Mechanical Engineering

Preamble: The curriculum of B. Tech. (Mechanical Engineering) program offered by the Department of Mechanical Engineering under Academic Regulation 2023 is prepared in accordance with the curriculum framework of AICTE, UGC and Andhra Pradesh State Council of Higher Education (APSCHE). Further this Outcome Based Curriculum (OBC) is designed with Choice Based Credit and Semester System (CBCSS) enabling the learners to gain professional competency with multi- disciplinary approach catering the minimum requirement (Program Specific Criteria) of Lead Societies like American Society of Mechanical Engineers (ASME) and other Professional Bodies as per the Engineering Accreditation Commission (EAC) of ABET and NBA. In addition, the curriculum and syllabi are designed in a structured approach by deploying Feedback Mechanism on Curriculum from various stakeholders viz. Industry, Potential Employers, Alumni, Academia, Professional Bodies, Research Organizations and Parents to capture their voice of the respective stakeholders.

The Curriculum design, delivery, and assessment, the three major pillars of academic system are completely aligned in line with Outcome Based Education (OBE) to assess and evaluate the learning outcomes facilitating the learners to achieve their Professional and Career Accomplishments.

The Vision

To train the students to be professional and competent Mechanical Engineers to take up the challenges in the society and strive continuously for excellence in education and research

The Mission

- To provide quality education for successful career and higher studies in Mechanical Engineering
- To emphasize academic and technical excellence in the profession
- To take up consultancy and research in solving the problems related to Mechanical Engineering

Program Educational Objectives (PEOs)

The PEOs are the educational goals that reflect Professional and Career Accomplishments that a graduate should attain after 4 – 5 years of his/her graduation

The graduates of Mechanical Engineering of NSRIT will

1. Continue to excel in professional mechanical related careers or chosen career path that apply 21st century skills following ethical standards and practices contributing towards sustainable development by providing feasible and viable technical solutions catering the real-time engineering problems
2. Engage in experiential learning through their professional practices and adapt to changing skills sets in the pursuit of lifelong learning
3. Continue to demonstrate the skill sets that are very much essential to work successfully for a rewarding career in a multidisciplinary setting

Program Specific Outcomes (PSOs)

1. Demonstrate adequate core competency in designing and fabricating mechanical systems, thermal and hydraulic machines, materials and similar others, and thereby providing sustainable computer aided solutions maintaining professional standards and value system
2. Demonstrate adequate knowledge in the allied specialization of Mechanical Engineering that adds value addition for professional practices

Category-wise Credit Distribution of Courses

Category		AICTE	JNTU - GV	NSRIT(A)
HS	Humanities and Social Sciences	8 -9%	8%	3.125%
BS	Basic Sciences	12 – 16%	13%	15.6%
ES	Engineering Sciences	10 - 18%	14%	10.3%
PC	Professional Core	30 - 36%	34%	38.4%
PE	Professional Elective	19 - 23%	21%	15.6%
MI	Inter- / trans - disciplinary Electives			
IN	Internship(s), Project & Seminars	8 - 11%	10%	10.3%
SC	Skill Oriented Courses	-	-	7.5%
MC	Mandatory Courses	-	-	-
AC	Audit Course	-	-	-

Curriculum with Multiple Entry &Multiple Exit (ME-ME) adhering to NEP 2020
(Academic Regulation 2023 – 2024)

	Credit requirement	Exit credit requirement	Total credit	Level as per NCRF
Undergraduate Certificate| (After the one year of study)	40	10	50	L5
Diploma| (After two year of study)	80	10	90	L6
Advanced Diploma | (After two year of study) - Lateral Entrants	40	10	50	
B.Sc. in Engineering (After three years of study)	120	10	130	L7
B. Tech. (Regular) | (Four years of study)	160	-	160	L8
B. Tech. (Minor)	12 (Inclusive of 160)	-	160	L8
B. Tech. (Honors)	175	15 (160+15)	175	L8

Semester I								Category
No.	Code	Course Title	POs / PSOs	L/D[1]	T[2]	P	Credit	
1	23HSX01	Communicative English	5, 8, 10	2	0	2	2.0	HS
2	23BSX21	Engineering Chemistry	1, 2, 7	3	1	0	3.0	BS
3	23BSX11	Linear Algebra & Calculus	1, 2	3	1	0	3.0	BS
4	23ESX01	Basic Electrical and Electronics Engineering	1, 2, 3	3	0	0	3.0	ES
5	23ME101	Engineering Mechanics	1, 2	3	0	0	3.0	PC
6	23HSX02	Communicative English Lab	9, 10	0	0	2	1.0	HS
7	23BSX22	Engineering Chemistry Lab	1, 4	0	0	2	1.0	BS
8	23ESX04	Electrical and Electronics Engg. Workshop	1, 2, 4	0	0	3	1.5	ES
9	23ME102	Engineering Mechanics lab	1, 4	0	0	3	1.5	PC
10	23ESS01	IT Workshop	1, 2, 3, 4, 5	0	0	2	1.0	SOC
11	23MSP01	NSS/ NCC/Scouts & Guides/Community Service	7, 8, 12	-	-	1	0.5	CSP
						Sub-total	20.5	
Semester II								Category
No.	Code	Course Title	POs / PSOs	L/D[1]	T[2]	P	Credit	
1	23BSX31	Engineering Physics	1, 2, 7	3	1	0	3.0	BS
2	23BSX12	Differential Equations and Vector Calculus	1, 2, 5	3	1	0	3.0	BS
3	23ESX02	Introduction to Programming	1, 2, 3	3	0	0	3.0	ES
4	23ESX03	Basic Civil & Mechanical Engineering	1, PSO #1	3	0	0	3.0	ES
5	23BSX32	Engineering Physics Lab	1, 4	0	0	2	1.0	BS
6	23ESX06	Engineering Workshop	1	0	0	3	1.5	ES
7	23ESX07	Engineering Graphics	1, 10	2	0	2	3.0	ES
8	23ESX05	Computer Programming Lab	1, 2, 3, 4, 5	0	0	3	1.5	ES
9	23WLP01	Health, Wellness, Yoga & Sports	2, 7, 12	-	-	1	0.5	Wellness
						Sub-total	19.5	
Exit mandate at the level of I year for the award of Undergraduate Certificate[3]								
1		Certification #1		Min. 60 hours			2.0	SOC
2		Certification #2		Min. 60 hours			2.0	SOC
3		Job Specific Internship / OJT / Apprenticeship		Min. 60 Days			6.0	OJT

[1] In case of digital learning other than face-to-face learning, double the number of learning hours is mandate for the equivalent credit as per NCRF

[2]Suggested tutorials do not carry credits

[3]Students exiting at the level of first year of study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits

Semester III								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	23BSX13	Numerical and Statistical Methods	PO1, PO2, PO12	3	0	0	3	BS
2	23HSX03	Universal Human Values: Understanding Harmony & Ethical Human Conduct	PO8, PO9, PO10, PO12	3	0	0	3	HS
3	23ME303	Thermodynamics	PO1, PO2, PO12, PSO1	3	0	0	3	ES
4	23ME304	Mechanics of Solids	PO1, PO2, PO12, PSO1	3	0	0	3	PC
5	23ME305	Material Science and Metallurgy	PO1, PO2, PO5, PO12	3	0	0	3	PC
6	23ME306	Mechanics of Solids and Material Science Lab	PO1, PO2, PO3, PO4, PO12	0	0	3	1.5	PC
7	23ME307	Computer Aided Machine Drawing	PO1, PO4, PO10, PO12, PSO1	0	0	3	1.5	PC
8	23CSS01	Python programming Lab	PO1, PO2, PO3, PO4, PO5, PO12, PSO1, PSO2	0	0	2	1.0	ES
9	23ECS01	Embedded Systems and IoT	PO1, PO5, PO10, PO12, PSO1	0	1	2	2	SOC
10	23ACX01	Environmental Science	PO1, PO12	2	0	0	-	MC
						Sub-total	**20.0**	
Semester IV								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	23HSX04	Industrial Management	PO11, PO12	2	0	0	2	HS
2	23BSX18	Probability and Complex Variables	PO1, PO2	3	0	0	3	BS
3	23ME403	Manufacturing Processes	PO1, PO6, PO12	3	0	0	3	PC
4	23ME404	Fluid Mechanics and Hydraulic Machines	PO1, PO2, PO12, PSO1	3	0	0	3	PC
5	23ME405	Design of Machine Members	PO1, PO2, PO12, PSO1	3	0	0	3	PC
6	23ME406	Fluid Mechanics and Hydraulic Machines Lab	PO1, PO2, PO3, PO4, PO12	0	0	3	1.5	PC
7	23ME407	Manufacturing Process Lab	PO1, PO2, PO3, PO4, PO12	0	0	3	1.5	PC
8	23SCX01	Soft Skills	PO8, PO9, PO10, PO12	0	1	2	2	SOC
9	23ESX08	Design Thinking & Innovation	PO1, PO2, PO12	1	0	2	2	HS
						Sub-total	**21.0**	
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation								
Exit mandate at the level of II Year for the award of Diploma[4,5]								
1		Certification #3		Min. 60 hours			2.0	SOC
2		Certification #4		Min. 60 hours			2.0	SOC
3		Job Specific Internship/OJT/Apprenticeship		Min. 60 Days			6.0	OJT

[4]The courses that come under mandatory category may be promoted either through self-learning or blended learning and accordingly campus LMS platform may be customized. It is mandate for all students to pursue an online certification course for minimum duration of 30 hours covering the areas of Sustainability, Climate changes, Environmental Impact Assessment in line with Sustainable Development Goals (SDG)

[5]Students exiting at the level of second year study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits

Semester V								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credit	
1	23ME501	Machine Tools & Metrology		3	0	0	3.0	PC
2	23ME502	Theory of Machines		3	0	0	3.0	PC
	23ME503	Thermal Engineering		3	0	0	3.0	PC
3	-	Program Elective – I		3	0	0	3.0	PE
4	-	Open Elective – I		3	0	0	3.0	OE
6	23ME506	Thermal Engineering Lab		0	0	3	1.5	PC
7	23ME507	Theory of Machines Lab		0	0	3	1.5	PC
8	23MES03	Machine Tools & Metrology		0	0	1	2	SOC
9	-	Tinkering Lab		0	0	2	1.0	ES
10	-	Evaluation of Community Service Centric Internship[6]		0	0	-	2.0	INTERN
						Sub-total	**23.0**	
Semester VI								Category
No.	Code	Course Title	POs / PSOs	L	T	P	Credit	
1	23ME601	Heat Transfer		3	0	0	3.0	PC
2	23ME602	Artificial Intelligence and Machine Learning		3	0	0	3.0	PC
3	23ME603	Control Systems		3	0	0	3.0	PC
4	-	Program Elective – II		3	0	0	3.0	PE
5	-	Program Elective –III		2	0	0	3.0	PE
6	-	Open Elective –II		3	0	0	3.0	OE
7	23ME607	Heat Transfer Lab		0	0	3	1.5	PC
8	23ME608	Control Systems Lab		0	0	3	1.5	PC
9	23MES04	Artificial Intelligence and Machine Learning		0	1	2	2.0	SOC
10	-	Technical Paper Writing &IPR[7]		2	0	0	-	SOC
		Sub-total					**23.0**	
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation								
Exit mandate at the level of third year for the award of Bachelor of Science in Engineering[5]								
1		Certification #5		Min. 60 hours			2.0	SOC
2		Certification #6		Min. 60 hours			2.0	SOC
3		Job Specific Internship / OJT / Apprenticeship[8]		Min. 60 Days			6.0	OJT

[6]The work pertaining to summer Internship #1 and #2 shall be completed at the end of the semesters IV & VI respectively. The assessment shall be carried out during the semesters V and VII. It is mandate for all the students to undergo 4-6 weeks of industrial training and appear for assessment during Semester V with report. With regard to summer internship #1 or Community Service Project (CSP), based on the availability the students can opt CSP as an alternate option for summer internship #1 for a duration of 04 weeks

[7]The students are expected to identify one research area in the recent trends, collect recent research articles, prepare a technical research review paper and publish in renowned annual conferences/ journals, preferably indexed in Scopus or UGC care

[8]Students exiting at the level of third year of study must complete two skill-oriented courses and Job specific Internship/ OJT/ Apprenticeship that tunes to a total of 10 credits

Semester VII								Category
No.	Code	Course Title	POs / PSOs	L	T	P	Credits	
1	23ME701	CAD/CAM		2	0	0	2.0	PC
2				2	0	0	2.0	HS
3	23ME702	CAD/CAM Lab		0	0	2	1.0	PC
4	-	Program Elective – IV		3	0	0	3.0	PE
5	-	Program Elective – V		3	0	0	3.0	PE
6	-	Open Elective –III		3	0	0	3.0	OE
7		Open Elective –IV		3	0	0	3.0	OE
8		Geometric Dimensioning and Tolerance		0	1	2	2.0	SOC
9		Gender Sensitization		0	1	2	-	MC
10	-	Evaluation of Industry Internship		-	-	-	2.0	INTERN
						Sub-total	**21.0**	
Semester VIII								Category
No.	Code	Course Title	POs / PSOs	L/D	T	P	Credits	
1	-	Full Semester Internship[6]	1-12, PSO#1,2	-	-	-	6.0	INTERN
2	-	Capstone Research Project	1-12, PSO#1,2	-	-	-	6.0	INTERN
						Sub-total	**12.0**	
						Total	**160.0**	

List of Electives

[9]The courses that come under mandatory category may be promoted either through self-learning or blended learning and accordingly campus LMS platform may be customized. It is mandate for all students to pursue an online certification course for minimum duration of 30 hours covering the area of Constitution of India

[10]It is mandate for all the students to undergo 6-8 weeks of industrial training and appear for assessment during Semester VII with report and those opted FSI during Semester VII shall appear through online for reviews

[11]Students opting for FSI in VII semester have to take up courses of VII semester in VIII semester. The students are expected to do a capstone project parallllly demonstrating their POs & PSOs and submit a separate report

Program Elective #1									
No	Code	Title	PO	L/D	T	P	C		
1	23ME001	Applied Thermodynamics	-	3	0	0	2.0	PE	
2	23ME002	Unconventional Machining Processes	-	3	0	0	2.0	PE	
3	23ME003	Rotor Dynamics	-	3	0	0	2.0	PE	
4	23ME004	Composite Materials	-	3	0	0	2.0	PE	
5	23ME005	Product Design	-	3	0	0	2.0	PE	
6	23ME006	Production Planning and Control	-	3	0	0	2.0	PE	
Program Elective #2									
7	23ME007	Refrigeration and Air Conditioning	-	3	0	0	3.0	PE	
8	23ME008	Flexible Manufacturing Systems	-	3	0	0	3.0	PE	
9	23ME009	Optimization Techniques	-	3	0	0	3.0	PE	
10	23ME010	Material Characterization	-	3	0	0	3.0	PE	
11	23ME011	CAD/CAM	-	3	0	0	3.0	PE	
12	23ME012	Total Quality Management	-	3	0	0	3.0	PE	
Program Elective #3									
13	23ME013	Power Plant Engineering	-	3	0	0	2.0	PE	
14	23ME014	Advanced Welding Technology	-	3	0	0	2.0	PE	
15	23ME015	Finite Element Method	-	3	0	0	2.0	PE	
16	23ME016	Condition Monitoring	-	3	0	0	2.0	PE	
17	23ME017	Computer Integrated Manufacturing	-	3	0	0	2.0	PE	
18	23ME018	Operations Research	-	3	0	0	2.0	PE	
Program Elective #4									
19	23ME019	Gas Dynamics and Jet Propulsion	-	3	0	0	3.0	PE	
20	23ME020	Advance Metal Casting	-	3	0	0	3.0	PE	
21	23ME021	Product Design and Manufacturing	-	3	0	0	3.0	PE	
22	23ME022	Non-Destructive Evaluation	-	3	0	0	3.0	PE	
23	23ME023	Robotics and Automation	-	3	0	0	3.0	PE	
24	23ME024	Project Planning and Management	-	3	0	0	3.0	PE	
Program Elective #5									
The curriculum provides academic flexibility to choose any of the domain specific courses from MOOCs as approved by the respective Board of Studies and Academic Council. The students can take up this course on self- study mode. The course shall be of 45–60 hours duration (3-credits) and the assessment shall be as per the academic regulations 2023.									PE
Inter – disciplinary Elective #1[7]			Pre-requisite[8]						
25	23CEO01	Environment Pollution and Control	-	-	-	3	0	0	3.0	MI-ES
26	23CS405	Operating Systems			-	3	0	0	3.0	MI-
27	23AIO01	Introduction to Python	23ESX02		-	3	0	0	3.0	MI-
28	23DSO01	Introduction to Database Management Systems	23BSX11		-	3	0	0	3.0	MI-
29	23ECO01	Semiconductor Devices and Circuits	23BSX31	23ESX01	-	3	0	0	3.0	MI-
30	23EEO01	Basics of DC Machines	23ESX01		-	3	0	0	3.0	MI-
31	23MEO01	Nano Technology	23BSX21		-	3	0	0	3.0	MI-
Inter – Disciplinary Elective #2			Pre-requisite						
32	23CEO02	Air Pollution	-	-	-	3	0	0	3.0	MI-ES
33	23CS305	Software Engineering	-		-	3	0	0	3.0	MI-
34	23AI305	Artificial Intelligence	-		-	3	0	0	3.0	MI-
35	23DSO02	Introduction to Data Science	23BSX15							
36	23ECO02	Digital Electronics	23ESX01		-	3	0	0	3.0	MI-
37	23EEO02	Basics of AC Machines	23ESX01		-	3	0	0	3.0	MI-
38	23MEO02	Biomaterials/Introduction to Industrial Robots	23BSX21		-	3	0	0	3.0	MI-

Inter – Disciplinary Elective #3			Pre-requisite							
39	23CEO03	Climate Change Mitigation and Adaption	23MCX04	23CE008	-	3	0	0	3.0	MI-ES

[7] Inter-disciplinary elective/trans-disciplinary electives shall be factored under B.Tech. minor. To travel in a particular minor track, two pre-requisite courses should be completed to a tune of six credit out of four or equivalent courses that suits the pre-requisite.

[8] Pre-requisite courses are those that are offered in core or in elective pertaining to minor offered by the respective program of study. It is not the program core of the parent department

40	23CS304	Database Management Systems			-	3	0	0	3.0	MI-
41	23AIO03	Machine Learning for Engineers	23BSX15		-	3	0	0	3.0	MI-
42	23DSO03	Introduction to Big data			-	3	0	0	3.0	MI-
43	23ECO03	Analog Electronic Circuits	23BSX31		-	3	0	0	3.0	MI-
44	23EEO03	Basics of Power Electronics								
45	23MEO03	Micro Electromechanical Systems/Introduction to Mechatronics	23ESX03		-	3	0	0	3.0	MI-
Inter – Disciplinary Elective #4			Pre-requisite							
46	23CEO04	Sustainability and Pollution Prevention Practices	23MCX04	23CE008	-	3	0	0	3.0	MI-ES
47	23CS502	Computer Networks			-	3	0	0	3.0	MI-
48	23AIO04	Fundamentals of Deep Learning			-	3	0	0	3.0	MI-
49	23DSO04	Introduction to Data Visualization			-	3	0	0	3.0	MI-
50	23ECO04	COMMUNICATION SYSTEMS			-	3	0	0	3.0	MI-
51	23EEO04	Introduction to Electric Vehicles			-	3	0	0	3.0	MI-
52	23MEO04	Surface Engineering/Operations Management			-	3	0	0	3.0	MI-
Trans – Disciplinary Stream #1 (Liberal Arts)										
1	23HSM01	Psychology			-	3	0	0	3.0	MI
2	23HSM02	English for Media			-	3	0	0	3.0	MI
3	23HSM03	Journalism and Mass media			-	3	0	0	3.0	MI
4	23HSM04	Tourism			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #2 (Statistics)										
1	23HSM05	Statistical Methods			-	3	0	0	3.0	MI
2	23HSM06	Statistical Inference			-	3	0	0	3.0	MI
3	23HSM07	Statistical Quality Control			-	3	0	0	3.0	MI
4	23HSM08	Introduction to Time Series			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #3 (General Management)										
1	23MBM01	General Management			-	3	0	0	3.0	MI
2	23MBM02	Organization Behavior			-	3	0	0	3.0	MI
3	23MBM03	Entrepreneurship and Business Venture Planning			-	3	0	0	3.0	MI
4	23MBM04	Cross Culture Management			-	3	0	0	3.0	MI
Trans – Disciplinary Stream #4 (Human Resource Management)										
1	23MBM05	Human Resource Planning			-	3	0	0	3.0	MI
2	23MBM06	Compensation Management & Employee Welfare Laws			-	3	0	0	3.0	MI
3	23MBM07	Performance Management and Talent Management			-	3	0	0	3.0	MI
4	23MBM08	Talent Management			-	3	0	0	3.0	MI
B. Tech. (Honors)										
Category I										
1	23MEH01	Advanced Thermodynamics			-	3	0	0	3.0	HO
2	23MEH02	Design and Analysis of Engineering Materials			-	3	0	0	3.0	HO
3	23MEH03	Advanced Strength of Materials			-	3	0	0	3.0	HO
Category II										
5	23MEH04	Advanced Fluid Mechanics			-	3	0	0	3.0	HO
6	23MEH05	Advanced Materials and processes			-	3	0	0	3.0	HO
7	23MEH06	Advanced Optimization Techniques			-	3	0	0	3.0	HO
Category III										
9	23MEH07	Jet Propulsion and Rocket Engineering			-	3	0	0	3.0	HO
10	23MEH08	Advanced Manufacturing Methods			-	3	0	0	3.0	HO
11	23MEH09	Design of Mechanical Transmission Systems			-	3	0	0	3.0	HO
Category IV										
13	23MEH10	Advanced Heat Transfer			-	3	0	0	3.0	HO
14	23MEH11	Rapid Prototyping			-	3	0	0	3.0	HO
15	23MEH12	Advanced Finite Element Analysis			-	3	0	0	3.0	HO
Category V: MOOCs										
Industry Connect Courses										
1	23ICC01	Competitive Programming			-	2	0	8	6.0	ICC
2	23ICC02	Web Technologies – Theory to Practice			-	2	0	8	6.0	ICC
3	23ICC03	Java and Springboard			-	2	0	8	6.0	ICC
4	23ICC04	Robotics Process Automation (RPA)			-	2	0	8	6.0	ICC
5	23ICC05	Information Security and Forensics			-	2	0	8	6.0	ICC

6	23ICC06	Battery Technologies for EV	-	2	0	8	6.0	ICC
7	23ICC07	Blockchain Technology	-	2	0	8	6.0	ICC
8	23ICC08	Network Administration	-	2	0	8	6.0	ICC
9	23ICC09	Product Engineering	-	2	0	14	9.0	ICC
10	23ICC10	Machine Learning Engineer	-	2	0	8	6.0	ICC
11	23ICC11	Data Scientist	-	2	0	8	6.0	ICC
12	23ICC12	Industrial IoT	-	2	0	8	6.0	ICC
Certification #1& #2								
1	23SOC07	Plumbing	-	0	0	2	2.0	SOC
2	23SOC08	Air conditioning and refrigeration	-	0	0	2	2.0	SOC
3	23SOC09	Mobile troubleshooting	-	0	0	2	2.0	SOC
4	23SOC10	Computer assembling	-	0	0	2	2.0	SOC
5	23SOC11	Digital marketing	-	0	0	2	2.0	SOC
6	23SOC12	Lathe	-	0	0	2	2.0	SOC
7	23SOC13	Electrical winding	-	0	0	2	2.0	SOC
8	23SOC14	Masonry	-	0	0	2	2.0	SOC
9	23SOC16	Automobile servicing (Basics)	-	0	0	2	2.0	SOC
Certification #3 & #4								
1	23SOC17	Industrial Safety	-	0	0	3	3.0	SOC
2	23SOC18	Equipment Maintenance and Repairing	-	0	0	3	3.0	SOC
3	23SOC19	Computer Aided Analysis and Design	-	0	0	3	3.0	SOC
4	23SOC20	Battery Management System (BMS)	-	0	0	3	3.0	SOC
5	23SOC21	Design of Machine Elements	-	0	0	3	3.0	SOC
6	23SOC22	Computer Servicing	-	0	0	3	3.0	SOC
7	23SOC23	Front Office Management	-	0	0	3	3.0	SOC
8	23SOC24	Facility Management Service	-	0	0	3	3.0	SOC
9	23SOC25	Hotel Management	-	0	0	3	3.0	SOC

Specialization

B. Tech. (Honors)

1. Advanced Thermal Systems
   - (i) Advanced Thermodynamics
   - (ii) Advanced Fluid Mechanics
   - (iii) Jet Propulsion and Rocket Engineering
   - (iv) Advanced Heat Transfer
2. Smart Manufacturing
   - (i) Design and Analysis of Engineering Materials
   - (ii) Advanced Materials and processes
   - (iii) Advanced Manufacturing Methods
   - (iv) Rapid Prototyping
3. Design
   - (i) Advanced Strength of Materials
   - (ii) Advanced Optimization Techniques
   - (iii) Design of Mechanical Transmission Systems
   - (iv) Advanced Finite Element Analysis

B. Tech. (Minor) – Trans – disciplinary

1. Liberal Arts
2. Statistics
3. General Management
4. Personal Management

B. Tech. (Minor) – Inter – disciplinary

1. Materials and Mechanical systems

HS **23HSX01 Communicative English** **2 0 0 2**

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

Code	Course Outcomes	Mapping with POs PO 5	PO 8	PO 10	DoK
23HSX01.1	Make use of the setting, subject, and specific details from social or transactional discussions	1	1	3	L1 - L3
23HSX01.2	Identify grammatical frameworks to construct sentences and select the appropriate word forms	1	1	3	L1 - L3
23HSX01.3	Examine discourse markers to talk coherently about a subject in informal conversations	1	1	3	L1 - L3
23HSX01.4	Assessing the reader's or listener's overall comprehension of reading, listening, and summary materials	1	1	3	L1 - L6
23HSX01.5	Justify intelligible essays, resumes, and paragraphs	1	1	3	L1 - L6

All the Cos are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning.

