours	**45**

Course Outcome

Upon completion of the course, the students will be able to:

CO1. Understand the major production planning and control activities.

CO2.Identify qualitative and quantitative forecasting techniques and their influence on production planning and control.

CO3.Understand the Master Production Scheduling and aggregate planning.

CO4.Understand the manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

CO5.Determine economic order quantity in either deterministic or stochastic modeling.

TEXT BOOK:

T1 - MartandTelsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.

T2 - James.B.Dilworth,"Operations management", Design, Planning and Control for manufacturing and services, Mcgraw Hill International edition 1992.

REFERENCES:

R1 - Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984.

R2 - Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition, John Wiley and Sons, 2000.

R3 - KanishkaBedi, " Production and Operations management", 2nd Edition, Oxford university press, 2007. R4 - Majumdar.S.R.,"Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO2	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO3	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO4	3	1	2	-	2	1	2	1	-	1	2	3	2	2
CO5	3	1	2	-	2	1	2	1	-	1	2	3	2	2
Avg	3	1	2	0	2	1	2	1	0	1	2	3	2	2

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

HINDUSTHAN ACADEMIC COUNCIL COLLEGE OF ENGG. Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.E.	19ME8302	HEATING, VENTILATION AND AIRCONDITIONING	3	0	0	3

Course Objective

The student should be able

1. To learn the types of heating, ventilation and air conditioning systems.
2. To enable the students to calculate the different types of load for air conditioning systems.
3. To learn the materials, standards, lining and insulation for ducts and pipes in HVAC systems.
4. To learn types of fans and blowers for different air conditioning systems.
5. To learn the maintenance, standards and various equipments for indoor air quality.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO HVAC SYSTMES** Types of air conditioning systems: All water systems, all air systems, air water systems, unitary systems and selection of air conditioning equipments. Air conditioning equipments: Window air conditioners, split air conditioners, packaged air conditioners, centralized air conditioners, evaporative coolers, passive cooling and heating systems. Constant and variable area volume systems.	9
II	**THERMAL LOAD CALCULATIONS** Cooling and heating load calculations: Heat transfer through building structure, occupancy load, electrical loads, ventilation load, infiltration load. Influence of relative humidity in thermal loads. Ventilation standards: Ventilation requirements in air conditioning buildings and ASHRAE standards.	9
III	**DUCTS AND PIPES IN HVAC SYSTEMS** Air flow through ducts, duct standards, duct fittings, types of air outlets and design of air conditioning ducts. Chill water supply pipe sizing calculations: Piping network for supply and return water line - pipe fittings - lining and insulation - piping system as per ASHRAE standards. Insulation materials: types, properties and economic thickness	9
IV	**FANS AND BLOWERS** Types of fans and blowers, performance characteristics, fan laws, static and dynamic losses in fans, design and selection of fans and blowers for air conditioning plants, cooling towers and ventilation systems, testing, speed, flow and noise control. Test standards of fans and blowers.	9
V	**INDOOR AIR QUALITY** Air pollution in air conditioning rooms: effects of air quality, ASHRAE standards. Air filtration: principle of air filtration in HVAC systems, HEPA and ULPA filters, electrostatic cleaners, filter standards, test methods and NAFA certification. Clean rooms: standards for clean rooms, design of clean rooms for hospitals, pharmaceutical and food industries. Measurement of indoor air pollutants, control of pollutants in air conditioning halls.	9
	Total Instructional Hours	45

Course Outcome

Upon completion of the course, the students will be able to:

CO1: Understand the types of HVAC systems.
CO2: Calculate the cooling and heating loads for various air conditioning rooms.
CO3: Design the air conditioning ducts and piping for HVAC systems.
CO4: Select fans and blowers for air conditioning, ventilation and cooling towers.
CO5: Understand the concept of indoor air quality.

TEXT BOOK:

T1 ."HVAC Fundamentals" Samuel C. Sugarman, Fairmont Press, 2nd edition, 2007.
T2. "Fundamentals of HVAC Systems", Robert Mcdowall, Academic Press, 2007.

REFERENCES:

R1. "HVAC Fundamentals", Volume-I, James E. Brumbou, Audel, 4th Edition,2010.
R2. "Home Heating & Air Conditioning systems", James Kittle, MGH. 2005.

R3. "Ventilation Systems: Design and Performance", Hazim B. Awbi.Routledge, 2007. R4. R. Velraj,

"Advances in Solar Heating and Cooling", Elsevier Publication. 2016.

PO& PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	-	-	-	-	1	-	1	-	1
CO2	3	1	1	2	1	-	-	-	-	1	-	1	-	1
CO3	3	2	2	2	1	-	-	-	-	1	-	1	-	1
CO4	3	1	1	1	2	-	-	-	-	2	-	1	3	1
CO5	3	1	2	1	2	-	-	-	-	2	-	1	3	1
Avg	3	1.2	1.4	1.4	1.4	0	0	0	0	1.4	0	1	3	1

Chairman, Board of Studies

Chairman - BoS
MECH - HiCET

ACADEMIC COUNCIL
HINDUSTHAN COLLEGE OF ENGG & TECH
Chairman

Dean – Academics

Dean (Academics)
HiCET