Unit I: HUMAN VALUES: A Power of a Plate of Rice by Ifeoma Okoye **9 Hours**
"Tomorrow is waiting" by Holli Mintzer - Strange Horizons
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing one self and others
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information
Writing: Mechanics of Writing - Capitalization, Spellings, Punctuation - Parts of Sentences
Grammar: Parts of Speech, Basic Sentence Structures - forming question
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words

COs: CO1

Self Learning Topic: The Time Machine – H.G. Wells

Unit II: NATURE: Night of the Scorpion by Nissim Ezekiel (Indian & Contemporary) **9 Hours**
Patterns of a Murmuration, in billions of data points by Jy Yang - Clares World
The Brook by Alfred Tennyson (Poem)
Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts
Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article; prepositions
Vocabulary: Homonyms, Homophones, Homographs

COs: CO2

Self Learning Topic: In Watermelon Sugar –Brautigan

Unit III: BIOGRAPHY: Elon Musk/Steve Jobs **9 Hours**

"The Life cycle of Software Objects" is a novella by American writer Ted Chiang, originally published in 2010 by Subterranean Press.
Listening: Listening for global comprehension and summarizing what is listened to
Speaking: Discussing specific topics in pairs orsmall groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension
Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs-tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

COs: CO3

Self Learning Topic: The Reader – Bernhard Schlink

Unit IV: Inspiration: TheToys of Peace by Saki **9 Hours**
A Story Told by a Machine The Circuitous Path to AI Writing
Listening: Making predictions while listening to conversations/transactional dialogues without video; listening with video
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions
Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/ relationships, communicate processesor display complicated data
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

COs: CO4

Self Learning Topic: The Prime of Life – Simone De Beauvoir

Unit V: MOTIVATION: The Power of Intra personal Communication (An Essay) **9 Hours**
The interplay of AI, modern lives and literature by Mimi Mondal - Hindusthan Times
Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension
Writing: Writing structured essays on specific topics
Grammar: Editing short texts - identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

COs: CO5

Self Learning Topic: Do Androids Dream of electric ship? PhilipK.Dick The City and the Stars – Aarthur C. Clarke

Board of Studies	Basic Science & Humanities (English)	
Approved in: BoS No. II	October 06, 2023	
Approved in ACM: ACM No.VIII	October 21, 2023	
Expert talk (To be delivered by SMEs from industries)	**COs**	**POs**
Workshop on Drama and enactive sessions	CO5	PO5, PO8, PO10
Seminar with Language expert	CO3	PO5, PO8, PO10

Text Books

1. Path finder: Communicative English for Undergraduate Students,1st Edition, Orient Black Swan, 2023 (Units 1, 2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

Reference Books

1. Dubey, ShamJi & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen, Academic writing: A Handbook for International Students Routledge, 2014
3. Murphy, Raymond, English Grammar in Use, 4th Edition, Cambridge University Press, 2019
4. Lewis, Norman, Word Power Made Easy - The Complete Handbook for Building a Superior Vocabulary, Anchor, 2014

Web References

Grammar

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Vocabulary

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	50	15
L2	20	30
L3	10	30
L4	10	15
L5	05	05
L6	05	05
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. List the major characters in the story
2. Who is the author of the poem "The Brook"?
3. What is the specific natural element that the poem revolves around?
4. Who is Elon Musk?
5. Can you name some of the companies founded or co-founded by Elon Musk?

L2: Understand

1. Can you summarize the plot of the story in your own words?
2. Explain the significance of the Brook's journey in the poem
3. What emotions or feelings does the poem evoke in you as a reader?
4. Explain the significance of SpaceX in Elon Musk's career and the aerospace industry
5. What are some of the major technological advancements associated with Elon Musk's companies?

L3: Apply

1. How would you apply the lessons from this story to your own life?
2. Can you apply the poem's themes to a different natural setting or body of water that you are familiar with?
3. Describe a real-life situation or natural phenomenon that parallels the Brook's journey in the poem
4. Apply Elon Musk's philosophy on sustainable energy to a current environmental issue
5. Describe a scenario in which the principles of innovation and risk-taking, as demonstrated by Elon Musk, could be applied in a different industry

L4: Analyze

1. How does the setting contribute to the overall mood of the story?
2. How does the poem's structure, including its rhyme scheme and meter, contribute to the overall meaning and mood of the poem?
3. Explore the role of sound and sensory imagery in conveying the Brook's essence
4. How has Elon Musk's leadership style contributed to the success of his companies?
5. Compare and contrast the goals and missions of SpaceX and Tesla, Inc.

L5: Evaluate

1. Evaluate the impact of the surprise ending in the story
2. Evaluate the effectiveness of the poem in conveying its themes and emotions
3. How might different readers interpret the poem's meaning based on their personal experiences or perspectives?
4. Do you agree with Elon Musk's vision for a sustainable future and his approach to achieving it? Why or why not?
5. Assess the ethical considerations surrounding some of Elon Musk's projects, such as Neuralink or the Hyperloop

L6: Create

1. Create a modern-day version of the story, updating the setting and circumstances while retaining the central theme of sacrifice
2. Write a short paragraph or poem that continues the story of the brook after the poem ends
3. Compose a piece of music inspired by the imagery and emotions conveyed in "The Brook"
4. Write a short essay discussing the potential long-term effects of Elon Musk's ventures on the global economy and society
5. Develop a concept for a new technology or project that aligns with Elon Musk's innovative spirit and goals

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Board of Studies (B S & H)

BS 23BSX21 Engineering Chemistry 3 0 0 3

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO2	PO7	
23BSX21.1	Compare the differences between temporary and permanent hardness of water	3	2	1	L1 - L3
23BSX21.2	Apply Nernst equation for calculating electrode, cell potentials and Pilling-Bedworth rule for corrosion	3	2	1	L1 - L3
23BSX21.3	Explain different types of polymers and their applications & solve the numerical problems based on Calorific value, octane number, refining of petroleum and cracking of oils.	3	2	1	L1 - L3
23BSX21.4	Explain the constituents of composites and its classification & the constituents of Portland cement & enumerate the reactions at setting and hardening of the cement	3	2	1	L1 - L3
23BSX21.5	Summarize the concepts of colloids, micelle and nanomaterials	3	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Water Technology **9 Hours**

Soft and hard water, Estimation of hardness of water by EDTA Method, Estimation of dissolved oxygen - Boiler troubles - Priming, foaming, scale and sludge, caustic embrittlement, Industrial water treatment - Specifications for drinking water, Bureau of Indian Standards (BIS) and World Health Organization (WHO) standards, Ion-exchange processes - desalination of brackish water, Reverse Osmosis (RO) and electro dialysis

COs: CO1

Self – Learning Topic: Advanced softening methods

Unit II: Electrochemical Cells and Corrosion and Its Applications **9 Hours**

Electrodes - electrochemical cell, Nernst equation, cell potential calculations.

Primary cells - Zinc-air battery, Secondary cells - Nickel-Cadmium (NiCad), and lithium ion batteries - working principle of the batteries including cell reactions; Fuel cells - Basic concepts, the principle and working of hydrogen-oxygen fuel cell.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling - Bedworth ratio and uses, factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).

COs: CO2

Self – Learning Topic: Nano electrochemical sensor

Unit III: Polymers and Fuel Chemistry **9 Hours**

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization.

Thermoplastics and Thermo-setting plastics: Preparation, properties and applications of poly styrene. PVC Nylon 6,6 and Bakelite.

Elastomers - Preparation, properties and applications of Buna S, Buna N, Thiokol rubbers.

Fuels - Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid fuels, refining of petroleum, Octane and Cetane number-alternative fuels-propane, methanol, ethanol and bio fuel-bio diesel.

COs: CO3

Self – Learning Topic: Advanced techniques of synthetic petrol

Unit IV: Modern Engineering Materials **9 Hours**

Composites-Definition, Constituents, Classification- Particle, Fibre and structural reinforced composites, properties and Engineering applications
Refractories-Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants-Classification, Functions of lubricants, Mechanism, Properties of lubricating oils-Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and applications.
Building materials-Portland Cement, constituents, Setting and Hardening of cement.

COs: CO4

Self – Learning Topic: Design materials

Unit V: Surface Chemistry and Nanomaterials **9 Hours**

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (any two methods with examples), chemical and electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, characterization of surface by physicochemical methods (SEM, TEM, X-ray diffraction), solid-gas interface, solid-liquid interface, adsorption isotherm, BET equation (no derivation) applications of colloids and nanomaterials - catalysis, medicine, sensors

COs: CO5

Self – Learning Topic: Optical methods

Board of Studies		Basic Science & Humanities (Chemistry)	
Approved in: BoS No. II		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Corrosion and material protection	CO1	PO1, PO2, PO7
2	Principles and applications of chemical energy sources	CO2, CO3	PO1, PO2, PO7

Text Books

1. Jain and Jain, "Engineering Chemistry", 16th Edition, Dhanpatrai Publications, 2013
2. Peter Atkins, Julio de Paula and James Keeler, Atkins "Physical Chemistry", 10th Edition, Oxford University Press, 2010
3. Shikha Agarwal, Engineering Chemistry: Fundamentals and Applications" 13th Edition, 2012

Reference Books

1. Lee J. D., "Concise Inorganic Chemistry", 5th Edition, Oxford University Press, 2008
2. Taylor H. F. W., "Cement Chemistry", 2nd Edition, Thomas Telford Publications, 1997

Web References

1. http://link.springer.com/chemistry
2. http://www.thphys.chemistry.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	30
L2	50	50
L3	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is soft water & hard water?
2. What are the salts causing hardness?
3. Define corrosion & give an example
4. Write any four applications of fuel cells
5. Define octane number
6. List any three properties of PVC
7. Define Flash point

L2: Understand

1. Explain estimation of hardness of water by EDTA Method
2. Explain Ion-exchange process with neat sketch
3. Differentiate between primary cells & secondary cells
4. Explain electroplating and electro less plating process
5. Differentiate chain growth polymerization and step growth polymerization
6. Explain about Ultimate analysis of coal
7. Explain about various types of lubricants

L3: Apply

1. Estimate the hard water can be converted into soft water by ion exchange process
2. Explain how estimation of hardness of water by EDTA method can be used to measurement of hardness
3. Discuss the challenges that need to be overcome for fuel cells to become more widely used
4. Automotive tires, gaskets for industrial machinery, or medical devices, can you choose an appropriate elastomer material based on its properties, such as elasticity, chemical resistance, and durability? Justify your answer
5. Explain the choice of refractory materials, their composition, and how they can withstand extreme temperatures, chemical reactions, and mechanical stresses
6. Describe the choice of a nanomaterial, its synthesis method, and how it enhances catalytic activity for a particular chemical reaction
7. Discuss the use of colloidal nanoparticles as catalysts in industrial processes

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Chairman
Board of Studies (BS & H)

BS 23BSX11 Linear Algebra and Calculus 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	PO2	DoK
23BSX11.1	Solve homogenous & non- homogenous linear system of equations	3	2	L1 - L4
23BSX11.2	Use Cayley- Hamilton theorem to find inverse & powers of a matrix and identify the nature of the quadratic forms using eigen values and eigen vectors	3	2	L1 - L4
23BSX11.3	Solve a given inequality using mean value theorems	3	2	L1 - L4
23BSX11.4	Make use of functions of several variables which is useful in optimization	3	2	L1 - L4
23BSX11.5	Analyze double and triple integrals using Beta and Gamma functions	3	3	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Solving Homogeneous and Non-Homogeneous Systems of linear equations **9 Hours**

Rank of a matrix by echelon form, normal form. Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method

COs: CO1

Self – Learning Topic: Rank by using minors

Unit II: Eigen Values and Eigen Vectors, Cayley - Hamilton theorem and Quadratic forms **9 Hours**

Eigen values, Eigen vectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

COs: CO2

Self – Learning Topic: Applications of Eigen Values and Eigen Vectors

Unit III: Calculus (Mean value theorems) **9 Hours**

Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems on the above theorems.

COs: CO3

Self – Learning Topic: Applications on the above theorems

Unit IV: Partial Differentiation and applications (Multi Variable Calculus) **9 Hours**

Partial Derivatives, Total derivatives, Chain Rule, Change of variables, Taylor's and Maclaurin's series expansion of functions ot two variables, Jacobians, maxima and minima of functions of two variables, method of lagrange multipliers.

COs: CO4

Self – Learning Topic: Jacobian of Implicit functions

Unit V: Beta and Gamma Functions & Multiple Integrals **9 Hours**

Gamma, Beta Functions and their Properties - Relation between Beta and Gamma Functions - Evaluation of Improper Integrals. Evaluation of Double triple Integrals - Direct Method

COs: CO5

Self – Learning Topic: Dirichlet's Integrals

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Introduction to MATLAB	CO1-CO5	PO2, PO5
2	Applications of Singular Value Decomposition	CO2	PO3

Text Books

1. Grewal, B. S. "Higher Engineering Mathematics", 44th Edition, 12th reprint, Khanna Publishers, 2022
2. Ramana, B. V. "Higher Engineering Mathematics",1st Edition, 35th Reprint,Tata McGraw Hill Education, 2019

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2021
2. Bali, N. P. "Engineering Mathematics",1st Edition, Lakshmi Publications, 2017
3. Peter O' Neil, "Advanced Engineering Mathematics",1st Edition, Cengage, 2010
4. Iyengar, T. K. V. Prasad, M. V. S. S. N., Ranganatham S. & B. Krishna Gandhi**,** "Engineering Mathematics - II", 3rd Edition, S. Chand Publications, 2020

Web References

1. http://nptel.ac.in/courses/
2. https://onlinecourses.nptel.ac.in
3. https://www.classcentral.com/course/swayam-basic-linear-algebra-13003
4. https://ocw.mit.edu/courses

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. State Cayley-Hamilton theorem
2. State Euler's theorem
3. Define the rank of a matrix
4. What is an orthogonal transformation?
5. What is the necessary condition for a non-homogenous system AX=B to be consistent
6. What is the index of a quadratic form?
7. State Rolle's Theorem

L2: Understand

1. Check whether $x = r\cos\theta$ and $y= r\sin\theta$ are functionally dependent.
2. Check the consistency of the system $x+ y+ z =4$, $2x+3y-2z=3$, $x+7y-7z=5$
3. Find whether the homogenous system $x+y-3z+2w=0$,$2x-y+2z-3w=0$,$3x-2y+z-4w=0$,$-4x+y-3z+w=0$ possess a non-trivial solution
4. If $u= x^2+y^2+z^2$, $v= xy + yz + zx$, $w = x + y + z$, show that u, v, w are functionally dependent and find the relationship between them

5. Verify Rolle's theorem for $f(x) = (x+2)^3(x-3)^4$ in [-2,3]

L3: Apply

1. Find non-singular matrices P and Q such that PAQ is in the normal form for $A=\begin{bmatrix} 2 & 3 & -1 \\ 0 & 1 & 2 \\ 3 & -4 & -2 \end{bmatrix}$
2. Reduce the matrix A to echelon form where $A = \begin{bmatrix} 1 & 2 & 4 & -3 \\ -2 & 7 & 5 & 2 \\ 4 & 13 & 0 & -4 \\ 6 & 5 & -3 & 3 \end{bmatrix}$
3. Find the shortest distance from origin to the surface $xyz^2 = \bar{2}$
4. Find the points on the surface $z^2 = x\,y + 1$ that are nearest to the origin

L4: Analyze

1. Consider the matrix $A = \begin{bmatrix} 2 & 0 & 0 \\ -1 & 3 & 2 \\ 1 & -1 & 0 \end{bmatrix}$ .If the characteristic polynomial of T is
   a. $C_T(\lambda) = (\lambda - 1)^p(\lambda - 1)^q$ then P =____q =_____
2. Find the minimal polynomial? what can be concluded from minimal polynomial?
3. Find a matrix S (if one exists) that diagonalizes [T]. What is the diagonal form of A of [T] produced
   i. by the matrix. **Answe**r: $S = \begin{bmatrix} a & b & a \\ b & b & -c \\ -b & a & b \end{bmatrix}$ then a =____ b =____ c =_____
4. The matrices $A = \begin{bmatrix} a & 1 \\ -2 & d \end{bmatrix}$ and $B = \frac{1}{25}\begin{bmatrix} a & 1 \\ -2 & d \end{bmatrix}$ have same Eigen values then find the values
   a. of **a** and **d**
5. 5.Consider the matrix $A = \begin{bmatrix} a & 1 & 1 \\ 1 & a & 1 \\ 1 & 1 & a \end{bmatrix}$ for what ranges of values of a the matrix is positive definite?
6. Compare Rolles theorem with LMVT and identify which is the the generalized onest
7. Test whether the pair of functions $\frac{x+y}{1-xy}$ and $tan^{-1}x + tan^{-1}y$ are functionally dependent and if so find the relation between them?

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Board of Studies (BS & H)

ES **23ESX01 Basics of Electrical and Electronics Engineering** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs				DoK
		PO1	PO2	PO3	PSO1	
23ESX01.1	Understand basic concepts of electrical circuits	3	2	-	1	L1, L2
23ESX01.2	Explain the operation of various machines and instruments	3	1	-	1	L1,L2
23ESX01.3	Understand the operation of different power plants	3	2	2	1	L1,L2
23ESX01.4	Analyze the working of electronic devices	3	-	-	1	L1 - L4
23ESX01.5	Examine the working of electronics circuits and devices	3	-	-	1	L1 - L4
23ESX01.6	Analyze various digital logic gates	3	2	2	1	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: DC & AC Circuits **9 Hours**

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, voltage and current relationship with phasor diagrams in R, L, and C circuits, concept of Impedance, active power, reactive power and apparent power, concept and measurement of power factor (Simple numerical problems). **COs: CO1**

Self- Learning Topic: Applications of electrical circuits

Unit II: Machines and Measuring Instruments **9 Hours**

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge **COs: CO2**

Self - Learning Topic: Applications of electrical machines

Unit III: Energy Resources, Electricity Bill & Safety Measures **9 Hours**

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various power generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers. **COs: CO3**

Equipment Safety Measures: Working principle of fuse and miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, safety precautions to avoid shock.

Self - Learning Topic: Importance of electrical safety measures

Unit IV: Semiconductor Devices **9 Hours**

Introduction - Evolution of electronics - Vacuum tubes to nano electronics - Characteristics of PN junction Diode – Zener Effect – Zener Diode and its characteristics. Bipolar Junction Transistor – CB, CE, CC configurations and characteristics – Elementary - Treatment of Small Signal Amplifier. **COs: CO4**

Self - Learning Topic: Applications of Zener diode

Unit V: Basic Electronic Circuits and Instrumentation **9 Hours**

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. Amplifiers: Block diagram of

Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response, Concept of voltage divider biasing. Electronic Instrumentation: Block diagram of an electronic instrumentation system. **COs:CO5**

Self - Learning Topic: Applications of rectifiers and amplifiers

Unit VI: Digital Electronics **9 Hours**

Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates - NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs). Simple combinational circuits-Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters. **COs: CO6**

Self - Learning Topics: Application of logic gates

Board of Studies		Electrical and Electronics Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Operation of Brush-less DC motor and its applications to industry	CO 2	PO1, PO2, PO3, PSO1
2	Operation of servo motor and its applications to industry	CO 2	PO1, PO2, PO3, PSO1

Text Books

1. Kulshreshtha D. C., "Basic Electrical Engineering", Revised 1st Edition, McGraw Hill, 2021
2. Rajendra Prasad, "Fundamentals of Electrical Engineering", 3rd Edition, PHI Publishers, 2020
3. Kotari D. P. and Nagrath I. J., "Basic Electrical Engineering", 3rd Edition ,Tata McGraw Hill, 2020
4. Boylestad R. L., & Louis Nashlesky, "Electronic Devices & Circuit Theory", Pearson Education, 2021

Reference Books

1. Mehta V. K. & Rohit Mehta, "Principles of Electrical Machines", 4th Edition, S. Chand Publications, 2019
2. Sedha R. S., "A Text Book of Electronic Devices and Circuits", 3rd Edition, S. Chand & Co., 2014
3. Madhu Sahu K. B., "Basic Electrical Engineering", 4th Edition, Scitech Publications (India) Pvt. Ltd., 2019
4. Paynter R. T., "Introductory Electronic Devices & Circuits - Conventional Flow Version", 2nd Edition, Pearson Education, 2009

Web References

1. https://www.classcentral.com/course/swayam-electrical-machines-iitd-14030
2. https://onlinecourses.nptel.ac.in/noc20_ee60/preview
3. https://onlinecourses.swayam2.ac.in/nou22_ec03/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	70	30
L3	-	30
L4	-	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

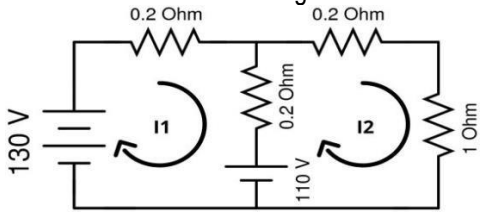
1. What is ohm's law?
2. Define RMS and peak values
3. What is form factor?
4. List any 2 types of rectifiers
5. List any 4 applications of operational amplifiers

L2: Understand

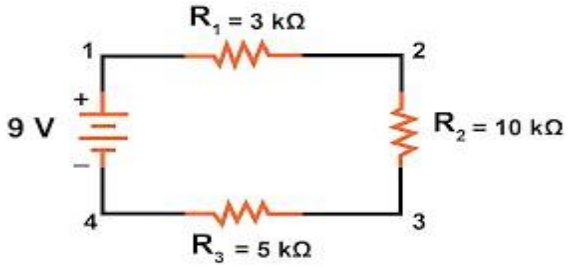
1. Explain in detail about Kirchhoff's current and voltage Law
2. Explain working principle of DC shunt generator
3. Explain the operation of single phase transformer

L3: Apply

1. Determine the current through 1 Ω resistance by using Kirchhoff's voltage law / Mesh analysis



2. By applying Kirchhoff's voltage law find current through R_3



L4: Analyze

1. Capacitors can be used for the filtering of ripples at the output of a rectifier. Suggest some other device which can work as a better filter
   a. Design the filter circuit
   b. Find the filter coefficients
   c. Analyse the form factor and ripple factor values of the rectifier by comparing them with the values of a rectifier which uses a capacitor for filtering
2. After completing the design and fabrication of an SSI-based digital system, a designer finds that one more inverter is required. However, the only spare gates in the system are a 2 input OR, a 3 input AND, and 2 input XNOR. How should the designer realize the inverter function without adding another IC?
3. For the manufacturing of a p-n junction diode we use either Germanium or Silicon semiconducting materials. Analyse the behaviour of a diode if it is made of a compound form of semiconducting materials like GaAs
   a. What change do you observe in the doping levels during the formation of p-region and n-region?
   b. What change do you observe in the V-I characteristics when compared with the characteristics of a conventional diode?

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Board of Studies (EEE)

PC **23ME101 Engineering Mechanics** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PSO1	DoK
23ME101.1	Develop free body diagrams for particles and rigid bodies in plane and space problems to solve the unknown forces, orientations and geometric parameters	3	1	2	L1 - L3
23ME101.2	Demonstrate the fundamental concepts in mechanics and determine the frictional forces for bodies in contact	3	1	2	L1 - L3
23ME101.3	Solve different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments	3	1	2	L1 - L3
23ME101.4	Identify the centroids, center of gravity and moment of inertia of different geometrical shapes	3	1	2	L1 - L3
23ME101.5	Make use of principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle	3	1	2	L1 - L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Engineering Mechanics **9 Hours**

Introduction to Engineering Mechanics - Basic Concepts and Applications

Systems of Forces: Coplanar Concurrent Forces - Components in Space- Resultant - Moment of Force and its Application - Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction. **COs: CO1**

Self - Learning Topic: Newton's law of motion and gravitation

Unit II: Equilibrium of Systems of Forces **9 Hours**

Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses.Principle of virtual work with simple examples **COs: CO2**

Self - Learning Topic: Distribution of forces in a plane

Unit III: Centroid, Centre of Gravity, Area moments of Inertia and Mass Moment of Inertia **9 Hours**

Centroid: Centroids of simple figures(from basic principles) - Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.

Area Moments of Inertia**:** Definition -Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. **COs: CO3**

Self - Learning Topic: Centroid for two dimensional bodies

Unit IV: Kinematics, Kinetics **9 Hours**

Rectilinear and Curvilinear motion of a particle**:** Kinematics and Kinetics -D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method **COs: CO4, CO5**

Self -Learning Topic: Cylindrical and spherical coordinates

Unit V: Work – Energy Method **9 Hours**

Rigid body Motion**:** Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method

COs: CO5

Self - Learning Topic: Potential energy and equilibrium

Board of Studies		Mechanical Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Importance of engineering mechanics in design and analysis of mechanical systems	CO1 - CO5	PO1, PO2
2	Real time applications of engineering mechanics	CO1 - CO5	

Text Books

1. Timoshenko S. and Young D. H.," Engineering Mechanics", 5th Edition, Mc Graw Hill Publications, 2013
2. Bavakatti S. S.," Engineering Mechanics Statics", 4th Edition, New Age International Publications, 2012
3. Tayal A. K., "Engineering Mechanics Statics and Dynamics", 6th Edition, Umesh Publications, 2006

Reference Books

1. Kurmi R. S.," Engineering Mechanics Statics",10th Edition, S. Chand Publications, 2005
2. Vijay Kumar Reddy K. and Suresh Kumar J.," Mechanics: Statics and Dynamics", 3rd Edition, B. S Publications, 2010
3. Ferdinand P. Beer, Russell Johnston Jr .E.," Vector Mechanics for Engineers Static sand Dynamics", 9th Edition, McGraw Hill Publications, 2011

Web References

1. https://www.iitg.ac.in/rkbc/me101/Presentation/L01-03.pdf
2. https://drive.google.com/file/d/12V_O8G7OrSnZMiFDjrJhF5sOEbGXstkQ/view

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	30
L3	40	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

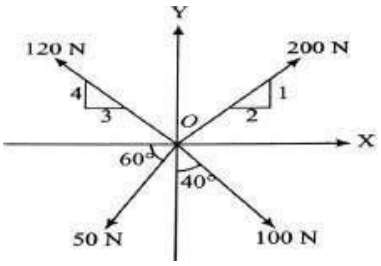
1. State the conditions for equilibrium of a rigid body in three dimensions
2. What is the principle of transmissibility?
3. State the Parallel axis theorem
4. Define centroid
5. State triangular law of forces

L2: Understand

1. Explain Pappus theorem I & II
2. Differentiate between polar moment of inertia and product of inertia
3. Write impulse momentum equation
4. What is a rolling body? Explain its importance
5. Explain work-energy method for a plane motion

L3: Apply

1. Two forces of magnitude 50 N and 30 N are acting at a point. If the angle between the two forces is 60^0 determine the magnitude and direction of the resultant force
2. A system of four forces acting on a body is shown in figure. Determine the resultant force and its direction



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HS 23HSX02 Communicative English Lab 0 0 2 1

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

Code	Course Outcomes	Mapping with POs	
		PO10	PO9
23HSX02.1	Recognize the various facets of English language ability, with a focus on LSRW abilities	3	1
23HSX02.2	Use numerous activities for language learners to practice communication skills	3	1
23HSX02.3	To improve listening and speaking comprehension, analyze the sounds, stress, rhythm, intonation, and syllable division of English speech	3	1
23HSX02.4	Assess your professionalism when taking part in group discussions and debating	3	1
23HSX02.5	Develop compelling messaging and get ready for upcoming interviews	3	1

List of Experiments

1. Vowels & Consonants **COs: CO1,CO2**
2. Neutralization/Accent Rules **COs: CO1,CO2**
3. Communication Skills & JAM **COs: CO3,CO4**
4. Role Play or Conversational Practice **COs: CO3,CO4**
5. E-mail Writing **COs: CO4,CO5**
6. Resume Writing, Cover letter, SOP **COs: CO4,CO5**
7. Group Discussions-methods & practice **COs: CO4,CO5**
8. Debates- Methods & Practice **COs: CO4,CO5**
9. PPT Presentations/ Poster Presentation **COs: CO4,CO5**
10. Interviews Skills **COs: CO4,CO5**

Reference Books

1. Meenakshi Raman, Sangeeta-Sharma, 4th Edition, Technical Communication, Oxford Press, 2022
2. Grant Taylor: English Conversation Practice, 1st Edition,Tata McGraw-Hill Education India, 2001
3. Hewing's, Martin, Cambridge Academic English (B2), Cambridge University Press, 2012
4. Balasubramanyam T., A Text Book of English Phonetics for Indian Students, 3rd Edition, Trinity, 2022

Suggested Software

- Walden Infotech
- Young India Films

Web Resources

Spoken English

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent

12. https://www.youtube.com/user/letstalkaccent/videos
13. https://www.youtube.com/c/EngLanguageClub/featured
14. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
15. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

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Board of Studies (BS & H)

BS 23BSX22 Engineering Chemistry Lab 0 0 2 1

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

Code	Course Outcomes	Mapping with POs	
		PO1	PO4
23BSX22.1	Determine the physical properties like surface tension, adsorption and viscosity	3	3
23BSX22.2	Estimate the Iron and Calcium in cement	3	3
23BSX22.3	Explain advanced polymer materials	3	3
23BSX22.4	Compare the total hardness for different water samples	3	3
23BSX22.5	Illustrate the functioning of the instruments such as pH and Potentiometric meters	3	3

List of Experiments

1.	Determination of Mn using standard oxalic acid solution (Redox titration)	**COs: CO1,CO2**
2.	Determination of temporary and permanent hardness of water using standard EDTA solution	**COs: CO1,CO3**
3.	Determination of strength of an acid in Pb-Acid battery	**COs: CO1,CO2**
4.	Preparation of a polymer (Bakelite)	**COs: CO3**
5.	Determination of percentage of Iron in cement sample by colorimetry	**COs: CO1,CO2**
6.	Preparation of nanomaterials by precipitation method	**COs: CO1,CO2**
7.	Adsorption of acetic acid by charcoal	**COs: CO1,CO2**
8.	Determination of percentage moisture content in a coal sample	**COs: CO1,CO2**
9.	Determination of the concentration of acetic acid using sodium hydroxide (pH-Metry method)	**COs: CO1,CO5**
10.	Determination of viscosity of lubricating oil by Redwood Viscometer 1	**COs: CO1**
11.	Determination of viscosity of lubricating oil by Redwood Viscometer 2	**COs: CO1**
12.	Determination of calorific value of gases by Junker's gas calorimeter	**COs: CO1**

References

1. Mendham J., Denney R. C., Barnes J. D., Thosmas M. and Siva Sankar B. Vogel's "Quantitative Chemical Analysis" 6th Edition, Pearson Publishers, 2000
2. Lab Manual for Chemistry, Department of Basic Science and Humanities, NSRIT, 2023

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Board of Studies (BS & H)

ES **23ESX04 Electrical and Electronics Engineering Workshop** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs		
		PO1	PO2	PO4
23ESX04.1	Verify Kirchhoff's laws and theorems	3	2	3
23ESX04.2	Determine various parameters of electrical measuring instruments	3	2	3
23ESX04.3	Determine the basic characteristics of electrical machines	3	2	3
23ESX04.4	Illustrate the characteristics of various electron devices	3	2	3
23ESX04.5	Examine the operation of a logical circuit	3	2	3

List of Experiments

Part-A: Basic Electrical Engineering Lab

1. Verification of KCL and KVL **COs: CO1**
2. Verification of superposition theorem **COs: CO1**
3. Measurement of resistance using Wheat Stone bridge **COs: CO2**
4. Magnetization characteristics of DC shunt generator **COs: CO3**
5. Conduct brake test on DC shunt motor **COs: CO3**
6. Speed control of DC shunt motor by field and armature control **COs: CO3**
7. Perform Swinburne's test on DC machine **COs: CO3**
8. Measurement of power and power factor using single - phase wattmeter **COs: CO2**
9. Measurement of earth resistance using Megger **COs: CO2**
10. Calculation of electrical energy for domestic premises **COs: CO2**

Part-B: Basic Electronics Engineering Lab

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias **COs: CO4**
2. Plot V-I characteristics of Zener diode and its application as voltage regulator **COs: CO4**
3. Implementation of half wave and full wave rectifiers **COs: CO4**
4. Plot input & output characteristics of BJT in CE and CB configurations **COs: CO4**
5. Frequency response of CE amplifier **COs: CO4**
6. Simulation of RC coupled amplifier with the design supplied **COs: CO5**
7. Verification of truth table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs **COs: CO5**
8. Verification of truth tables of S-R, J-K& D flip flops using respective ICs **COs: CO5**

Web References

1. https://www.vlab.co.in/broad-area-electrical-engineering

References

1. Kulshreshtha D. C., "Basic Electrical Engineering", Revised 1st Edition, McGraw Hill, 2021
2. Sedha R. S., "A Text Book of Electronic Devices and Circuits", 3rd Edition, S. Chand & Co, 2014
3. Lab Manual for "Electrical and Electronics Engineering Workshop", Department of Electrical and Electronics Engineering & Department of Electronics and Communication Engineering, NSRIT

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Board of Studies (EEE)

PC **23ME102 Engineering Mechanics Lab** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs	
		PO1	PO4
23ME102.1	Confirm law of polygon of forces and law of moment using force polygon and bell crank lever	1	3
23ME102.2	Evaluate the coefficient of friction between the inclined plane and the roller	1	3
23ME102.3	Indicate the centre of gravity and moment of inertia of different configurations.	1	3
23ME102.4	Identify the equilibrium conditions of a rigid body under the action of different force systems	1	3
23ME102.5	Solve the acceleration and momentum of pulley and compound pendulum, flywheel and rotating disc	1	3

All the COs are mapped to PO12 as few experiments are inbuilt in syllabus promoting autonomous learning

List of Experiments

1	Verification of law of parallelogram of forces	**COs: CO1**
2	Verification of law of triangle of forces	**COs: CO1**
3	Verification of the law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table	**COs: CO1**
4	Determination of coefficient of static and rolling frictions	**COs: CO2**
5	Determination of centre of gravity of different shaped plane lamina	**COs: CO3**
6	Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam	**COs: CO4**
7	Study of the systems of pulleys and draw the free body diagram of the system	**COs: CO4, CO5**
8	Determine the acceleration due to gravity using a compound pendulum	**COs: CO5**
9	Determine the moment of inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass	**COs: CO5**
10	Determine the moment of inertia of a flywheel	**COs: CO5**

Add-on Experiment

1	Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever	**COs: CO1**

References

1. Lab Manual for Engineering Mechanics, Department of Mechanical Engineering, NSRIT

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Board of Studies (ME)

SOC 23SOC01 IT Workshop

0 0 2 1

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

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23SOC01.1	Perform Hardware troubleshooting	3	2	-	-	2	2	1
23SOC01.2	Explain the world wide web and Internet	3	2	2	-	2	2	2
23SOC01.3	Develop a working knowledge of HTML, CSS	2	2	-	-	3	2	2
23SOC01.4	Demonstrate the usage of MS-Word, MS-Excel spreadsheets	3	3	3	2	3	2	2
23SOC01.5	Show the use of MS-PowerPoint for presentations and experiment with ChatGPT AI tool	3	2	2	1	3	2	2

List of Experiments

PC Hardware **COs: CO1**

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web **COs: CO2**

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

HTML and Introduction to CSS **COs: CO3**

Task 1: Coding Basics: Introduction to HTML syntax, HTML, head, title, & body tags headings, paragraphs, & lists, strong & em tags, doctype, lang attribute, meta tag & Unicode character set

Task 2: Coding Links: Absolute & Relative URLs, Anchor tags & hrefs Linking to other websites, Linking to pages within a website Opening a link in a new browser window/tab

Task 3: Adding Images: Break tag, image tag & source attribute using the width, height, & alt attributes, using horizontal rules

Task 4: Introduction to Cascading Style Sheets (CSS): Style tag, tag selectors, font-size, font-family, color, & line-height properties, hexadecimal color codes

WORD **COs: CO4**

Task 1: Creating project abstract Features to be covered: Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 2: Creating a Newsletter: Features to be covered: Table of Content, Newspaper columns, Images from files and clipart, drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel **COs: CO4**

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel - Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered: Cell Referencing, Formulae in excel - average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP **COs: CO4**

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

Power point **COs: CO5**

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting -Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting - Background, textures, Design Templates, Hidden slides.

AI Tools – ChatGPT **COs: CO5**

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model

completes them.
Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas
Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3.1: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.
Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Task 3.2: Futuristic Predictions: Have fun by asking the model to predict future technological advancements, societal changes, or even hypothetical scenarios. Compare its responses with your own ideas.
Ex: Prompt: "Predict how artificial intelligence will transform everyday life in the next 20 years."

References

1. Vikas Gupta, "Comdex Information Technology Course tool Kit", 6th Edition, Dreamtech Press, 2005
2. Cheryl A. Schmidt, "The Complete Computer Upgrade and Repair Book", 3rd Edition, Dreamtech Press, 2002
3. ITL ESL, "Introduction to Information Technology", 2nd Edition, Pearson, 2012
4. Kate J. Chase, "PC Hardware and A+ Handbook", Microsoft Press, 2004
5. Lab Manual for IT-Workshop, Department of Computer Science & Engineering, NSRIT

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CSP **23CSP01 NSS /NCC /Scouts & Guides /Community Service Project** **0 0 1 0.5**

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

Code	Course Outcomes	Mapping with POs		
		PO7	PO8	PO12
23CSP01.1	Understand the importance of discipline, character and service motto	3	1	1
23CSP01.2	Outline the needs and problems of the community	3	1	1
23CSP01.3	Solve some societal issues by applying acquired knowledge, facts, and techniques	3	2	1
23CSP01.4	Explore human relationships by analyzing social problems	2	1	1
23CSP01.5	Determine to extend their help for the fellow beings and downtrodden people	2	2	1

Unit I: Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance. **3 Hours**

Activities:

i) Conducting -ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students -future plans-activities-releasing road map etc. **COs: CO1**
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

Unit II: Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition. **3 Hours**
iv) Organising Zero-waste day. **COs: CO2**
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.

Write a summary on any book related to environmental issues

Unit III: Community Service **3 Hours**

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc. **COs: CO3**
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs, etc.

General Guidelines

1. Institutes must assign slots in the Timetable for the activities
2. Institutes are required to provide instructor to mentor the students

Assessment Pattern

1. Evaluated for a total of 100 marks
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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BS 23BSX31 Engineering Physics 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PO7	DoK
23BSX31.1	Choose the experimental evidence of wave nature of light to understand interference in thin films, diffraction and polarization	3	2	1	L1 - L3
23BSX31.2	Apply the laws of physics, classify various types of lasers & optical fibers	3	2	1	L1 - L3
23BSX31.3	Interpret the concepts and applications of magnetic and dielectric materials	3	2	1	L1 - L3
23BSX31.4	Identify and summarize the crystal structures and XRD techniques	3	2	1	L1 - L3
23BSX31.5	Interpret the microscopic behaviour of matter with quantum mechanics, summarise various types of solids based on band theory and identify the type of semiconductor using Hall effect	3	2	1	L1 - L3

All the COs are mapped to PO12 as few self-learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Wave Optics **9 Hours**

Interference: Introduction**,** Interference in thin films by reflection-Newton's rings (Theory, Experimental study), applications (wavelength of a source and refractive index of a liquid). Diffraction: Concept of diffraction difference between Fresnel's and Fraunhofer diffraction-Fraunhofer diffraction at single slit (quantitative), diffraction at double slit Diffraction grating. Raleigh's criteria, Resolving Power of grating. Polarization: Types of polarization, polarization by reflection, refraction and Double refraction-Nicol's prism construction and working Wave plates: half wave plate and quarter wave plate

COs: CO1

Self – Learning Topic: Young's double slit experiment

Unit II: Lasers and Fiber Optics **9 Hours**

Laser: Concept of laser, Characteristics of laser, Spontaneous and Stimulated emission of radiation, Einstein's Coefficients, pumping mechanisms, Ruby laser, Helium Neon Laser-Applications of Laser (Communications, R&D, Medicinal, etc.)

Fiber Optics: Introduction to Optical fiber, Principle and structure of optical fiber, classification of optical fibers (based on modes and refractive index profile). Acceptance angle, Acceptance cone Numerical Aperture-Applications of optical fiber. (Communications, Medicinal etc.)

COs: CO2

Self – Learning Topic: Concepts of 3 level and 4 level LASER systems

Unit III: Magnetic Materials and Dielectric Materials **9 Hours**

Introduction, magnetic dipole moment, Magnetic Susceptibility-Magnetic permeability-Classification of Magnetic materials-Dia, Para, Ferro, Weiss Domain theory(qualitative) Hysteresis curve, Soft and Hard magnetic materials-Applications. Dielectric Materials: Dielectric Polarization-Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic, Ionic and Orientational polarizations (qualitative), Lorentz internal field (qualitative), Claussius-Mossoti Equation-Applications of dielectrics

COs: CO3

Self – Learning Topic: Relation between D, E and P & Dielectric losses

Unit IV: Crystallography and X-Ray Diffraction **9 Hours**

Crystallography: Introduction, Space lattice, Basis, Unit cell, Bravais lattices-Crystal systems-structures and packing fractions of SC, BCC and FCC X-Ray Diffraction: Directions and planes in crystals-Miller indices-Separation between successive (h k l) planes-Bragg's law. Bragg's spectrometer, X-ray diffraction methods (powder and Laue) **COs: CO4**

Self – Learning Topic: Concept of Brillouin zones

Unit V: Quantum Mechanics and Semiconductor Physics **9 Hours**

Quantum Mechanics: Introduction De-Broglie's concept of Matter waves-Physical significance of wave function-Schrodinger Time Independent and time dependent wave equations-Particle in a one-dimensional potential box Semiconductor physics: Origin of energy band formation in solids, classification of materials into conductors, semiconductors and insulators using band diagram, Intrinsic and Extrinsic semiconductors. Hall Effect, Hall coefficient and applications of Hall Effect **COs: CO5**

Self – Learning Topic: Density of states - Fermi energy

Board of Studies		Basic Science & Humanities (Physics)	
Approved in: BoS No. II		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	LASER as a source in optical fiber communications	CO2	PO1, PO2, PO7
2	Merits and demerits of X-ray diffraction	CO4	PO1, PO2, PO7

Text Books

1. Avadhanulu M. N. & K Shirasagar P.G., "A Text Book of Engineering Physics", 1st Edition S. Chand Publications, 2011
2. Palanisamy P. K., "Engineering Physics", 4th Edition ,SciTech Publishers, 2014
3. Pillai S.O., "Applied Physics", 2nd Edition, New Age international Publishers, 2008

Reference Books

1. Charles Kittle, "Introduction to solid state physics", 5th Edition ,Willey India Pvt. Ltd., 2012
2. Arumugam M., "Applied Physics", 4th Edition , Anuradha Agencies, 2013
3. Bhattacharya D. K., "Engineering Physics", 2nd Edition , Oxford University Press, 2010
4. Sanjay D Jain and Girish G Sahasrabudhe "Engineering Physics", 1st Edition ,University Press, 2010
5. Pandey B. K. & Chaturvedi S., "Engineering Physics", 1st Edition, Cengage Learning, 2012
6. Srinivasan M. R., "Engineering Physics", 2nd Edition , New Age international Publishers, 2014

Web References

1. http://link.springer.com/physics
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com
5. https://nptel.ac.in

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	50	50
L3	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define interference
2. Define types of polarization
3. State Dielectric polarization and electric susceptibility
4. Define types of polarization in dielectrics
5. Define Spontaneous emission of radiation

L2: Understand

1. Explain the construction and working principle of Nicol's prism
2. Demonstrate working principle of He-Ne laser with energy level diagram
3. Outline de Broglie concept of matter waves
4. Discuss polarization by reflection
5. Explain the Raleigh's criteria

L3: Apply

1. Suggest a dielectric material with high dielectric constant, high operating voltage range and also which can be eco friendly for the preparation of a capacitor. Justify your answer
2. Suggest a soft magnetic material with low retentivity and coercivity, and also which can be eco friendly for the preparation of an electromagnet. Justify your answer
3. Even though based on quantum mechanical principles quantum free theory is a partly successful theory. Justify the statement

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Chairman
Board of Studies (BS & H)

BS 23BSX12 Differential Equations and Vector Calculus 3 0 0 3

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

Code	Course Outcomes	Mapping with POs PO1	PO2	PO5	DoK
23BSX12.1	Solve the first order differential equations related to various engineering fields	3	2	1	L1 - L4
23BSX12.2	Solve the second order differential equations related to various engineering fields	3	2	1	L1 - L4
23BSX12.3	Identify solution methods for partial differential equations that model physical processes	3	2	1	L1 - L4
23BSX12.4	Apply Gradient, Divergence, Curland Laplacian to scalar and vector point functions	3	2	1	L1 - L4
23BSX12.5	Interpret Gradient, Directional Derivative, Divergence, Curl and Green's, Stoke's and Gauss theorems	3	2	1	L1 - L4

All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus promoting autonomous learning

Unit I: Differential Equations of First Order and first degree **9 Hours**

Linear differential equations - Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling - Law of natural growth and decay- Electrical circuits, Orthogonal trajectories

COs: CO1

Self – Learning Topic: Orthogonal trajectories

Unit II: Linear differential equations of higher order (Constant Coefficients) **9 Hours**

Linear differential equations, linear differential equations with constant coefficients, The operator D, the inverse operator $\frac{1}{D}$, $\frac{1}{D-a}$, $\frac{1}{D+a}$ Homogeneous & Non-Homogeneous Differential equations, Complimentary Function, Particular Integral, General solution, Wronskian, Method of Variation of parameters, Applications to L-C-R circuit problems

COs: CO2

Self – Learning Topic: Simple Harmonic motion

Unit III: Partial Differential equations **9 Hours**

Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

COs: CO3

Self – Learning Topic: Classification of second order partial differential equations

Unit IV: Vector Differentiation **9 Hours**

Scalar and vector point functions, vector operator del, del applied to scalar point functions - Gradient, del applied to vector point functions-Divergence and Curl, Laplacian operator, vector identities (without proofs).

COs: CO4

Self – Learning Topic: Geometrical meaning of all operators

Unit V: Vector Integration **9 Hours**

Line integral - circulation - work done, surface integral - flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof).

COs: CO5

Self – Learning Topic: Applications of the above theorems

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Solving one-dimensional wave equation and two-dimensional equations using MATLAB	CO3	PO1, PO2, PO5
2	Applications of vector calculus in different branches of Engineering	CO4	PO1, PO2

Text Books

1. Grewal B. S., "Higher Engineering Mathematics", 44th Edition,12th Reprint, Khanna Publishers, 2022
2. Ramana B. V.,"Higher Engineering Mathematics",1st Edition, 35th Reprint, Tata McGraw Hill Education, 2019

Reference Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics",10th Edition, Wiley India, 2021
2. Bali N .P., "Engineering Mathematics",1st Edition, Lakshmi Publications, 2017
3. Peter O' Neil, "Advanced Engineering Mathematics",1st Edition, Cengage Publications, 2010
4. Iyengar T. K. V., Prasad M. V. S. S. N., Ranganatham S. and Krishna Gandhi B., "Engineering Mathematics - I", 2nd Revised Edition, S. Chand Publications, 2021
5. Iyengar T. K. V., Prasad M. V. S. S. N., Ranganatham S. and Krishna Gandhi B., "Engineering Mathematics - III", 8th Revised Edition, S. Chand Publications, 2020

Web References

1. http://nptel.ac.in/courses/
2. https://onlinecourses.nptel.ac.in
3. https://nptel.ac.in/courses/111/108/111108144/
4. https://ocw.mit.edu/courses

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define a partial differential equation
2. What is a Bernoulli's equation?
3. What is the general form of Leibnitz's equation in y?
4. What is the sufficient condition for the exactness of Mdx+Ndy=0
5. Solve the PDE $z=px+qy-2\sqrt{pq}$
6. Solve$(D^2+2DD1+1)z=0$
7. Find the unit normal vector at (1,2,2) to the surface $x^2 + y^2 + z^2 = 9$
8. Define a line integral and explain its significance in physics or engineering contexts
9. Define a homogeneous linear partial differential equation with constant coefficients

L2: Understand

1. Solve $(D^2-DD1+D1-1)z= \cos(x+2y)+e^{y-x}$
2. Find the directional derivative of the function $\emptyset = xy^2 + yz^3$ at the point (2,-1,1) in the direction of the normal to the surface x logz − y2 + 4 = 0 at (-1,2,1)
3. If $F=x^2yz$, G= xy -3z^2 Then find div(grad F x grad G)
4. Find the surface integral of $F = x\bar{i} + z^2\bar{j} + 2yz\bar{k}$ over the tetrahedron bounded by x=0, y=0, z= 0 and the plane x+ y+ z =1
5. Solve $Dx + 2\mathbf{D}'u = u$, $u(x,0) = 6\ \mathbf{e}^{-3x}$ by the method of separation of variables
6. Solve $(1+y^2)\,dx + (x-e^{\tan^{-1}x})\,dy=0$
7. Solve $(D^2+3D+2)\,y = 4\cos 2x$
8. Explain the process of forming a partial differential equation by eliminating arbitrary constants and arbitrary functions from a given expression
9. Explain how the Wronskian is used to determine linear in dependence of solutions
10. Explain the geometric interpretation of the dot product and cross product of two vectors. How are these operators used in vector calculus

L3: Apply

1. Find the area of the circle $x^2+ y^2 =a^2$ using double integral in polar coordinates
2. Find the volume of the sphere $x^2 +y^2+z^2=a^2$ using spherical coordinates
3. Find by double integration the area lying between the parabolas $y^2=4ax$ and $x^2=4ay$
4. Find the scalar potential of the vector F= $(x^2-yz)\,i + (y^2-zx)\,j + (z^2-xy)k$, if exists
5. Evaluate by Gauss divergence theorem $F=(x^3-yz)i-2x^2yj-zk$ taken over the surface of the cube formed by the planes $x=y=z=a$
6. Analyze the implications of having complex roots in the characteristic equation of a second order differential equation
7. Given the PDE $u_x + 2u_x = 0$, solve it using Lagrange's method to find the general solution

L4: Analyze

1. If $f(x, y, z) = 4x^2+7xy +3xz^2$, what is the direction in which the function f(x, y, z) increases more rapidly at the point P=(1.0.2)
2. List some physical examples of scalar and vector fields
3. From Stoke's theorem, analyze the form of Green's function for a curve lying in
   i. xy - plane ii. zx - plane
4. Asses the circulation of the field $F = y\bar{i} + (x+2y)\,\bar{j}$ around the closed path $x^2 +y^2=4$ where circulation in counter clockwise direction
5. Evaluate $\int(x + \sqrt{y})\,dS$ along a curve C, where c is given by $C = C_1 + C_2$ such that $C_1 = \{x = t.\ y = t2\}$ from (0,0) to (1,1) and $C_2 = \{x = t.\ y = t\}$ from (1,1) to (0,0)

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Chairman
Board of Studies (BS & H)

ES 23ESX02 Introduction to Programming 3 0 0 3

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

Code	Course Outcomes	Mapping with POs / PSOs					DoK
		PO1	PO2	PO3	PSO1	PSO2	
23ESX02.1	Illustrate basics of computers, problem solving approach and algorithmic thinking	3	3	2	3	2	L1, L2
23ESX02.2	Demonstrate the control structures, branching and looping statements	3	3	3	3	2	L1 - L3
23ESX02.3	Make use of arrays, pointers and string fundamentals	3	3	3	3	2	L1 - L3
23ESX02.4	Develop Modular program aspects in solving complex problems	3	3	3	3	2	L1 - L3
23ESX02.5	Identify the use of userdefined data types and files	3	3	3	3	2	L1 - L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Programming and Problem Solving **9 Hours**

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

COs : CO1

Self - Learning Topics: Compilation and Interpretation

Unit II: Basics of C Programming **9 Hours**

Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else-if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

COs: CO2

Self - Learning Topic: Escape Sequence

Unit III: Arrays, Pointers and Strings **9 Hours**

Introduction, Operations on Arrays, Two Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer. Strings: String Fundamentals, String handling functions.

COs: CO3

Self - Learning Topic: String pattern matching

Unit IV: Functions **9 Hours**

Introduction to Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Arrays as Function Arguments, Pointers as Function Arguments, Command Line Arguments, Variable Storage Classes. Recursion.

COs: CO4

Self - Learning Topic: Implementation of recursion

Unit V: User Defined Data types, File Handling **9 Hours**

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type – Enum variables, Using Typedef keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.

COs: CO5

Self - Learning Topics: Binary files and operations on binary files

Board of Studies		Computer Science and Engineering	
Approved in: BoS No. VI		October 06, 2023	
Approved in ACM: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs / PSOs**
1	Logic building using C Programming	CO1 - CO6	PO1, PO2, PO3, PO12, PSO1, PSO2
2	Real time applications of C Proramming	CO2 - CO6	PO1, PO2, PO3, PO12, PSO1, PSO2

Text Books

1. Behrouz A. Forouzan., Richard F. Gilberg, "A Structured Programming Approach Using C", 3rd Edition, Cengage, 2007
2. Dromey R. G., "How To Solve It By Computer", 1st Edition, Pearson Education, 2014
3. Byron Gottfried, "Programming with C", 3rd Edition, Tata McGraw Hill, 2017
4. Herbert Schildt, "C The Complete Reference", 4th Edition, TMH, 2017
5. Ajay Mittal, "Programming In C A-Practial Approach", 1st Edition, Pearson, 2010

Reference Books

1. Balagurusamy E., "Computing fundamentals and C Programming", 2nd Edition, McGraw-Hill Education, 2017
2. Rema Theraja, "Programming in C", 2nd Edition,OUP India, 2016
3. Prasad F. E. V, "C Programming: A Problem-Solving Approach", Giliberg, Cengage Learning, 2010
4. Yashavant Kanetkar, "Let Us C", 16th Edition, BPB, 2017

Web References

1. https://www.geeksforgeeks.org/c-programming-language
2. https://www.tutorialspoint.com/cprogramming/index.html
3. https://www.javatpoint.com/c-programming-language-tutorial

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	20
L2	30	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What do you mean by flowchart?
2. What are the components in the flowchart?
3. What are various storage classes in C?
4. What is a string?
5. Write a C program to copy one string to another
6. Write a C program to read and display the content of a file
7. What is recursive function?
8. What are the constraints for defining a recursive function with an example?
9. Why switch statement is more advantageous than nested if-else statement
10. What is meant by a variable in C programming?
11. Write a C program to count number of vowels and consonants in a string using pointers

L2: Understand

1. Explain about enumerated types with example

2. Explain counter controlled and exit controlled loops with examples
3. Write a program to compare two strings for equality without using strcmp() function
4. Demonstrate about declaration and initialization of string in C. How strings are displayed with different formats? Explain with examples
5. Illustrate a C program to find the sum of first and last digit of a number
6. Illustrate a C program to merge two files into single file
7. Explain different looping statement with syntax and example
8. Explain function prototype and explain different methods to call the function
9. Explain in detail about array of structure and pointer to structure with example
10. Discuss the usage of bitwise logical operators used in C? Compare them from logical operators with suitable program
11. Explain about call by value and call by reference with reference to functions with example
12. Explain the term dynamic memory allocation and the terms malloc(), calloc() and realloc() functions

L3: Apply

1. Write a C program to check whether the given number is palindrome or not
2. Write a C program to solve the factorial of a given number using for loop
3. Write an algorithm, flowchart and pseudo code to identify largest of given 3 numbers using conditional operator
4. Write a C program to perform the operation of multiplication of two matrices
5. Write a C program to interchange the largest and smallest elements in an array
6. Write a C program by applying pointers to count number of vowels and consonants in a string
7. Write a C program to select any arithmetic operations using switch cases
8. Write a C program to find given number is Armstrong or not
9. Write a C program to check whether the given string is palindrome or not
10. List file handling functions. Utilize file handling functions with an example
11. Design a modular banking application using C programme that can facilitate transactions such as deposit and withdrawal of funds
12. How can you design an efficient algorithm to generate a list of the first n prime numbers? Can you analyse the time complexity of your algorithm? Implement and test your program to ensure it works correctly for a range of input values
13. Write a C program that finds the second largest element in an array of integers. Explain how you handle different cases such as empty array, array with only one element, array with duplicate elements, etc.
14. Write a C program that simulates a simple calculator that can perform addition, subtraction, multiplication, and division operations on two operands. Explain how you handle user input, error checking, and precedence of operators
15. Write a C program that reads a text file and counts the number of words, lines, and characters in it. Explain how you handle different types of delimiters and end-of-file conditions

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Chairman
Board of Studies (CSE)

ES **23ESX03 Basics of Civil and Mechanical Engineering** **3 0 0 3**

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

Code	Course Outcomes	Mapping with POs		DoK
		PO1	PSO1	
23ESX03.1	Comprehend the evolution of civil engineering, scope, functions and various building elements and materials	3	2	L1, L2
23ESX03.2	Demonstrate the principles of surveying	3	2	L1, L2
23ESX03.3	Calculate the required quantity of water and the purification process involved, solid waste management along with the sewage systems	3	2	L1, L2
23ESX03.4	Outline the role of mechanical engineering in the society and study of various metals and materials	3	2	L1, L2
23ESX03.5	Demonstrate the different manufacturing process, working principles of thermal systems	3	2	L1, L2
23ESX03.6	Illustrate the working principles of various power plants, Power transmission systems and fundamentals of robotics	3	2	L1, L2

All the COs are mapped to PO12 as few self-learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction to Civil Engineering **9 Hours**

History and development of civil engineering - scope for the civil engineering - Functions of civil engineering. Characteristics of good building materials like stone, brick, tile, timber, cement aggregate and concrete. General concepts relating to Buildings: Selection of site - Basic functions of buildings - Major components of buildings. Foundations - Purpose of a foundation - Bearing capacity of soils - types of foundations and their uses.

COs: CO1

Self - Learning Topic: Representation of the building plan

Unit II: Surveying **9 Hours**

Surveying: Definition and purpose - classification - Basic principles - Measurement of length by chains and tapes - Calculation of area of a plot - Introduction to Bearings, basic problems of Bearing - Levelling instruments used for levelling, calculation of the instrument height. Types of Highways, Types of pavements, Cross-section of the pavements, Camber

COs: CO2

Self - Learning Topics: Rise & fall method, Materials used for the various pavements

Unit III: Water supply & Sanitary Engineering **9 Hours**

Sources of water supply - Quantity of water requirements - Purification of water involving sedimentation, filtration and disinfection. Definition of terms - Collection and disposal of solid wastes - Sewage systems - Septic tanks - Oxidation ponds.

COs: CO3

Self - Learning Topics: Methods of water distribution, types of filters

Unit IV: Introduction to Mechanical Engineering **9 Hours**

Role of mechanical engineering in industries and society - Technologies in different sectors such as energy, Manufacturing, Automotive, Aerospace, and Marine sectors.
Engineering Materials - Metals - Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

COs: CO4

Self - Learning Topic: Nanomaterials

Unit V: Manufacturing Processes & Thermal Engineering **9 Hours**

Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.
Thermal Engineering - Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning

COs: CO5

cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

Self - Learning Topic: Surface finishing

Unit VI: Power plants, mechanical power transmission and Robotics **9 Hours**

Power plants - Working principle of Steam, Diesel, Hydro, Nuclear power plants.
Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.
Introduction to Robotics - Joints & links, configurations, and applications of robotics. **COs: CO6**

Self - Learning Topic: Kinematics of robotics

Board of Studies		Civil Engineering & Mechanical Engineering	
Approved in: BoS No. VI		October 06, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Importance of the safe bearing capacity of soils	CO1	PO1, PO7
2	Real time applications of mechanical systems	CO4 - CO6	PO1

Text Books

1. Shanmugam G. and Palanisamy M. S., "Basic Civil and the Mechanical Engineering", 4th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2013
2. Bhavikatti S. S.," Basic Civil Engineering", 3rd Edition, New Age International Publishers, 2022
3. Ganesan V., "Internal Combustion Engines", Tata McGraw Hill Publications (India) Pvt. Ltd., 2017
4. Rattan S. S., "A Tear book of Theory of Machines", Tata McGraw Hill Publications, (India) Pvt. Ltd., 2012

Reference Books

1. Punmai B. C.," Surveying Volume-1", 16th Edition, Laxmi Publications Pvt Ltd, 2006
2. Duggal S. N., "Environmental Engineering-1", 8th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2013
3. Appuu Kuttan K. K, "Robotics" Volume-I, 1st Edition, I. K. International Publishing House Pvt. Ltd., 2013
4. Jyothish Kumar L, Pulak M Pandey, "3D printing & Additive Manufacturing Technology", 2nd Edition, Springer Publications, 2018
5. Mahesh M Rathore, "Thermal Engineering", 5th Edition, Tata McGraw Hill Publications (India) Pvt. Ltd., 2010
6. Rao P. N, "Manufacturing Technology" - Vol. 1, 4th Edition, Tata McGraw Hill publications (India) Pvt. Ltd., 2017
7. Rao P. N, "Manufacturing Technology" - Vol. 2, 4th Edition, Tata McGraw Hill publications (India) Pvt. Ltd., 2018

Web References

1. https://www.youtube.com/watch?v=f2uuyKh02n4
2. https://www.youtube.com/watch?v=jdVgwbXZef8
3. https://nptel.ac.in/courses/112/103/112103019/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	40
L2	60	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the properties of good stone?
2. What are the basic principles of surveying?
3. What are the sources of water supply?
4. What are ferrous metals?
5. List any two joining process
6. Define Robot
7. What is meant by pulverization?

L2: Understand

1. Identify the requirements in the selection of site for a construction
2. Illustrate the way to find the levels at various points of the plain area which is irregular in shape
3. Demonstrate the procedure which you want to follow in collecting and disposing the waste in your own community
4. How to calculate the area for the given plot by the use of conventional practice?
5. How to calculate the quantity of water requires for the given area?
6. Explain the role of mechanical engineer in manufacturing industry
7. Classify various engineering materials
8. Compare two stroke and four stroke IC engines
9. Explain the working principle of Hydro - electric power plant
10. Differentiate between two stroke and four stroke engines
11. Explain the working of overfeed and underfeed fuel beds
12. Explain the auxiliaries of a diesel power plant with neat sketch

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Chairmans
Board of Studies (CE & ME)

BS 23BSX32 Engineering Physics Lab 0 0 2 1

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

Code	Course Outcomes	Mapping with POs	
		PO1	PO4
23BSX32.1	Relate the principle of physics in engineering field and compare the results with theoretical calculations	3	3
23BSX32.2	Demonstrate modern engineering physics techniques and tools in real time applications in engineering studies	3	3
23BSX32.3	Develop the laboratory skills in handling of electrical and optical instruments	3	3
23BSX32.4	Demonstrate the interference and diffraction phenomena of light	3	3
23BSX32.5	Analyse the effect of sound on physical parameters	3	3

List of Experiments

1.	Determination of Radius of Curvature of Plano Convex Lens by Newton's rings	**COs: CO1-CO4**
2.	Determination of wavelength of a source using Diffraction Grating Normal incidence method	**COs: CO1-CO4**
3.	Determination of thickness of thin Object- Air wedge method	**COs: CO1-CO4**
4.	Determination of wavelength of Laser source	**COs: CO1-CO4**
5.	Verify the relation between frequency and volume- Using Volume resonator	**COs: CO1,CO5**
6.	Determination of Rigidity modulus of material (wire)- (torsional pendulum)	**COs: CO1,CO2**
7.	Verify magnetic field along the axis of a current carrying coil - Stewart and Gee's apparatus	**COs: CO1-CO3**
8.	Determination of dispersive power of prism	**COs: CO1-CO3**
9.	Determine acceleration due to gravity and radius of gyration using compound pendulum	**COs: CO1,CO2**
10.	To find the Energy Band gap of a Semiconductor using p - n junction	**COs: CO1-CO3**
11.	Study the characteristics of a Thermistor and obtain its temperature coefficient	**COs: CO1-CO3**
12.	Determination of dielectric constant using charging discharging method	**COs: CO1-CO3**
13.	Determination of resolving power of a grating	**COs: CO1-CO4**
14.	Verification of laws of stretched string by using Sonometer	**COs: CO1,CO5**
15.	Estimation of Planck's constant using photo electric effect	**COs: CO1-CO4**
16.	Study the variation of B versus H by magnetizing the magnetic material (B-H curve)	**COs: CO1-CO4**
17.	Verification of Brewster's law	**COs: CO1,CO2, CO4**
18.	Determination of frequency of electrically maintained tuning fork by Melde's experiment	**COs: CO1-CO3**

Note: In the above experiments at least 10 assessment experiments should be completed in a semester, out of which 2 experiments may be conducted in virtual mode

References

1. Balasubramanian S., Srinivasan M. N. ,"A Text Book of Practical Physics"- S. Chand Publishers, 2017
2. Lab Manual for Engineering Physics, Department of Basic Science and Humanities, NSRIT, 2023

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Board of Studies (BS & H)

ES **23ESX06 Engineering Workshop** **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs PO1
23ESX06.1	Demonstrate the workshop tools and their operational capabilities	1
23ESX06.2	Employ workshop tools for various joints and fitting.	1
23ESX06.3	Interpret the development of sheet metal using tin smithy tools	1
23ESX06.4	Illustrate the house wiring	1
23ESX06.5	Make use of moulding tools prepare a pattern	1

List of Experiments

Student shall **do two experiments** from five trades

Demonstration: Safety practices and precautions to be observed in workshop.

1	Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints. a) Half -Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint	**COs:CO1, CO2**
2	Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets. a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing	**COs:CO1, CO2**
3	Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises. a) V-fit b) Dove tail fit c) Semi-circular fit d) Bicycle tyre puncture and change of two-wheeler tyre	**COs:CO1, CO2**
4	Electrical Wiring: Familiarity with different types of basic electrical circuits and make the following connections. a) Parallel and series b) Two-way switch c) Go-down lighting d) Tube light e) Three phase motor f) Soldering of wires	**COs:CO1, CO3**
5	Foundry Trade: Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.	**COs:CO1, CO4**

Add-on Experiments

1	Welding Shop: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint	**COs: CO1**
2	Plumbing: Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters	**COs: CO1**

References

1. Lab Manual for Engineering Workshop, Department of Mechanical Engineering, NSRIT

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Board of Studies (ME)

ES **23ESX07 Engineering Graphics** **1 0 3 3**

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO10	PSO1	
23ESX07.1	Demonstrate the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.	3	3	2	L1 - L3
23ESX07.2	Construct the orthographic projections of points and lines in front and top views.	3	3	2	L1 - L3
23ESX07.3	Construct the systems of projection of planes and solids with respect to the observer, object and the reference planes	3	3	2	L1 - L3
23ESX07.4	Develop the concepts of sectional views to represent details of solids in simple positions.	3	3	2	L1 - L3
23ESX07.5	Develop the ability to draw isometric views and orthographic views and should be able to convert isometric views to orthographic views and vice versa.	3	3	2	L1 - L3

All the COs are mapped to PO12 as few self learning topics are inbuilt in syllabus promoting autonomous learning

Unit I: Introduction of Geometrical Constructions **9 Hours**

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

COs: CO1

Self - Learning Topic: Construct polygons by special methods

Unit II: Introduction of Orthographic Projections **9 Hours**

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

COs: CO2

Self - Learning Topic: Traces of lines

Unit III: Projections of Planes and Solids **9 Hours**

Projections of planes: Regular planes perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes

Projections of solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of solids with axis inclined to one reference plane and parallel to other

COs: CO3

Self - Learning Topic: Auxiliary views of planes

Unit IV: Projection and Section of solids **9 Hours**

Projections of Solids Projection of Solids with axis inclined to one reference plane and parallel to other Sections of Solids**:** Perpendicular and inclined section planes, Sections of solids in simple position only. **COs: CO4, CO5**

Self - Learning Topic: Development of surfaces

Unit V: Conversion of Views **9 Hours**

Conversion of Views: Conversion of isometric views to orthographic views and vice versa.

Computer graphics: Creating 2D & 3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination). **COs: CO5**

Self - Learning Topic: Isometric Projection

Board of Studies		Mechanical Engineering	
Approved in: BoS No. VI		October 07, 2023	
Approved in: ACM No. VIII		October 21, 2023	
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Real time applications of engineering graphics	CO4 - CO5	PO1, PO10
2	Spatial Visualization	CO4 - CO5	PSO1

Text Books

1. Bhatt N.D.," Engineering Drawing", 53rd Edition, Chariot Publications, 2018
2. Agarwal and Agarwal," Engineering Drawing", 3rd Edition, Tata McGraw Hill Publishers, 2017
3. Sham Tickoo," Auto CAD 2017", Engineers & Designers", 23rd Edition, Dream tech Press, 2016

Reference Books

1. Narayana K. L. and Kannaiah P.," Engineering Drawing", 5th Edition, Scitech Publishers, 2017
2. Varghese P.I," Engineering Graphics", Mc Graw Hill Publishers, 2013
3. Venugopal K. Prabhu Raja V.," Engineering Drawing + Auto Cad", 5th Edition, New Age Publications, 2011

Web References

1. https://nptel.ac.in/courses/112/103/112103019/

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	10
L2	40	30
L3	40	60
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

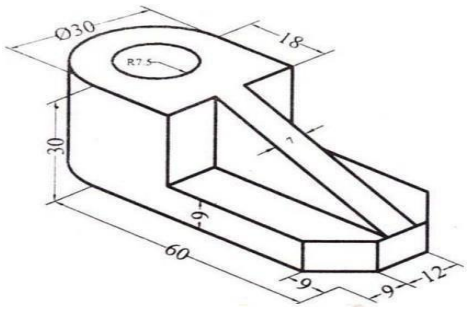
1. Divide a straight-line AB of 60 mm long into eight numbers of equal parts
2. How to draw an Octagon given the length of side 25 mm
3. Draw an equilateral triangle of 75 mm side and inscribe a circle in it
4. Show a regular pentagon in a circle of 100 mm diameter

L2: Understand

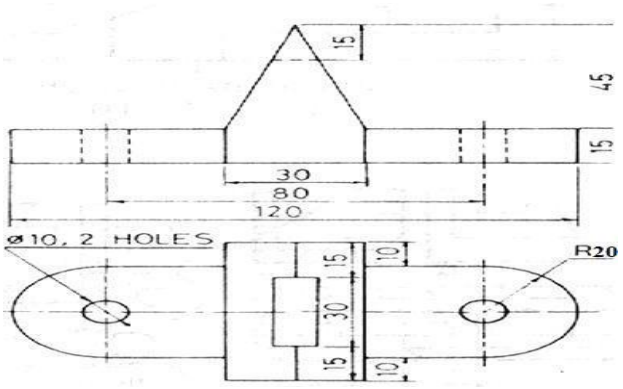
1. Cconstruct a cycloid for a generating circle of radius 30 mm. Also draw a tangent and normal at any point on the cycloid
2. A line AB is on HP and its one end A is 20 mm in front of VP. The line makes an angle of 45° with VP and its front view is 60 mm long. Draw the projections of the line and determine the true length
3. A regular hexagon of 40 mm side has a corner in the HP. Its surface inclined at 45° to the HP. And the top view of the diagonal through the corner which is in the HP. makes an angle of 60° with the VP. Demonstrate its projections
4. A pentagonal pyramid has an edge of the base in the VP and inclined at 30° to the HP, while triangular face containing that edge makes an angle of 45° with the VP. Illustrate the three views of the pyramid. Length of side of the base is 30 mm, while that of the axis is 65 mm

L3: Apply

1. A thin circular plate of 45mm diameter with its centre 35 mm above HP and 40 mm in front of VP is perpendicular to VP and inclined to HP at angle of 30°. Develop the projections of the plate
2. A square pyramid of base 40 mm and height 60 mm is on HP with one of its base edges so that the axis is making 45° with HP and the base edge making 30° with VP. Construct the projections
3. Construct a scale of 1.5 inches = 1 foot to show inches and long enough to measure up to 4 feet
4. Draw (i) Front View (ii) Top View (iii) Left Hand Side View



5. Build the Isometric view



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ES 23ESX05 Computer Programming Lab 0 0 3 1.5

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

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23ESX05.1	Demonstrate the use of basic language features	2	2	2	1	3	2	1
23ESX05.2	Apply the right control structure for solving the problem	3	3	3	3	3	3	2
23ESX05.3	Implement simple programs to solve computing problems using user defined functions	3	3	3	3	3	3	2
23ESX05.4	Develop programs using arrays and pointers	3	3	3	3	3	3	2
23ESX05.5	Experiment with user defined data types and file operations	3	3	3	3	3	3	2

List of Experiments

1. Write C programs to Familiarization with programming environment **COs: CO1**
2. Write simple C programs with printf(), scanf() Functions **COs: CO1**
3. Write C programs to Simple computational problems using arithmetic expressions **COs: CO1**
4. Write C programs to computational problems using the operator' precedence and associativity **COs: CO1**
5. Write C programs to involving if-then-else structures **COs: CO2**
6. Write C programs on while and for loops **COs: CO2**
7. Write C programs on 1D Array manipulation, linear search **COs: CO4**
8. Write C programs on Matrix ,String operations **COs: CO4**
9. Write C programs on Functions, call by value, scope and extent **COs: CO3**
10. Write C programs to implement Recursive functions **COs: CO3**
11. Write C programs on Simple functions using Call by reference, Dangling pointers **COs: CO4**
12. Write C programs on Pointers, structures and dynamic memory allocation **COs: CO4**
13. Write C programs on Bitfields, Self-Referential Structures **COs: CO4**
14. Write C programs to implement File operations **COs: CO5**
15. Domain Specific Applications

CSE allied branches & ECE:

i) Write a Program to implement employee management system **COs: CO5**

ii) Write a program to implement Election System **COs: CO4**

Civil Engineering: **COs: CO2**

i) Calculate the Eluer's load for a column with various end conditions.

ii) Calculate the Shear force and Bending Moments for a beam under the various loading condition

Mechanical Engineering:

i) Write a C program for resolution of forces **COs: CO3**

ii) Write a C program for calculation of coefficient of discharge **COs: CO2**

Electrical and Electronics Engineering: **COs: CO2**

i) Write a C Program to find the efficiency of the DC motor for different values of time T

ii) Write a C Program to derive the transfer function of a DC motor for given values

Exercise problems

1. Basic Linux environment and its editors like Vi, Vim & Emacs etc.
2. Exposure to Turbo C, gcc
3. Writing simple programs using printf(), scanf()

4. Sum and average of 3 numbers
5. Conversion of Fahrenheit to Celsius and vice versa
6. Simple interest calculation
7. Finding the square root of a given number
8. Finding compound interest
9. Area of a triangle using heron's formulae
10. Distance travelled by an object
11. Evaluate the following expressions.
    a. A+B*C+(D*E)+F*G
    b. A/B*C-B+A*D/3
    c. A+++B---A
    d. J= (i++)+(++i)
12. Find the maximum of three numbers using conditional operator
13. Take marks of 5 subjects in integers, and find the total, average in float
14. Write a C program to find the max and min of four numbers using if-else
15. Write a C program to generate electricity bill
16. Find the roots of the quadratic equation
17. Write a C program to simulate a calculator using switch case
18. Write a C program to find the given year is a leap year or not
19. Find the factorial of given number using any loop
20. Find the given number is a prime or not
21. Compute sine and cos series
22. Checking a number palindrome
23. Construct a pyramid of numbers
24. Find the min and max of a 1-D integer array
25. Perform linear search on 1D array
26. The reverse of a 1D integer array
27. Find 2's complement of the given binary number
28. Eliminate duplicate elements in an array
29. Addition of two matrices
30. Multiplication two matrices
31. Concatenate two strings without built-in functions
32. Reverse a string using built-in and without built-in string functions
33. Write a C function to calculate NCR value
34. Write a C function to find the length of a string
35. Write a C function to transpose of a matrix
36. Write a C function to demonstrate numerical integration of differential equations using Euler's method
37. Write a recursive function to generate Fibonacci series
38. Write a recursive function to find the lcm of two numbers
39. Write a recursive function to find the factorial of a number
40. Write a C program to swap two numbers using call by reference
41. Demonstrate Dangling pointer problem using a C program
42. Write a C program to copy one string into another using pointer
43. Write a C program to find no of lowercase, uppercase, digits and other characters using pointers
44. Write a C program to find the sum of a 1D array using malloc()
45. Write a C program to find the total, average of n students using structures
46. Enter n students data using calloc() and display failed students list
47. Write a C program to implement realloc()
48. Read student name and marks from the command line and display the student details along with the
    a. total
49. Create and display a singly linked list using self-referential structure
50. Demonstrate the differences between structures and unions using a C program
51. Write a C program to shift/rotate using bitfields
52. Write a C program to copy one structure variable to another structure of the same type

53. Write a C program to write and read text into a file
54. Write a C program to write and read text into a binary file using fread() and fwrite()
55. Copy the contents of one file to another file
56. Write a C program to merge two files into the third file using command-line arguments
57. Find no. of lines, words and characters in a file
58. Write a C program to print last n characters of a given file

References

1. Ajay Mittal, “Programming in C - A Practical Approach”, 1st Edition, Pearson, 2010
2. Behrouz A. Forouzan, Richard F. Gilberg, “A Structured Programming Approach Using C”, 3rd Edition, Cengage, 2007
3. Forouzan, Gilberg, Prasad, "C Programming: A Problem - Solving Approach", 1st Edition, Cengage Learning, 2011
4. Lab Manual for Computer Programming, Department of Computer Science & Engineering, NSRIT

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Wellness **23WLP01 Health And Wellness, Yoga and Sports** **0 0 1 0.5**

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

Code	Course Outcomes	Mapping with POs		
		PO2	PO7	PO12
23WLP01.1	Be physical fit to perform daily routine without undue fatigue	3	1	1
23WLP01.2	Be mentally alert and socially cohesive	3	1	1
23WLP01.3	Consider success and failure equally	3	2	1
23WLP01.4	Develop positive personality	2	1	1
23WLP01.5	Improve leadership qualities	2	2	1

Unit I: Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups. **3 Hours**

Activities

i) Organizing health awareness programmes in community
ii) Preparation of health profile **COs: CO1**
iii) Preparation of chart for balance diet for all age groups

Unit II: Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation,stress management and yoga, Mental health and yoga practice. **3 Hours**

Activities

Yoga practices - Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar **COs: CO2**

Unit III: Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games. **3 Hours**

Activities

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.Practicing general and specific warm up, aerobics **COs: CO3**
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running

General Guidelines

1. Institutes must assign slots in the timetable for the activities of Health/Sports/Yoga
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students

Assessment Pattern

1. Evaluated for a total of 100 marks
2. A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks
3. A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject

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SOC **23SOC07 Plumbing** **0 0 0 2**

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

Code	Course Outcomes
23SOC07.1	Demonstrate the principles of designing plumbing systems for different types of fluids, including gas, air, steam, sewage and water
23SOC07.2	Demonstrate competency in the use of specialized tools and equipment essential for professional pipe installation
23SOC07.3	Diagnose and troubleshoot common plumbing problems in residential, commercial and industrial settings

Min. 60 Hours

Plumbing tools, levelling instruments, valves and meters, soft soldering, rigging and hoisting, Pipe Materials & Joining Methods, Plumbing Fixture, Distribution Piping, Drain, Waste & Vent System, Water Heating / Fuel Storage Equipment, Site & Drain Design, installing water supply piping, septic systems, storm ater and sumps, reapiring water supply systems, supporting and testing pipe.

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SOC **23SOC08 Refirgeration and Air Conditioning** **0 0 0 2**

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

Code	Course Outcomes
23SOC08.1	Develop the knowledge and practical skills required to install, troubleshoot, and repair a wide range of R&AC systems, including heating, ventilation, air conditioning, furnaces, and water heaters
23SOC08.2	Demonstrate the procedures for conducting warranty services, including documenting issues, ordering replacement parts, and completing repairs within warranty coverage
23SOC08.3	Learn to assess and identify maintenance issues in refrigeration and air condition equipment, as well as recommend preventive measures to improve system longevity and performance

Min. 60 Hours

Refrigeration and Air Conditioning: Types of refrigerants, study of refirgeartion cycles, Vapour absorption system, Vapour compression refrigeration test rig, study of compressors, valves, types of air conditioning, Summer and winter air conditioning, Fitting and Welding, Thermal Insulation,Commercial RAC Plants & Car Air Conditioner, Commercial Compressor & Capacity Control, Water Softening Plants & Chiller, three fulid refrigeration

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SOC **23SOC09 Mobile Troubleshooting** **0 0 0 2**

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

Code	Course Outcomes
23SOC09.1	Demonstrate the Basic electronics concepts and Basics of mobile communications and different mobile technologies.
23SOC09.2	Gain proficiency in various components of PCB and different Sections on Motherboard and Different ICs used in MotherBoard.
23SOC09.3	Gain proficiency in Hardware and Software tools and trouble Shootings.

Min. 60 Hours

Basic Electronics - Current, Voltage, AC Current & DC Current, Resistor, Transistor, Capacitor, Diode, Inductor / Coil, Transformer, Integrated Circuit , Study of Digital Electronics, Study of Various components inside the mobile phone, Assembling and disassembling of various models of mobile phones,Study of various tools and equipment used in mobile phone repairs, Using a multi-meter, Use of DC Power Supply, Introduction and study of Printed Circuit Board (Motherboard), Details of various components on the PCB, Circuits and Different Sections on Motherboard: Power Circuit, Charging Circuit, SIM Circuit, Display Circuit, Keypad Circuit, Touch Screen Circuit, Audio Circuit, Memory card Circuit, Speaker and Microphone Circuit, Network Circuit, Bluetooth Circuit, Wi-fi Circuit, Testing of various parts and components, Study of different ICs (chips) used on the motherboard, How to recognize various ICs, Soldering & de-soldering of components by using a soldering iron, Soldering & de-soldering of components by using a rework station, Reheating and mounting of various BGA and SMD chips. Use of various secret codes. Fault finding, troubleshooting and repairing of various faults, Common repair procedure for hardware related faults, Common repair procedure for software related faults, Water damaged repair techniques, Circuit tracing, jumper techniques and solutions, Troubleshooting through schematic diagrams, Advanced troubleshooting techniques.

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SOC 23SOC10 Computer Servicing 0 0 0 2

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

Code	Course Outcomes
23SOC10.1	Demonstrate system Assembling and hardware troubleshooting
23SOC10.2	Identify automated backups of your system
23SOC10.3	Build systems to safeguard from various types of user activities
23SOC10.4	Solve and configure Networking related issues

Min. 60 Hours

Identify motherboard components and connections, understand error code for fault troubleshooting, verify components with the configuration of CMOS BIOS set up, Test and understand various beep sounds in case of trouble, Assemble and disassembling a Computer System, Upgrade RAM, HDD and other parts. Test fault finding and troubleshooting techniques, Configuration of camera, mic, WLAN and Bluetooth etc, install any popular antivirus software - View its various options, Explore Firewall options, use various disk cleanup utilities to remove junk files from hard disk, create automated backups, identify various Network devices - Switch, Router, Rack, crimping LAN cables, installing a printer and carrying self-test, Replacement of toner cartridge of laser printers.

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Board of Studies (CSE)

SOC 23SOC11 Digital Marketing 0 0 0 2

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

Code	Course Outcomes
23SOC11.1	Identify the Market and the behaviour of the customer and how the digital marketing will be useful
23SOC11.2	Search engines, methods to identify the search engines and their optimization in both on page and off page
23SOC11.3	Exercise on the Social media marketing and Email Marketing and gaining the reputation through online management
23SOC11.4	Demonstrate cognitive knowledge of the skills required in conducting online research and research on online markets

Min. 60 Hours

Introduction to Digital Marketing: Nature and Scope of Digital Marketing, Evolution of Digital Marketing, Traditional versus digital marketing, Integration of Market Place from conventional to the virtual, Social Media and Communication Mix - Benefits & Challenges - social media and Customer Engagement - ROC - New Role of Customers - The Social Business Eco system - REAN, RACE, integrating social media with Overall Market efforts - Developing Social Media Marketing plan. Social Media Business Blocks: Segmenting B2C Market - B2B Markets - managing the cyber social Campaign - Joining the Conversation - Lurking and Listening - Engagement with Audience - Staying Engaged - Engagement on the Social Web - Social Objects - Social graph - Social Applications - leveraging Search Engine Optimization (SEO) for social media - Optimizing social media for Search Engines. Digital Media Mix: Blogs, Podcasts, Vlogs - Blog - Create a Podcast - Producing the Video cast - Measuring Blogging, Podcasting, Vlogging Metrics using any social media like Facebook, Twitter, LinkedIn etc. Measuring the Results - Other Social Media Marketing Sites - Communities.

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SOC **23SOC12 Machining** **0 0 0 2**

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

Code	Course Outcomes
23SOC12.1	Demonstrate the various components and parts of a lathe machine, and to Understand the types of cutting tools, tool holders, and tool materials
23SOC12.2	Develop proficiency in performing fundamental lathe operations, such as turning, facing, drilling, boring, threading, and taper turning
23SOC12.3	Learn and adhere to safety guidelines, including the use of personal protective equipment (PPE), safe work habits, and hazard recognition in a lathe shop environment

Min. 60 Hours

Precision and Non Precision Instruments, Various Lathe Parts, Centering of Job in 4 Jaw and 3 Jaw Chuck, Lathe Operations like Straight Turning, TaperTurning, Facing Operation, Boring, Grooving, Knurling Operation, Metric and SSW Thread Cutting in Right Hand and Left Hand Direction, BSP Thread Cutting on the Pipe and Internal Thread Cutting on the Flange, Tool Grinding on Bench Grinder, Personal Safety and Safe Working Practices

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SOC 23SOC13 Electrical Wiring 0 0 0 2

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

Code	Course Outcomes
23SOC13.1	Examine various tools and know their usage
23SOC13.2	Explain different joints, soldering practice andexecute wiring circuits
23SOC13.3	Perform various methods of earthing

Min. 60 Hours

Identify size, shape, purpose, speed and use of electrical wiring tools with respect to screw drivers, polers, drilling machines, Rawl plug jumpers, Line tester, Splicers, Standard wire gauge, Identify different types of electrical wiring accessories with respect to switches, Ceiling roses, Lamp holders and adopters, Sockets, Plug, Fuses, Identify different types of main switches with respect to SP, DP mains, TP, ICDP, ICTP, SPDT, DPDT, TPDT, Change over-Knife type, Rotary, Micro, Modular switches, 2-pole and 3-pole MCBs. Prepare straight joint/Married joint, T joint, Western union joint, Pig tail joint, Femialirisation to use soldering tools and components and soldering of simple electronic circuits on PCB. Make a circuit with one lamp controlled by one switch with PVC surface conduit system, two lamps controlled by two switches with PVC surface conduit system, Make a circuit with one lamp controlled by one switch and provision of 2/3-pin socket. Make a circuit for stair case wiring, Make a circuit for godown wiring, Control two lamps by series - Parallel connection using one 1-way switch & two 2-way switches with PVC surface conduit system, Controlt wosub - circuits through energy meter, MCB's and two1-way switches, Prepare switch board with star delta starter, MCB, Pilot lamps for 3 phase motor, Control and practice the wiring for fluorescent lamp, Connect computer by main switch board with a miniature circuit breaker. Prepare pipe earthing and plate earthing.

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SOC **23SOC14 Masonry** **0 0 0 2**

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

Code	Course Outcomes
23SOC14.1	Identify the tools required for various purposes and its working in construction activity
23SOC14.2	Preparing the cement sand motor mix in appropriate proportions based on the suitability and type of work
23SOC14.3	Undergo the types of openings, floors and need for the slope and ceiling finish as per the drawings and standards

Min. 60 Hours

Introduction to the tools and their usage, materials, properties, ratios of the mix, types masonry, types of bonds in masonry, height and width of rooms based on the purpose, types of partition, materials for partition, openings, requirements of openings, height and width of openings and ventilators, types of materials used as ventilators, provision of grooves in the brick work, finishing materials, thickness of finish, motor ratio for the finishings, types of shuttering, checking of the level by the Plum bob or liquid levels. Performing the RCC works by rod cutting, bending & placing. Making of the different floors with various materials with determination and formation of slopes, performing the ceilings finishing for the slabs must be done as per the standards and with drawing specifications maintaining the accuracy.

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Board of Studies (CE)

SOC 23SOC15 Automobile Servicing and Maintenance 0 0 0 2

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

Code	Course Outcomes
23SOC15.1	Identify parts in a diesel and petrol engine of LMV/ HMV
23SOC15.2	Observe and report the reading of Tachometer, Odometer, temp. and Fuel gauge under ideal and on load condition
23SOC15.3	Engage in practical exercises to discern variances in the constituents of gasoline and diesel engines, and acquire hands-on experience in disassembling both light and heavy motor vehicle engines following established protocols

Min. 60 Hours

Description of internal & external combustion engines, Classification of IC engines, Principle & working of 2 & 4 - stroke diesel engine (Compression ignition Engine (C.I)), Principle of Spark Ignition Engine(SI), differentiate between 2-stroke and 4 stroke, C.I engine and S.I Engine, Direct injection and Indirect injection, Technical terms used in engine, Engine specification. Study of various gauges/instrument on a dash board of a vehicle- Speedometer, Tachometer, Odometer and Fuel gauge, and Indicators such a gearshift position, Seat belt warning light, Parking-brake-engagement warning light and an Engine- malfunction light.

Different type of starting and stopping method of Diesel Engine Procedure for dismantling of diesel engine from a vehicle.

Petrol Engine Basics: 4-stroke spark-ignition engines- Basic 4-stroke principles. Spark-ignition engine components - Basic engine components, Engine cams & camshaft, Engine power transfer, Scavenging, Counter weights, Piston components. Intake & exhaust systems - Electronic fuel injection systems, Exhaust systems. Intake system components, Air cleaners, Carburettor air cleaners, EFI air cleaners, Intake manifolds, Intake air heating.

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Board of Studies (ME)

BS 23BSX13 Numerical and Statistical Methods 3 0 0 3

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

Code	Course Outcomes		DoK	
		PO1	PO2	
23BSX13.1	Apply numerical methods to solve algebraic and transcendental equations	3	2	L1 – L4
23BSX13.2	Derive interpolating polynomials using interpolation formulae	3	2	L1 – L4
23BSX13.3	Solve differential and integral equations numerically	3	2	L1 – L4
23BSX13.4	Identify real life problems into Mathematical Models.	3	2	L1 – L4
23BSX13.5	Apply the probability theory and testing of hypothesis in the field of civil engineering Applications.	3	3	L1 – L4
All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning				

Unit I:	**Solution of Algebraic & Transcendental Equations**	**9 Hours**
Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton-Raphson method System of Algebraic equations: Gauss Elimination Gauss Siedal method. *Self Learning Topic: Jacobi's method*		**COs: CO1**
Unit II:	**Interpolation**	**9 Hours**
Finite differences-Newton's forward and backward interpolation formulae, Lagrange's formulae, Newton's Divided Difference interpolation formulae, Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares *Self Learning Topic: Fitting a power curve by* method of least squares		**COs: CO2**
Unit III:	**Solution of Initial value problems to Ordinary differential equations**	**9 Hours**
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and -Runge-Kutta methods (second and fourth order). *Self Learning Topic: M*odified Euler's methods		**COs: CO3**
Unit IV:	**Estimation and Testing of hypothesis, large sample tests**	**9 Hours**
Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems *Self Learning Topic: Test for single proportion, difference of proportions*		**COs: CO4**
Unit V:	**Small sample tests**	**9 Hours**
Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes. *Self Learning Topic:* Test for observed Correlation and Regression Coefficients		**COs: CO5**

Textbooks:

1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition

3. Miller and Freunds, Probability and Statistics for Engineers,7/e, Pearson, 2008.India.

ReferenceBooks:

1. ErwinKreyszig, AdvancedEngineeringMathematics, JohnWiley&Sons, 2018, 10th Edition.
2. R.K.JainandS.R.K.Iyengar,AdvancedEngineeringMathematics,AlphaScienceInternationalLtd.,2021 5th Edition(9th reprint).
3. Ronald E. Walpole, Probability and Statistics for Engineers and Scientists, 9th edition, december 2010, PNIE
4. H. K Das, Er. Rajnish Verma,Higher Engineering Mathematics, S. Chand Publications,2014, Third Edition (Reprint 2021)

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3. http://nptel.ac.in/courses/111105090

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Introduction to MATLAB	CO1-CO5	PO2, PO5
2	Solving ODEs using MATLAB	CO3	PO3

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Prove that (1+Δ)(1-∇)=1
2. Identify the root lies between the values x^3-5x+1=0
3. Define Population and Sample
4. Define the types of errors in test of hypothesis
5. Write the normal equations in fitting a parabola by using the principle of least squares

L2: Understand

1. Find the root of the equation $\cos x = xe^x$ using the Falsi-method correct to four decimal places.

2.Using Lagranges interpolation formula, find the polynomial of the given data:

x	-1	0	3	6
f(x)	3	-6	39	822

3. Using Newton's forward interpolation formula, find the value of f(1.6), if

x	1	1.4	1.8	2.2
y	3.49	4.82	5.96	6.5

4. .A Population consists of five members 2,3,6,8 and 11.Consider all possible samples of size two each can be drawn with replacement from the population find

(a) Population mean
(b) Standard deviation of the population
(c) The mean of the sampling distribution of means

The Standard deviation of the sampling distribution of means

5.Explain the Procedure of hypothesis testing ?

L3: Apply

1. The area A of a circle of diameter d is given for the following values. Calculate the area of a circle of diameter 105.

d	80	85	90	95	100
A	5026	5674	6362	7088	7854

2.Using the method of separation of symbols, prove that

$u_0 + u_1 + u_2 + u_3 + \ldots\ldots + u_n = (n+1)C_1 u_0 + (n+1)C_2 \Delta u_0 + (n+1)C_3 \Delta^2 u_0 + \ldots\ldots\ldots (n+1)C_{n+1} \Delta^n u_0$

3 . 7 coins are tossed and no.of heads are noted .The experiment is repeated 128 times and follow the distribution is obtained

No.of heads	0	1	2	3	4	5	6	7
Observed frequencies	7	6	19	35	30	23	7	1

Fit a binomial distribution from the above data and check the goodness of fit if coin is unbaised

4.The 9 items of a sample have the following values 45,47,50,52,48,47,49,53,51.Does the mean of these values differ significantly from the assumed mean 47.5?use a 0.05 level of significance.

5. The following table gives the number of breakdowns in a factory in various days of a week

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
No.of breakdowns	14	22	16	18	12	19	11

Check whether the breakdowns are uniformly distributed or not

L4: Analyze:

1) Twelve cars were equipped with radial tires and driven over a test course. Then the same 12 cars (with the same drivers) were equipped with regular belted tires and driven over the same course. After each run, the cars' gas economy (in km/l) was measured. Is there evidence that radial tires produce better fuel economy? (Assume normality of data, and use = .05.)

Car Gas eco.	1	2	3	4	5	6	7	8	9	10	11	12
Y1 (radial)	4.2	4.7	6.6	7.0	6.7	4.5	5.7	6.0	7.4	4.9	6.1	5.2
Y2 (belted)	4.1	4.9	6.2	6.9	6.8	4.4	5.7	5.8	6.9	4.7	6.0	4.9

2) A gambler plays a game that involves throwing 3 dice in a succession of trials. His winnings are directly proportional to the number of sixes recorded. If the dice are fair,what is the probability distribution that governs the outcome of each throw?

The frequencies of the sixes observed in100 trials are recorded, together with their expected values, in the following table:

Number of sixes	Expected Count	Observed Count
0	58	47
1	34.5	35
2	7	15
3	0.5	3

You are asked to assess whether it is likely that the dice have been unfairly weighted, using a chi-square test of goodness of fit.

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HS **23HSX03 Universal Human Values: Understanding Harmony & Ethical Human Conduct 3 0 0 3**

Pre-requisite: -

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

Code	Course Outcomes	Mapping with POs			DoK
		PO8	PO9	PO10	
23HSX03.1	Develop holistic vision of life	3	2	1	L1, L2, L3
23HSX03.2	Improve socially responsible behaviour	3	2	1	L1, L2, L3
23HSX03.3	Familiarize environmentally responsible work	3	2	1	L1, L2, L3
23HSX03.4	Develop ethical human conduct	3	2	1	L1, L2, L3
23HSX03.5	Identify Competence and Capabilities for Maintaining Health and Hygiene	3	2	1	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning					

Unit I	**Introduction to Value Education**	**9 hours**
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 Fulfil the Basic Human Aspirations Practice Session: Sharing about Oneself, Exploring Human Consciousness, Exploring Natural Acceptance		**COs: CO1**
Unit II	**Harmony in the Human Being**	**9 hours**
Understanding Human being as the Coexistence 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 Practice Session: Exploring the difference of Needs of Self and Body, Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body		**COs: CO2**
Unit III	**Harmony in the Family and Society**	**9 hours**
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order Practice Session: Exploring the Feeling of Trust, Exploring the Feeling of Respect, Exploring Systems to fulfill Human Goal		**COs: CO3**
Unit IV:	**Harmony in the Nature/Existence**	**9 hours**
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence Practice Session: Exploring the Four Orders of Nature, Exploring Co-existence in Existence		**COs: CO4**
Unit V	**Implications of the Holistic Understanding – a Look at Professional Ethics**	**9 hours**
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 Practice Session: Exploring Ethical Human Conduct, Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order		**COs: CO5**

Board of Studies		BASIC HUMANITIES AND SCIENCES	
Approved in: BoS No. VII			
Approved in: ACM No. IX			
Expert talk		COs	POs
1	Seminar with Socialists	CO1	PO8

Text Books

1. The Textbook: 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
2. The Teacher's Manual Teachers'**:** Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book)
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
6. Small is Beautiful - E. F Schumacher

Internal Assessment Pattern

Cognitive Level	InternalAssessment#1(%)	InternalAssessment#2(%)
L1	20	20
L2	50	50
L3	30	30
Total(%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Value education?
2. Write any two naturally accepted situations as your real-life experiences.
3. What is the basic unit of human interaction?
4. What is self-regulation?

L2: Understand

1. Briefly explain the self-exploration as the process for value education.
2. Explain the basic unit of interaction.
3. Explain 'respect' as the right evaluation.

L3: Apply

1. Discuss the role of a family dynamics play in shaping an individual's understanding of values and holistic well-being.
2. In what aways can holistic understandings of societal issues influence the values we prioritize as individuals and communities?
3. Discuss how can educational institutions integrate value-based teachings to cultivate a holistic understanding of societal harmony within students?

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ES **23ME303 Thermodynamics** **3 0 0 3**

Pre-requisite: Engineering Chemistry, Mathematics

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO2	PSO1	
23ME304.1	Relate the fundamental concepts of thermodynamics and processes of thermodynamics	3	1	1	L1, L2
23ME304.2	Demonstrate the principle of first law of thermodynamics and energy transfer.	3	1	1	L1, L2
23ME304.3	Specification of second law of thermodynamics and functions, usage and the relations.	3	1	1	L1, L2
23ME304.4	Illustrate pure substance and diagrams of related properties and phase transformations	3	1	1	L1, L2
23ME304.5	Evaluate the COP of refrigerating systems, Air-Conditioning with respect to its properties, processes of psychrometry and sensible and latent heat loads.	3	1	1	L1, L2
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning					

Unit I:	**Basic Concepts**	**12 hours**
Introduction: Basic Concepts: System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of		**COs: CO1**
Unit II:	**First law of Thermodynamics**	**12 hours**
Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroeth Law of Thermodynamics – PMM-I, Joule's Experiment – First law of Thermodynamics and applications. Limitations of the First Law – Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.		**COs: CO2**
Unit III:	**Thermodynamic Laws**	**12 hours**
Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence/ Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.		**COs: CO3**
Unit IV:	**Pure Substances**	**12 hours**
Pure Substances, P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimetry.		**COs: CO4**
Unit V:	**Refrigeration and Air-Conditioning**	**12 hours**
Introduction to Refrigeration: working of Air, Vapour compression, VCR system Components, COP Refrigerants. Introduction to Air Conditioning: Psychrometric properties & processes – characterization of sensible and latent heat loads – load concepts of SHF. Requirements of human comfort and concept of effective temperature- comfort chart – comfort air conditioning, and load calculations.		**COs: CO5**

Board of Studies			
Approved in: BoS No. VII			
Approved in: ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Text Books

1. P.K. Nag -Engineering Thermodynamics, McGraw Hill 6thEdition 2013
2. Sonntag, Borgnakke, Van Wylen, Fundamentals of Thermodynamics–6thEdition, Wiley-2015
3. Yunus A Cenegel, Michael A Boles, Thermodynamics, an Engineering Approach, Edition- 2014
4. Dr. J. P. Holman Thermodynamics, McGrawHill-6thEdition, McGraw Hill- 2013

Reference Books

1. PrasannaKumar, Thermodynamics, Pearson Publishers McGraw Hill - 6thEdition, - 2011
2. Jones & Dugan, Engineering Thermodynamics–PHI- McGraw Hill- 6thEdition, 2012.
3. Dr. Y. V. C. Rao-An Introduction to Thermodynamics– Universities presses publications- 2012.
4. W. Z. Black & J. G. Hartley, Thermodynamics, Pearson Publications 3rd Edition - 2010.

Web References

1. https://nptel.ac.in/courses/112/105/112105123/
2. https://nptel.ac.in/courses/112/105/112105266/
3. https://nptel.ac.in/courses/101/104/101104063/

Internal Assessment Pattern

CognitiveLevel	InternalAssessment#1(%)	InternalAssessment#2(%)
L1	40	30
L2	40	30
L3	20	40
Total(%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the types of thermodynamic systems?
2. Define quasi-static process.
3. What is second law of thermodynamics?
4. List the entropy categories with respect to thermodynamic relations.
5. Write the enthalpy functions of thermodynamic properties.
6. What are availability and irreversibility?
7. Define Carnot's theorem.
8. Describe the triple point and critical point.
9. What is ideal gas?
10. Define dry bulb temperature and wet bulb temperature.

L2: Understand

1. Describe the concept of thermometry and its reference points
2. What are the differences between point function and path function?
3. Describe the corollaries of first law of thermodynamics
4. Demonstrate Kelvin Planck and Clausius statement with example
5. What do mean by the terms relative humidity and specific humidity?

L3: Apply

1. A pump discharges a liquid into a drum of rate of the 0.032 m^3/sec. The drum constitute the diameter of 1.5m and 4.2 in length, which can hold 3000kg of the liquid. Find the density of the liquid at the mass flow rate of the liquid handled by the pump.

2. Illustrate First law applied to a flow system.
3. An engine cylinder has a piston of area 0. 12sq.m and contains gas at a pressure of 1.5Mpa, the gas expands according to the process Which represented by a straight line on a pressure volume. The final pressure is 0.15MPa. Calculate the work done on a gas by the piston.
4. Design P-V-T surfaces and T-S, h-s diagrams.
5. Find the enthalpy and entropy of a steam, When the pressure is 2 MPa and specific volume is 0.09 m^3/kg

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PC **23ME304 Mechanics of Solids** **3 0 0 3**

Pre-requisite: Engineering Mechanics, Differential Equations and vector calculus

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO2	PSO1	
23ME304.1	Analyse material behaviour under various loading conditions, evaluate stress-strain responses, and assess the effects on resilience and strain energy	3	2	2	L1, L2, L3
23ME304.2	Draw the shear force and bending moment diagrams for beams of various supports and loads and utilize various methods to ascertain forces in pin plane frames.	3	2	2	L1, L2, L3
23ME304.3	Illustrate bending and shear stresses in different types of beam sections	3	2	2	L1, L2, L3
23ME304.4	Interpret the behaviour of beams under bending and torsional loading conditions	3	2	2	L1, L2, L3
23ME304.5	Comprehend stress and strain in thin and thick cylinders, analyse column buckling, and evaluate limitations of relevant formulas	3	2	2	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning					

Unit I:	**Simple Stresses & Strains**	**12 hours**
Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress–strain diagram for ductile and brittle material–Working stress–Factor of safety–Lateral strain, Poisson's ratio & volumetric strain. Elastic Module & the relationship between them–Bars of varying section–composite bars– Temperature stresses. Stresses on an inclined plane under different axial and biaxial stress conditions, Principal planes and principal stresses Strain energy – Resilience–Gradual, sudden, impact and shock loadings *Mohr's Circle*		**COs: CO1**
Unit II:	**Shear Force and bending Moment, Analysis of Pin Jointed Plane Frames**	**12 hours**
Definition of beam –Types of beams–Concept of shear force and bending moment–SF and BM diagrams for cantilever, simply supported and overhanging beams subjected to point loads, UDL, UVL and combination of these loads–Point of contra flexure **Analysis of Pin**- Jointed Plane Frames: Determination of forces in the members of various types of cantilevers & simply supported trusses using Method of Joints *Relation between SF and BM and rate of loading at section of a beam, determination of forces in members using method of sections*		**COs: CO2**
Unit III:	**Bending and Shear Stresses**	**12 hours**
A: Bending Stresses: Theory of simple bending– Assumptions– Neutral axis – Derivation of bending equation:]Determination bending stresses– section modulus of rectangular and circular sections (Solid and Hollow), I, T sections–Design of simple beam sections. **B: Shear Stresses:** Derivation of formula – Shear stress distribution across various beam sections – rectangular, circular, triangular, I, T sections. *Bending and shear stress in angle and channel section*		**COs: CO3**
Unit IV:	**Deflection of Beams and Torsion**	**12 hours**
Deflection of Beams: Bending into a circular arc–slope, deflection and radius of curvature – Differential equation for the elastic line of a beam–Macaulay's methods– Determination of slope and deflection for cantilever and simply supported beams subjected to point loads- UDL – uniformly varying load. **Torsion:** Theory of pure torsion – Assumptions – Derivation of torsion equation, polar section modulus – power transmitted by shafts – combined bending and torsion *Double integration method, Shafts in series and parallel*		**COs: CO4**
Unit V:	**Thick, Thin Cylinders and Columns**	**12 hours**
Thin Cylinders: Thin seamless cylindrical shells–Derivation of formula for longitudinal and circumferential stresses– hoop, longitudinal and volumetric strains. **Thick Cylinders**: lame's equation – cylinders subjected to inside & outside pressures –compound cylinders. **Columns:** Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions,		**COs: CO5**

Limitations of Euler's Formula *Changes in diameter and volume of thin cylinders, Limitations of Rankine's Formula*	

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Gere and Timoshenko, Mechanics of Materials- CBS Publishers- 12th Edition- 2014
2. GH Ryder, Strength of materials, Mc Millan publishers India Ltd- 10th Edition-2011
3. Popov, Prentice Hall- Solid Mechanics, Engle wood cliffs,New Jersey- 13th Edition-2017.

Reference Books

1. Ramamrutham.S, Strength of Materials, Dhanpat Rai Publications- 11th Edition-2017
2. Bhavikatti.S.S.- Mechanics of solids –New Age International Publications- 15th Edition-2018
3. Jindal, Strength of Materials, Umesh Publications- 9th Edition- 2010
4. Andrew Pytel and Ferdinond L. Singer Longman- Strength of Materials LSA Publication- 2013
5. Bansal. R.K.- Strength of Materials, Laxmi Publications- 15th Edition- 2015

Web References

1. https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204
2. https://www.coursera.org/learn/mechanics-1
3. https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior
4. https://drive.google.com/file/d/0BylKfvgX-GD6c2FFRF9GLTNNVTA/view
5. https://drive.google.com/file/d/1R-kxYKtjVB7g-Kiq60n1KrL-RpRDJUDB/edit
6. nptel.ac.in/courses/112107147
7. www.springer.com › Home › Materials › Characterization & Evaluation of Materials
8. discovermagazine.com/tags/strength of materials

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	40	35
L3	45	50
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Define elasticity and plasticity
2. State the Hooke's Law?
3. Write the types of loads?
4. What are the General sign conventions for shear force and bending moment in general?
5. State the assumptions made in the theory of simple bending.

L2: Understand

1. What do you mean by “a bar of uniform strength”?
2. Distinguish the Impact and Shock loading?
3. Write a note on impact loads?
4. Express Poisson’s ratio in terms of shear and Bulk module.
5. What is statically determinate beam? Give some examples

L3: Apply

1. Two vertical rods one of steel and other of copper are each rigidly fixed at the top and 50 cm apart. Diameters and lengths of each rod are 2 cm and 4m respectively. A cross bar fixed to the rods at the lower end carries a load of 5000 N such that the cross bar remains horizontal even after loading. Find the stresses in each rod and the position of the load on the bar. Take E for steel = $2x10^5$ N/mm^2 and E for copper = $1x10^5$N/mm^2.
2. A beam of length 6m is simply supported at its ends. It is loaded with a gradually varying load of 750 N/m from left end to 1500 N/m to the right end. Construct the SF and BM diagrams and find the magnitude and position of the maximum BM.
3. A beam of symmetrical section 30cm deep and I= 12000cm^4, carries U.D.L. of 16kN/m. Calculate the maximum span of the beam if the maximum bending stress is not to exceed160N/mm^2. With this span, calculate the maximum central load if the bending stress is not to exceed the limit given above.
4. A beam of uniform section, 10 meters long, is simply supported at the ends. It carries point loads of 110 KN and 60 KN at distances of 2m and 5m respectively from the left end. Calculate: The deflection under each load and maximum deflection. Given: E = $200x10^6$N/m^{2}and I = $118x10^{-4}$m^4.
5. A closed cylindrical vessel made of steel plates 4 mm thick with plane ends, carries fluid under a pressure of 3N/mm^2. The diameter of the cylinder is 25 cm and length is 75 cm, calculate the longitudinal and hoop stress in the cylinder wall and determine the change in the in diameter, length and volume of the cylinder. Take E= 2.1x105 N/mm^2 and Poisson’s ratios is 0.286.

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Chairman
Board of Studies (ME)

PC **23ME305 Material Science and Metallurgy** **3 0 0 3**

Pre-requisite:

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO2	PO5	
20ME305.1	Classify metals and alloys based on behaviour of bonds and properties.	3	2	2	L1, L2
20ME305.2	Illustrate the regions of stability of the phases occur in an alloy system.	3	2	2	L1, L2
20ME305.3	Compare cast irons and steels with respect to their properties and practical applications.	3	2	2	L1, L2
20ME305.4	Summarize the affect of various alloying elements on iron-iron carbide system, various heat treatment and strengthening processes.	3	2	2	L1, L2
20ME305.5	Make use of non-ferrous metals and alloys for practical applications.	3	2	2	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning					

Unit I:	**Structure of Metals and Constitution of Alloys**	**12 hours**
Bonds in Solids, Metallic bond, crystallization of metals, Packing Factor - SC, BCC, FCC& HCP-line density, plane density. Grain and grain boundaries, effect of grain boundaries on the Properties of metal / alloys – determination of grain size. Imperfections point, line, surface and volume- Slip and Twinning. Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds **Equilibrium Diagrams**: Experimental methods of construction of equilibrium diagrams, Isomorphism alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peristaltic reaction. Transformations in the solid state, allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe3		**COs: CO1**
Unit II:	**Ferrous Metals and Alloys**	**12 hours**
Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheroid graphite cast iron, Alloy cast irons. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels. Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys		**COs: CO2**
Unit III:	**Heat Treatment of Alloys**	**12 hours**
Effect of alloying elements on Fe-Fe3C system, Annealing, normalizing, hardening, TTT diagrams, tempering, harden ability, surface - hardening methods, Age hardening treatment, Cryogenic treatment of alloys.		**COs: CO3**
Unit IV:	**Powder Metallurgy**	**12 hours**
Basic processes- Methods of producing metal powders- milling atomization Granulation-Reduction. Electrolytic Deposition. Compacting methods. Sintering methods of manufacturing sintered parts. Sintering Secondary operations. Sizing, coining, machining -Factors determining the use of powder metallurgy. Application of this process		**COs: CO4**
Unit V:	**Ceramic and Composite Materials**	**12 hours**
Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, various methods of component manufacture of composites, particle reinforced materials, and fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C – C composites. Nano materials, definition, properties and applications.		**COs: CO5**

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Sidney H. Avener – Introduction to Physical Metallurgy - McGrawHill- 6th Edition- 2015
2. Donald R.Askeland -Essential of Materials science and engineering – Cengage- 7th Edition- 2015
3. Dr. V.D.kodgire- Material Science and Metallurgy, Everest Publishing House- 4th Edition- 2015
4. Callister & Baalasubrahmanyam, Materials Science and engineering- Wiley Publications- 11th Edition- 2015

Reference Books

1. Fischer – Material Science for Engineering students –Elsevier Publishers- 11th Edition-2010
2. Rahghavan.V-Material science and Engineering - PHI Publishers- 5th Edition- 2009
3. Yip-Wah Chung- Introduction to Material Science and Engineering –CRC Press- 8th Edition- 2012
4. Suryanarayana. A V K- Material Science and Metallurgy– B S Publications- 13th Edition- 2013
5. Jindal. U.C-Material Science and Metallurgy– Pearson Publications- 15th Edition-2016

Web References

1 www.edinformatics.com/math_science/how_is_heat_transferred.htm
2 https://www.quora.com/Why-are-dimensionless-numbers-used-in-heat-transfer-and-fl
3 http://nptel.ac.in/courses/103103032/16
4 web.mit.edu/16.unified/www/FALL/thermodynamics/notes/node128.html
5 web.pdx.edu/~yongkang/main/class/Internal%20Flow.pdf

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	30	30
L2	30	30
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1) Define elasticity and plasticity
2) Define Space Lattice.
3) What is the significance of liquids, solidus and solves lines in phase diagram?
4) Compare nodular cast iron and malleable cast iron.
5) When will you prefer annealing?
6) What are the properties of Titanium alloys?
7) List abrasive materials.

L2: Understand

1. Explain point defect, Line defect and plane defect. b) Mention the types of solid solutions with examples.
2. Draw iron-carbon equilibrium diagram and mark on it all salient temperatures, composition and phases involved.
3. a) Classify different types of cast iron. Why silicon is added to cast iron? Explain the effects of any four alloying elements on the properties of cast iron.
4. Explain the structure and properties of plain carbon steels.
5. a) Discuss different types of annealing processes. b) Define harden ability of a material and list the factors affecting harden ability.

6. a) What are the types of copper alloy, their composition, properties and applications? b) Enlist the properties of pure Aluminum and mention the composition, specific properties and applications of any one aluminum alloy.
7. a) What are Nano materials? What are their advantages? b) What is a Composite material? How it is classified? Explain briefly.

L3: Apply

1) Write equations for the following invariant reactions: eutectic, peristaltic, monotectic, eutectoid and peritectoid. How many degrees of freedom do exist at invariant reaction points in binary phase diagram
2) Explain different types of transformations in solid state? Illustrate with an example
3) Compare annealing and normalizing. When do you use them
4) Find the degrees of freedom in a binary system (C=2) at single phase, double phase, and triple phase region at atmospheric pressure conditions using phase rule
4) Explain thermal analysis method of construction of phase diagram
5) Explain the manufacture of fibre reinforced composites

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Chairman
Board of Studies (ME)

PC 23ME306 MECHANICS OF SOLIDS & MATERIAL SCIENCE LAB **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs			
		PO1	PO2	PO3	PO4
20ME306.1	Knowing about the mechanical tests.	1	2	1	1
20ME306.2	Find out the different materials properties.	1	2	1	1
20ME306.3	Perform the impact & compression tests	1	2	2	1
20ME306.4	Able to identify the different materials micro structures	1	2	1	1
20ME306.5	Study the heat treatment process	1	2	1	1
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos					
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create, DoK: Depth of Knowledge					

Note: Any 6 experiments from each section A and B

List of Experiments

(A) MECHNICS OF SOLIDS LAB:

1. Direct tension test
2. Bending test on a) Simple supported b) Cantilever beam
3. Torsion test
4. Hardness test a) Brinell's hardness test b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test a) Charpy test b) Izod test
8. Punch shear test

(B) MATERIAL SCIENCE LAB:

1. Preparation and study of the Microstructure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, High carbon steels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat-treated steels.
6. Hardenability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

References

1. Lab manual for Mechanics of Solids & Metallurgy lab, department of mechanical engineering, NSRIT

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Chairman
Board of Studies (ME)

PC 23ME307 COMPUTER-AIDED MACHINE DRAWING **0 0 3 1.5**

Pre-requisite: Engineering Graphics

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO4	PO10, PSO1	
23ME204.1	Demonstrate the conventional representations of materials and machine components.	1	1	3	L2, L3
23ME204.2	Model riveted, welded and key joints using CAD system.	1	1	3	L2, L3
23ME204.3	Create solid models and sectional views of machine components.	1	1	3	L2, L3
23ME204.4	Generate solid models of machine parts and assemble them.	1	1	3	L2, L3
23ME204.5	Translate 3D assemblies into 2D drawings.	1	1	3	L2, L3

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

PART- A	**I. Drawing of Machine Elements and simple parts**	**6+3+3 hours**
The following are to be done by any 2D software package **Conventional representation of materials and components:** **Detachable joints:** Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts. **Riveted joints:** Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints. **Welded joints:** Lap joint and T joint with fillet, butt joint with conventions. **Keys:** Taper key, sunk taper key, round key, saddle key, feather key, woodruff key. **Couplings:** rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's' coupling.		**COs: CO1,CO2,CO3**
PART- B	**II. Assembly Drawings:**	**6+3+3 hours**
The following exercises are to be done by any 3D software package: **Sectional views:** Creating solid models of complex machine parts and sectional views. **Assembly drawings:(Any four of the following using solid model software)** Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling. **Production drawing:** Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.		**COs: CO4,O5**

Textbooks

1. Machine drawing by N.Sideshwar, P. Kannaiah, V.V.S.Sastry, TMH Publishers. 2014.
2. Machine Drawing byK.L.Narayana, P.Kannaiah and K.Venkat Reddy, New Age International Publishers, 3/e, 2014
3. Production Drawing- K.L.Narayana, P.Kannaiah&K. Venkata Reddy / New Age/Publishers

Reference Books

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

Web References

- https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf
- https://archive.nptel.ac.in/courses/112/105/112105294/
- https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cad-fundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete
- https://www.youtube.com/watch?v=0bQkS3_3Fq4

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	-	-
L2	50	50
L3	50	50
Total (%)	100	100

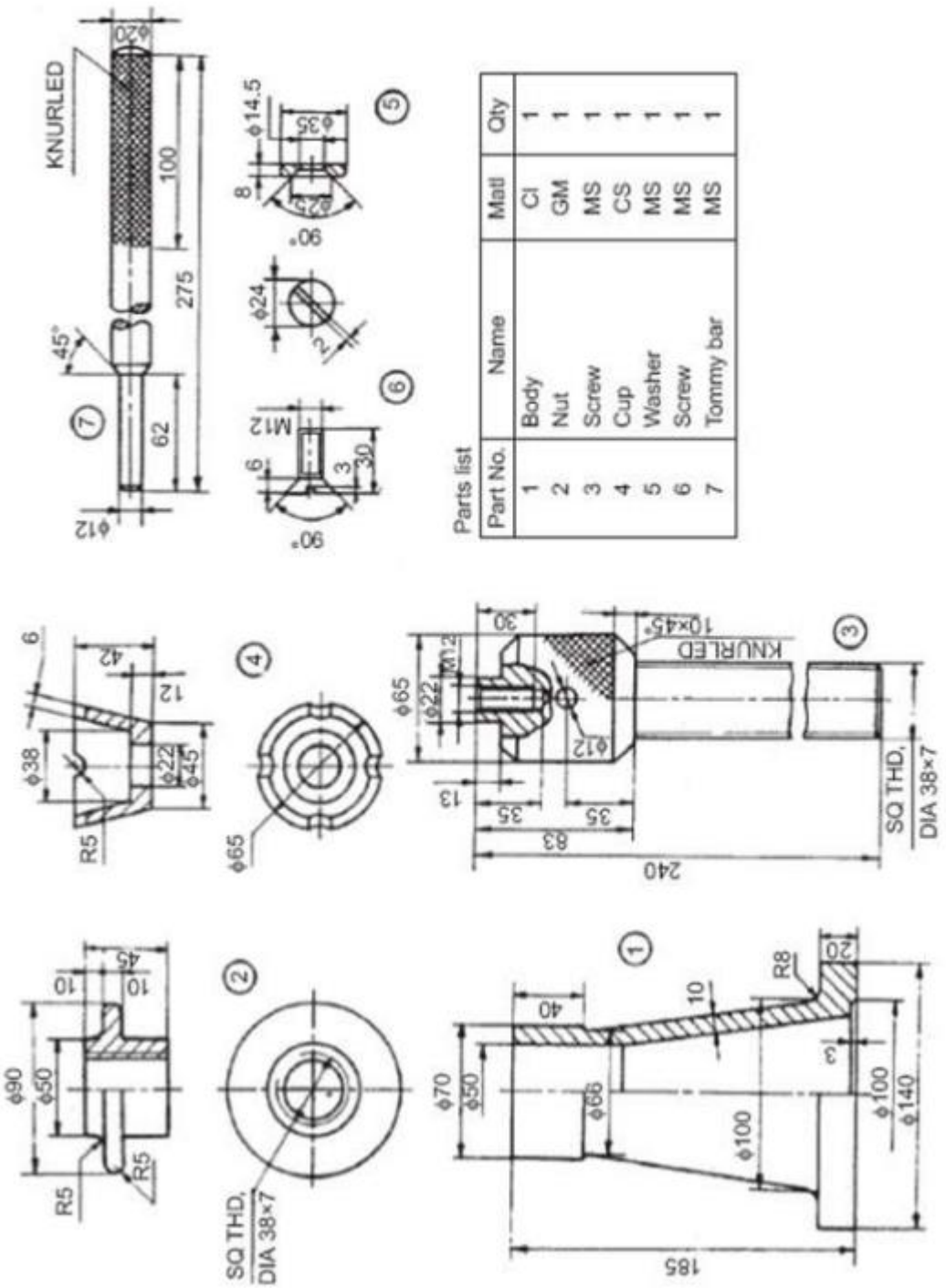
Sample Short and Long Answer Questions of Various Cognitive Levels

L2: Understand

1. Sketch the following thread profiles for a nominal diameter of 25 mm and pitch 3 mm and give their applications: (a) BSW thread, (b) Buttress thread (c) Square thread,(d) ACME thread and (e) Worm thread.
2. Sketch the following forms of nuts, with proportions marked. i) Flanged nut ii) Capstan nut.
3. Sketch the following conventional materials i) Bronze ii) Cast Iron iii) Concrete.

L3: Apply

1. Draw the half sectional elevation and side view of Cotter and sleeve joint used to connect two rods of 50 mm diameter.
2. Draw the sectional front view and top view of single riveted butt joint with double straps chain type to join two plates of 20 mm thickness each.
3. Assemble all the parts of screw jack shown in figure. Draw the following views. [48] a) Half sectional view from the front b) Top view



Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

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Chairman
Board of Studies (ME)

ES 23CSS01 Python Programming Lab 0 0 2 1.0

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

Code	Course Outcomes	Mapping with POs / PSOs						
		PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
23ESX06.1	Solve the different methods for linear, non-linear and differential equations	2	2	2	3	3	3	1
23ESX06.2	Learn the PYTHON Programming language	3	3	3	3	3	3	1
23ESX06.3	Familiar with the strings and matrices in Python	3	3	3	3	3	3	1
23ESX06.4	Write the Program scripts and functions in Python to solve the methods	3	3	3	3	3	3	1
23ESX06.5	Evaluate different methods of numerical solutions	3	3	3	3	3	3	1

List of Experiments

1	Write a Program to find the roots of non-linear equation using Newton Raphson's method.	**COs: CO1**
2	Write a Program to Curve fitting by least – square approximations	**COs: CO1**
3	Write a Program to solve the system of linear equations using Gauss - elimination method	**COs: CO1**
4	Write a Program to solve the system of linear equations using Gauss - Siedal method	**COs: CO1**
5	Write a Program to solve the system of linear equations using Gauss - Jordan method	**COs: CO2**
6	Write a Program to integrate numerically using Trapezoidal rule	**COs: CO2**
7	Write a Program to integrate numerically using Simpsons rule	**COs: CO4**
8	Write a Program to find the largest eigen value of a matrix by Power – method	**COs: CO4**
9	Write a Program to find numerical solution of ordinary differential equations by Euler's method	**COs: CO3**
10	Write a Program to find numerical solution of ordinary differential equations by Runge-Kutta method	**COs: CO3**
11	Write a Program to find numerical solution of ordinary differential equations by Milne's method	**COs: CO4**
12	Write a Program to find the numerical solution of Laplace equation	**COs: CO4**
13	Write a Program to find the numerical solution of Wave equation	**COs: CO4**
14	Write a Program to find the solution of a tri-diagonal matrix using Thomas algorithm	**COs: CO5**
15	Write a Program to fit a straight using least square technique	

Exercise problems

1. Write a program to display your details using output function
2. Write a program to find the given year is leap year or not
3. Write a program to find the sum of the even numbers & odd numbers up to a given number
4. Write a program to find the sum of the individual digits of a given number
5. Write a program that asks the user for an integer and creates a list that consists of the factors of that integer
6. Write a program that uses a for loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89
7. Write a program that generates a list of 20 random numbers between 1 and 100. Print the total and average of the elements in the list
8. Write a function called number_of_factors that takes an integer and returns how many factors the number has
9. Write a python program to find the numerical solutions of the function f(x) = x^3-x-1 using Newton Raphson's method.
10. Write a Python program to check the tank of radius 5 metres and height 10 metres the over filled with water

within 2 hours. If the water inflow is 15 metre cube per minute

References

1. Ajay Mittal, “Programming in C – A Practical Approach”, 1st Edition, Pearson, 2010
2. Behrouz A. Forouzan, Richard F. Gilberg, “A Structured Programming Approach Using C”, 3rd Edition, Cengage, 2007
3. Forouzan, Gilberg, Prasad, "C Programming: A Problem - Solving Approach", 1st Edition, Cengage Learning, 2011
4. Lab Manual for Computer Programming, Department of Computer Science & Engineering, NSRIT

Online Learning Sources

1. https://www.w3schools.com/python/python_intro.asp
2. https://onlinecourses.nptel.ac.in/noc20_cs83/preview
3. Virtual Labs - https://python-iitk.vlabs.ac.in/
4. Virtual Labs - https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
5. Virtual Labs - https://cse02-iiith.vlabs.ac.in/

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Board of Studies (CSE)

SOC **23ECS01 EMBEDDED SYSTEMS AND IoT** **0 1 2 2**

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

Code	Course Outcomes	Mapping with POs				
		PO1	PO5	PO10	PSO1	DoK
23MES01.1	Comprehend Microcontroller-Transducers Interface techniques.	1	2	1	1	L4
23MES01.2	Establish Serial Communication link with Arduino	1	2	1	1	L6
23MES01.3	Analyse basics of SPI interface.	1	2	2	1	L4
23MES01.4	Understand the concept of M2M (machine to machine) with necessary protocols and get awareness in implementation of distance sensor.	1	2	1	1	L2
23MES01.5	Realize the revolution of internet in mobile devices, cloud and sensor networks	1	2	1	1	L3
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos						
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create, DoK: Depth of Knowledge						

Embedded Systems Experiments: (Any 5 experiments from the following)

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal.

COMPONENTS/ BOARDS: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.

Internet of Things Experiments: (Any 5 experiments from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace
3. and debug Python code on the device.
4. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
5. Raspberry Pi interact with online services through the use of public APIs and SDKs.
6. Study and Install IDE of Arduino and different types of Arduino.
7. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
8. Calculate the distance using distance sensor Using Arduino.
9. Basic LED functionality Using Arduino.
10. Calculate temperature using temperature sensor Using Arduino.

11. Calculate the distance using distance sensor Using Node MCU.
12. Basic LED functionality Using Node MCU.

Text Books:

1. Arsheep Bahga & Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.
2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,.

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. https://archive.nptel.ac.in/courses/108/105/108105057/
4. https://www.edx.org/learn/embedded-systems/the-university-of-texas-at-austin-embedded-systems-shape-the-world-microcontroller-input-output?index=product&objectID=course-785cf551-7f66-4350-b736-64a93427b4db&webview=false&campaign=Embedded+Systems+-+Shape+The+World%3A+Microcontroller+Input%2FOutput&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fembedded-systems
5. https://www.edx.org/learn/iot-internet-of-things/universitat-politecnica-de-valencia-introduction-to-the-internet-of-things?index=product&queryID=e1322674dcb3d246be981d0669265399&position=4&linked_from=autocomplete&c=autocomplete
6. https://www.edx.org/learn/iot-internet-of-things/curtin-university-iot-sensors-and-devices?index=product&queryID=94ff5bcb80b8e4f427a0985bb2a5e07f&position=3&results_level=first-level-results&term=IOT&objectID=course-967eee29-87e8-4f2d-9257-a1b38ec07e85&campaign=IoT+Sensors+and+Devices&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch
7. Virtual Labs - http://vlabs.iitkgp.ac.in/rtes/
8. Virtual Labs - https://cse02-iiith.vlabs.ac.in/
9. Virtual Labs - https://iotvirtuallab.github.io/vlab/Experiments/index.html

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Board of Studies (ECE)

BS **23ACX01 Environmental Science** **2 0 0 -**

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

Code	Course Outcomes	Mapping with POs		DoK
		PO1	PO12	
23ACX01.1	Gain in-depth knowledge on importance of environment,natural resources utilization and exploitation	3	1	L1, L2, L3
23ACX01.2	Classify the various types of an eco systems and Identify their interconnections	3	1	L1, L2, L3
23ACX01.3	Illustrate the impacts of ever increasing environmental pollution and understand the issues on global environment.	3	1	L1, L2, L3
23ACX01.4	Understand various acts formulated by Govt.of India and apply the knowledge gained in conserving energy and environmental protection	3	1	L1, L2, L3
23ACX01.5	Explain the importance of Environment and human health.	3	1	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning				

Unit I:	**Multidisciplinary Nature of Environmental Studies & Natural Resources**	**4 hours**
Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness. **Natural Resources :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources		**COs: CO1**
Unit II:	**Ecosystems& Biodiversity and its Conservation :**	**4 hours**
Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem. b. Grassland ecosystem c. Desert ecosystem. d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Biodiversity and its Conservation :** Introduction ,Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		**COs: CO2**
Unit III:	**Environmental Pollution& Solid Waste Management :**	**4 hours**

Environmental Pollution: Definition, Cause, effects and control measures of : a. Air Pollution. b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards **Solid Waste Management:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.	**COs: CO3**
Unit IV: Social Issues and the Environment:	**4 hours**
From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.	**COs: CO4**
Unit V: Human Population and the Environment:	**4 hours**
Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies. **Field Work**: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..	**COs: CO5**

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Textbook of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.AzeemUnnisa, “Environmental Studies” Academic Publishing Company
4. K.RaghavanNambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House

6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

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Chairman
Board of Studies (BS&H)

HS 23HSX04 Industrial Management **2 0 0 2**

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

Code	Course Outcomes	Mapping with POs		DoK
		PO11	PO12	
23HSX04.1	Learn about how to design the optimal layout.	3	1	L1,L2
23HSX04.2	Demonstrate work study methods.	3	1	L1,L2
23HSX04.3	Explain Quality Control techniques.	3	1	L1,L2
23HSX04.4	Discuss the financial management aspects	3	1	L3,L4
23HSX04.5	Understand the human resource management methods.	3	1	L3, l4

Unit I:	**Unit I: Introduction to Industrial Engineering**	**9 hours**
Introduction: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management. **Plant Layout:** Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.		**COs: CO1**
Unit II:	**Work Study**	**9 hours**
Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.		**COs: CO2**
Unit III:	**Quality Control and Management**	**9 hours**
Statistical Quality Control: Quality control, Queuing assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – *X* and R –charts *X* and *S* charts and their applications, numerical examples. **Total Quality Management**: zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma–definition, basic concepts		**COs: CO3**
Unit IV:	**Financial Management**	**9 hours**
Scope and nature of financial management, Sources of finance, Ratio analysis, Management of working capital, estimation of working capital requirements, stock management, Cost accounting and control, budget and budgetary control, Capital budgeting – Nature of Investment Decisions – Investment Evaluation criteria- NPV, IRR, PI, Payback Period, and ARR, numerical problems.		**COs: CO4**
Unit V:	**Human Resource Management**	**9 hours**
Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, and types. **Value Analysis:** Value engineering, implementation procedure, enterprise resource planning and supply chain management.		**COs: CO5**

Text Books

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018.
2. Mart and Telsang, Industrial Engineering and Production Management, S.Chand & Company Ltd. New Delhi, 2006.

Reference Books

1. Bhattacharya DK, Industrial Management, S.Chand, publishers, 2010.
2. J.G Monks, Operations Management, 3/e, McGraw Hill Publishers1987.
3. T.R. Banga, S.C.Sharma, N. K. Agarwal, Industrial Engineering and Management Science, Khanna Publishers, 2008.
4. Koontz O'Donnell, Principles of Management, 4/e, McGraw Hill Publishers, 1968.
5. R.C.Gupta, Statistical Quality Control, Khanna Publishers, 1998.
6. NVS Raju, Industrial Engineering and Management, 1/e, Cengage India Private Limited, 2013.

Web References

- https://onlinecourses.nptel.ac.in/noc21_me15/preview
- https://onlinecourses.nptel.ac.in/noc20_mg43/preview
- https://www.edx.org/learn/industrial-engineering
- https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi
- https://youtube.com/playlist?list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	25	25
L2	35	35
L3	20	20
L4	20	20
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What is Managerial Economics?
2. Define production function
3. List out any three market competions.
4. Define Accounting
5. Define capital budgeting

L2: Understand

1. Explain the law of demand and its assumptions and limitations
2. Discuss the laws of production function
3. Explain the perfect market competition and its price output determination
4. Explain accounting principles
5. Illustrate capital budgeting methods

L3: Apply

1. Journalise the following transactions
   2013 Jan 1st ABC Firm commenced business with Rs.40000
   Jan 2nd Deposited into bank Rs.30000
   Jan 3rd Bought goods worth Rs.48000 from Kamala
   Jan 4th Sold goods worth Rs.60000
2. Calculate Net Profit Ration from the following data
   Sales returns Rs.100000 Administration expences Rs.10000
   Gross Profit Rs.40000 Selling expences Rs.10000

Income from investment Rs.5000 Loss on account of fire Rs.3000

3. From the following particulars findout
   Selling price Rs.200 per unit
   Variable cost Rs.100 per unit
   Total fixed cost Rs.96000
   i) Break even units and values
   ii) Sales to earn a profit Rs.20000
4. The following are the Ratios related to XYZ Limited company.
   Inventory holding period 2 months
   Gross profit ration 25 %
   Gross profit for the current year announced Rs.200000
   Closing stock is excess of Rs 40000 over opening stock. Findout
   A) Sales
   B) Cost of goods sold
   C) Closing stock
   D) Opening stock

L4: Analyze

1. A Project cost is Rs.144000. The average annual cash inflows are likely to be Rs.45000 for a period of 5 Years calucalte IRR for the project
2. The cost of project is Rs.50000 The annual cash iunflows for the next 4 years are Rs.25000 what is the PBP for the project
3. A firm is considering two different investment options A & B detailes of both the options are given below (Rs,in Lakhs) and conclude using acceptance criteria under NPV method , PV factor 13%.

	Investment cost	**Inflow 1**	**Inflow 2**	**Inflow 3**
Option A	(25)	10	10	12
Option B	(40)	15	20	24

4. Compare two projects using ARR method (ARR on original investment)
   Inintial investment Rs.1200000

Year	Cashinflows (Rs)	
	Project A	Project B
1	600000	500000
2	500000	300000
3	200000	200000
4	-	300000

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Chairman
Board of Studies (ME)

BS 23BSX18 Probability and Complex Variables 3 0 0 3

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

Code	Course Outcomes		DoK	
		PO1	PO2	
23BSX18.1	Understand the concepts of Probability and its applications	3	2	L1 – L4
23BSX18.2	Learn how to deal with random variables, conditional probability, joint distribution and statistical independence.	3	2	L1 – L4
23BSX18.3	Formulate and solve engineering problems involving random variables	3	2	L1 – L4
23BSX18.4	Analyze limit, continuity and differentiation of functions of complex variables and Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.	3	2	L1 – L4
23BSX18.5	Understand Cauchy's theorem, Cauchy integral formulas and apply these to Evaluate complex contour integrals. Classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.	3	3	L1 – L4
All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning				

Unit I:	**Probability**	**9 Hours**
Probability through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events. *Self learning topic: Applications of Probability*		**COs: CO1**
Unit II:	**Random Variables**	**9 Hours**
Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Normal, Exponential. *Self learning topic: Rayleigh Distribution*		**COs: CO2**
Unit-III	**Operations on Random variable**	**9 Hours**
Moments-moments about the origin, Central moments, Variance and Skewness, moment generating function, characteristic function.Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Stochastic Independence. *Self Learning Topic: Shepard 's corrections*		**COs: CO3**
Unit IV:	**Complex Variable – Differentiation**	**9 Hours**
Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method. *Self Learning Topic: Applications of Harmonic conjugate functions*		**COs: CO4**

Unit V:	**Complex Variable – Integration**	**9 Hours**
Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof). *Self Learning Topic: Evaluation of definite integral involving sine and cosine.*		**COs: CO5**

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in : BoS No. IV			
Approved in : ACM No.			
Expert talk (To be delivered by SMEs from industries)		**COs**	**POs**
1	Applications of Complex variables using MATLAB	CO1-CO5	PO2, PO5
2	Descriptive and Inferential Statistics using R	CO2	PO3

Textbooks:

1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", 4th Edition, TMH, 2002.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition

Reference Books:

1. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, PHI, 2002
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India
3. Henry Stark and John W.Woods, "Probability and Random Processes with Application to Signal Processing," 3rd Edition, Pearson Education, 2002.
4. B.V.Ramana, Higher Engineering Mathematics, Mc Graw Hill publishers.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc20_ma50/preview

https://onlinecourses.nptel.ac.in/noc21_ma66/preview#:~:text=This%20course%20provides%20random%20variable,and%20simple%20Markovian%20queueing%20models.

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember:

1.State Baye's theorem
2.What is Statistical Independence.
3.Define Analytic Function.
4.Write Cauchy's Riemann equations in polar form.

L2: Understand

1.What are the conditions for a function to be a random variable.
2.Write the properties of joint distribution function.
3.Write the generalized Cauchy's integral formula.
4. Show that $\boldsymbol{u = x^2 - y^2 - x}$ is harmonic**.**

L3: Apply

1. The content of urns I,II,III are as follows
   1 white ,2 black and 3 red balls
   2 white,1 black and 1 red ball
   1 white,5 black and 3 red balls

One urn is choosen at random and two balls are drawn they happen to be white and red what is the probability that they come from urn II

2.If X and Y are two random variables having a joint density function defined by
$\boldsymbol{f(x,y) = \frac{1}{8}(6 - x - y); 0 < X < 2, 2 < Y < 4}$ and 0 else where Find (i)$\boldsymbol{P(X < 1 \cap Y < 3)}$

(ii) $\boldsymbol{P(X + Y < 3)}$ (iii)) $\boldsymbol{P(X < 1/\ Y > 3)}$

3. Find the regular function whose imaginary part is $\boldsymbol{log\left(x^2 + y^2\right) + x - 2y}$.

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Chairman,
Board of Studies-(BS&H)

PC 23ME403 Manufacturing Processes 3 0 0 3

Pre-requisite: Nil

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

Code	Course Outcomes	Mapping with POs		DoK
		PO1	PO6	
20ME403.1	Explore the various casting methods for product making with their merits and demerits.	2	-	L1, L2
20ME403.2	Evaluate the various materials joining process and associated defects with possible cause and cure	2	1	L1, L2, L3
20ME403.3	Identify various metal forming process with its application	2	-	L1, L2, L3
20ME403.4	Describe various processes involved in sheet metal forming	2	-	L1, L2, L3
20ME403.5	Analyze use of advance manufacturing processes for customized applications	2	2	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning				

Unit I:	**Metal Casting Processes**	**12 hours**
Introduction to casting, Steps involved in making a casting, Patterns, Types of patterns. Pattern allowances, ingredients of molding sand, Properties of molding sand, Core, different types of cores, materials. Principles of Gating, Gating ratio and design of Gating systems. Risers, Types. Methods of melting and types of furnaces, cupola, electric arc, resistance and induction furnace. Solidification of castings. Fettling. Casting defects. Basic principles and applications of special casting processes - Centrifugal casting, True, semi and centrifuging, Die casting, Investment casting and shell molding *Types of molding*		**COs: CO1**
Unit II:	**Metal Joining Processes**	**12 hours**
Welding : Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, Submerged arc welding, TIG &MIG welding. Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing. welding defects, causes and remedies, destructive and non-destructive testing of welds. *Heat affected zones in welding; pre & post heating*		**COs: CO2**
Unit III:	**Bulk Deformation Processes**	**12 hours**
Bulk forming processes: Forging, Types of Forging, Smith forging, Drop Forging, Roll forging, Forging hammers, Rotary forging, forging defects. Rolling, fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing. *Plastic deformation in metals*		**COs: CO3**
Unit IV:	**Sheet metal Processes**	**12 hours**
Sheet metal forming, Blanking and piercing, Deep drawing, Stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools. High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations *Forces and power requirement*		**COs: CO4**
Unit V:	**Introduction to Additive Manufacturing**	**12 hours**

Introduction to AM, Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photopolymerization AM Processes, Extrusion - Based AM Processes, Powder Bed Fusion AM Processes, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications *Industrial Applications in aerospace, automobile, medical, jewelry, sports, electronics, food, construction and architecture*	**COs: CO5**

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Rao. P.N, Manufacturing Technology -Vol I-TMH- 13th Edition-2014
2. Kalpakjian S and Steven R Schmid, Manufacturing Processes for Engineering Materials — Pearson Publications- 15th Edition-2015
3. Ghosh.A&A.K.Malik – Manufacturing Science –East West Press Pvt. Ltd- 10th Edition-2011
4. Lindberg, Process and materials of manufacture- - PHI- 12th Edition-2017

Reference Books

1. Jain.R.K- Production Technology- Khanna- Tata McGrawHill- 10th Edition-2011
2. Sharma.P.C-Production Technology- S. Chand- 13th Edition-2013
3. Shaun.H.S.- Manufacturing Processes- Pearson- 12th Edition-2012
4. Kaushish.P.S.- Manufacturing Processes- PHI Publishers Distributors Pvt.Ltds- 5th Edition-2015

Web References

1. https://www.thomasnet.com/articles/custom-manufacturing-fabricating/types-of-casting-processes/
2. http://www.velhightech.com/Documents/ME8451%20Manufacturing%20Technology%20II.pdf
3. https://www.sciencedirect.com/topics/materials-science/plastic-deformation
4. https://www.machinemfg.com/sheet-metal-fabrication-technological-process
5. https://link.springer.com/chapter/10.1007/978-3-031-05863-9_1

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	**40**	**30**
L2	**40**	**30**
L3	**20**	**40**
Total (%)	**100**	**100**

Sample Short and Long Answer Questions of Various Cognitive Levels

L1:Remember

1. List out the steps involved in solving a problem.
2. List any four types of patterns.
3. What are the Steps involved in making a casting?
4. Give the reasons of welding processes.
5. Explain steps involved in a casting process with a neat sketch.

6. What is the high energy rate forming processes?
7. Define Casting.
8. Explain type of patterns and also explain any three patterns with a neat sketch.
9. Explain injection molding and Blow molding.
10. What is the difference between the solidification of pure metals and metal alloys

L2:Understand

1. Explain the two types of crucible furnaces with diagrams?
2. What is the difference between the solidification of pure metals and metal alloys?
3. Explain briefly the Investment casting and Die casting?
4. How do you classify the welding processes?
5. What is meant by penetration? Explain its relevance to welding.

L3: Apply

1. Explain the two types of crucible furnaces with diagrams?
2. What is the difference between the solidification of pure metals and metal alloys?
3. Explain briefly the Investment casting and Die casting?
4. How do you classify the welding processes?
5. What is meant by penetration? Explain its relevance to welding
6. Briefly describe the oxy-acetylene welding equipment?

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Chairman
Board of Studies (ME)

PC **23ME404 Fluid Mechanics and Hydraulic Machines** **3 0 0 3**

Pre-requisite: Linear Algebra & Differential Equations, Partial Differential Equations & Vector Calculus, Engineering Physics

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO2	PSO1	
23ME404.1	Apply mathematical knowledge to predict the properties and characteristics of a fluid.	3	3	2	L1, L2, L3
23ME404.2	Applications of the conservation laws to flow through pipes are studied	3	3	2	L1, L2, L3
23ME404.3	Understand the importance of dimensional analysis	3	3	2	L1, L2, L3
23ME404.4	Understand the concept of velocity profiles of a different flows	3	3	2	L1, L2, L3
23ME404.5	Estimate the performance parameters of a Centrifugal and Reciprocating pump	3	3	2	L1, L2, L3
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning					

Unit I:	**Fluid Properties and Flow Characteristics**	**12 hours**
Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity and Measurement of pressures. Manometer, Piezometer, U-Tube, Inverted and Differential Manometer -Pascals and Hydrostatic laws/ Buoyancy and Floating-buoyancy centre of buoyancy, Meta centre, Meta centric height, Condition of Equilibrium of floating and submerged bodies. *Oscillation of a floating Body*		**COs: CO1**
Unit II:	**Flow through Circular Conduits**	**12 hours**
Types of Fluid motion -Rate of flow, Continuity equation, Velocity and acceleration, Potential function and Vortex flow. Equation of motion-Euler's equation of motion, Bernoulli's equation, applications of Bernoulli's equation. Concept of control volume- energy equation and momentum equation .Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor-minor losses – Flow through pipes in series and parallel. *Free Liquid Jets, Orifice and Mouth piece*		**COs: CO2**
Unit III:	**Boundary Layer Theory & Dimensional Analysis**	**12 hours**
Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles. **Dimensional Analysis:** Dimensions and Units, Dimensional Homogeneity, Non dimensionalities of equations, Method of repeating variables and Buckingham Pi Theorem.		**COs: CO3**
Unit IV:	**Pumps**	**12 hours**
Impact of jets - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification. *Jet Propulsion of ships*		**COs: CO4, CO5**
Unit V:	**Turbines**	**12 hours**
Classification of turbines – Heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines. *Hydraulic Press and Hydraulic Accumulators*		**COs: CO6**

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Textbooks

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2013.
2. Bansal.R.K "Fluid Mechanics and Hydraulic Mchinary", 6th Edition, Laxmi Publications,2005.

Reference Books

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", Eurasia *Publishing,* 2011
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

Web References

https://www.nptel.ac.in/courses/112/104/112104118

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	40	30
L2	40	30
L3	20	40
Total(%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. Expression for Surface tension on a liquid droplet.
2. Define buoyancy.
3. Define dimensional analysis.
4. Define momentum thickness.

L 2: Understand

1. A U-tube is made of two capillaries of diameter 1mm and 1.5mm respectively. The tube is kept vertically and partially filled with water of surface tension 0.0736 N/m and zero contact angle. Calculate the difference in the levels of the menisci caused by the capillary
2. State Darcy-Weisbach equation OR What is the expression for head loss due to friction?
3. List the repeating variables used in Buckingham π theorem
4. Explain in detail about Specific speed of turbine & Type
5. Briefly explain about Cavitations in centrifugal pumps

L 3: Applying

1. A centrifugal pump with an impeller diameter of 0.4m runs at 1450rpm. The angle at outlet of the backward curved vane is 25° with tangent. The flow velocity remains constant at 3m/s. If the manometric efficiency is 84%. Determine the fraction of the kinetic energy at outlet recovered as static head.

2. A reaction turbine at 450 rpm, head 120 m, diameter at inlet 120 cm, flow area 0.4 m2 has angles made by absolute and relative velocities at inlet 20° and 60° respectively. Find volume flow rate, H.P and Efficiency.

3. A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 30˚ and velocity of flow at outlet is 3 m/s. The pump is working against a total head of 30 m and discharge through the pump is 0.3 m3 /s. If the manometric efficiency of the pump is 75%. Determine the diameter of the impeller and width of the impeller.

5. Derive expression for the force exerted by the jet of water on a series of moving radial curved vanes mounted on a wheel. Also find the maximum efficiency.

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Board of Studies (ME)

PC 23ME405 Design of Machine Members 3 0 0 3

Pre-requisite: Engineering Mechanics, Differential Equations and vector calculus

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

Code	Course Outcomes	Mapping with POs			DoK
		PO1	PO2	PSO1	
23ME405.1	Estimate safety factors of machine members subjected to static and dynamic loads.	3	3	2	L1, L2, L3
23ME405.2	Design the fasteners subjected to variety of loads.	3	3	2	L1, L2, L3
23ME405.3	Select of standard machine elements such as shafts, shaft couplings	3	3	2	L1, L2, L3
23ME405.4	Design of clutches, brakes, and springs.	3	3	2	L1, L2, L3
23ME405.5	Design of bearing and gears.	3	3	2	L1, L2, L3

All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning

Unit I:	**Introduction, Design for Static and Dynamic loads**	**12 hours**
Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials. **Design for Static Loads:** Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads. **Design for Dynamic Loads:** Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. *Fatigue design under combined stresses.*		**COs: CO1**
Unit II:	**Design of Bolted and Welded Joints**	**12 hours**
Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints. **Welded Joints:** Strength of lap and butt welds, Joints subjected to bending and torsion. *Eccentrically loaded welded joints.*		**COs: CO2**
Unit III:	**Power transmission Shafts and Couplings**	**12 hours**
Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors. **Couplings:** Design of flange and bushed pin couplings *universal coupling.*		**COs: CO3**
Unit IV:	**Design of Clutches, Brakes and Springs**	**12 hours**
Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory. **Brakes:** Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes. **Springs:** Design of helical compression, tension, torsion *leaf springs*.		**COs: CO4**
Unit V:	**Design of Bearings and Gears**	**12 hours**
Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. **Design of Rolling Contact Bearings:** Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue. **Design of Spur Gears:** Spur gears, beam strength, Lewis equation, design for dynamic and wear loads. *Bearing Failures.*		**COs: CO5**

Board of Studies			
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1			
2			

Note: Design data book is permitted for examination

Textbooks

1. R.L. Norton, Machine Design an Integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
3. Dr. N. C. Pandya &Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.
4. R.S. Khurmi, A Textbook of Machine Design, Paperback– 7 May 2020
5. S.Md.Jalaludeen, Design data book, 2015

Reference Books

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.
4. K. Mahadevan &K.Balaveera Reddy, Design data handbook, CBS Publications, 4/e, 2018.
5. Raghavendra/Design of Machine Elements I Dme I (Pb 2020)

Web References

- https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-ofmachine-elements-1-nptel
- https://www.digimat.in/nptel/courses/video/112105124/L01.html
- https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html
- https://archive.nptel.ac.in/courses/112/105/112105125/
- https://www.coursera.org/learn/machine-design1

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	20	20
L2	40	40
L3	40	40
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What are the factors which govern the selection of material for a machine component?
2. What is a coupling?
3. What are rolling contact bearings?

L2: Understand

1. Describe various theories of failure?
2. Define endurance limit, stress concentration and notch sensitivity?
3. Explain the design procedure for flange coupling

L3: Apply

1. The load on a bolt consists of an axial pull of 10kN together with a transverse shear force of 5kN. Find the diameter of bolt required according to i). Maximum principal stress theory; ii). Maximum shear stress theory; iii). Maximum principal strain theory; iv). Maximum strain energy theory; and v). Maximum distortion energy theory. Take permissible tensile stress at elastic limit = 100MPa and Poisson's ratio = 0.3.
2. A simply supported beam has a concentrated load at the center, which fluctuates from a value of P to 4P. The span of the beam is 0.5 m and its cross-section is circular with a diameter of 0.06 m. Taking for the beam material an ultimate stress of 700 MPa, a yield stress of 500 MPa, endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9.
3. Design a cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the full load torque. The shear stress for cast iron is 14 MPa

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Chairman
Board of Studies (ME)

PC 23ME407 Fluid Mechanics and Hydraulic Machines Lab 0 0 3 1.5

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

Code	Course Outcomes	Mapping with POs			
		PO1	PO2	PO3	PO4
23ME407.1	Find the Friction Factor of given pipe.	3	2	1	2
23ME407.2	Find the Loss of Head Factor of given pipe	3	2	1	2
23ME407.3	Evaluate the performance of Pelton Wheel, Kaplan turbine	3	2	2	2
23ME407.4	Evaluate the performance of single stage and multi stage centrifugal pumps	3	2	1	2
23ME407.5	Compare the coefficient of discharge of venture meter and orifice meter	3	2	1	2
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos					
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create, DoK: Depth of Knowledge					

List of Experiments

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Kaplan Turbine.
4. Performance Test on Single Stage Centrifugal Pump.
5. Performance Test on Multi Stage Centrifugal Pump.
6. Performance Test on Reciprocating Pump.
7. Calibration of Venturimeter.
8. Calibration of Orifice meter.
9. Determination of friction factor for a given pipe line.
10. Determination of loss of head due to sudden contraction in a pipeline.
11. Turbine flow meter

References

1. Lab Manual for Manufacturing Process Lab, Department of Mechanical Engineering, NSRIT

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Chairman
Board of Studies (ME)

PC 23ME407 Manufacturing Processes Lab **0 0 3 1.5**

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

Code	Course Outcomes	Mapping with POs			
		PO1	PO2	PO3	PO4
20ME406.1	Test the properties of molding	1	2	1	1
20ME406.2	Fabricate joints using gas welding and arc welding	1	2	1	1
20ME406.3	Perform injection molding studies on plastics.	1	2	2	1
20ME406.4	Able to identify, manipulate and control machining parameters for various manufacturing processes used in industry	1	2	1	1
20ME406.5	Able to illustrate the basic engineering principles applied to explain structure, properties and applications of materials	1	2	1	1
1. Weakly Contributing | 2. Moderately Contributing | 3. Strongly Contributing, for the attainment of respective Pos					
L1: Remember | L2: Understand | L3: Apply | L4: Analyze | L5: Evaluate | L6: Create, DoK: Depth of Knowledge					

List of Experiments

1. To Make on Taper Section under Pattern Making
2. To Make on I-Section under Pattern Making
3. To Make on Stepped Cone Pulley
4. To Make on lap Joint under Arc Welding
5. To Make on Butt Joint under Arc Welding
6. To Make on Spot welding under Arc Welding
7. To Make on Taper Section under Casting Making
8. To Make on I-Section under Casting Making
9. To Make on Stepped cone pulley under Casting Making
10. To Make on Injection Molding.

References

1. Lab Manual for Manufacturing Process Lab, Department of Mechanical Engineering, NSRIT

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Chairman
Board of Studies (ME)

SOC **23SCS01 Soft Skills** **0 1 2 2**

Pre-requisite: None. Soft Skills (Desirable)

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

Code	Course Outcomes	Mapping with POs			DoK
		PO8	PO9	PO10	
23SCS01.1	List out various elements of soft skills	2	1	1	L1, L2
23SCS01.2	Describe methods for building professional image	2	1	1	L1, L2
23SCS01.3	Apply critical thinking skills in problem solving	2	1	2	L3
23SCS01.4	Analyse the needs of an individual and team for well-being	2	1	1	L4
23SCS01.5	SA the situation and take necessary decisions	2	1	1	L5
All the COs are by default mapped to PO12 as few topics are inbuilt in syllabus promoting autonomous learning					

MODULE I:	**Soft Skills & Communication Skills**	**6+3 hours**
Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques. **Activities:** Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity. Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace. Non-verbal communication – Public speaking – Mock interviews – presentations with an objective toidentify non- verbal clues and remedy the lapses on observation		**COs: CO1**
MODULE 2:	**Critical Thinking**	**6+3hours**
Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection **Activities:** Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis		**COs: CO2**
MODULE 3:	**Problem Solving & Decision Making**	**6+3hours**
Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles **Activities:** Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision-Case Study & Group Discussion.		**COs: CO3**
MODULE 4:	**Emotional Intelligence & Stress Management**	**4+2 hours**
Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips **Activities:** Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates		**COs: CO4**
MODULE 5:	**Corporate Etiquette**	**6+3+3 hours**
Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges **Activities**		**COs: CO5**

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games	

Board of Studies		Basic Science & Humanities (Mathematics)	
Approved in : BoS No. VII			
Approved in : ACM No. IX			
Expert talk (To be delivered by SMEs from industries)		COs	POs
1	Seminar with Socialists	CO1	PO10

Prescribed Books:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

Reference Books

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand & Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher : Vayu Education of India, 2014

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZeI_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

ASSESSMENT:

This is a mandatory course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation

- Assessment by faculty mentor: 10 m
- Self-assessment: 10 marks
- Assessment by peers: 10 marks
- Socially relevant project/Group Activities/Assignments: 20 marks
- Semester End Examination: 50 marks
- The overall pass percentage is 40%.In case the student fails , he/she must repeat the course

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Board of Studies-(BS&H)

HS 23ESX08 Design Thinking & Innovations 3 0 0 3

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

Code	Course Outcomes		DoK	
		PO1	PO2	DoK
23ESX08.1	Explain the fundamentals of Design Thinking and innovation .	3	2	L1 – L4
23ESX08.2	Emphatize and Analyze the model action plan in implementing the process in driving innovations	3	2	L1 – L4
23ESX08.3	Evaluate the value of creativity & Analyse to work in a multidisciplinary environment	3	2	L1 - L4
23ESX08.4	Describe the principles of innovation and idea generation in product design	3	2	L1 – L4
23ESX08.5	Formulate specific problem statements of real time issues	3	3	L1 – L4
All the COs are mapped to PO12 as few self-learned topics are inbuilt in syllabus (italic) promoting autonomous learning				

Unit I:	**Introduction to Design Thinking**	**9 Hours**
Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry *Self learning topic*		**COs: CO1**
Unit II:	**Design Thinking Process**	**9 Hours**
Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development **Activity:** Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.		**COs: CO2**
Unit III:	**Innovation**	**9 Hours**
Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity. **Activity:** Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.		**COs: CO3**
Unit IV:	**Product Design**	**9 Hours**
Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies **Activity:** Importance of modelling, how to set specifications, Explaining their own product design.		**COs: CO4**
Unit V:	**Design Thinking in Business Processes**	**9 Hours**
Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes. **Activity:** How to market our own product, About maintenance, Reliability and plan for startup		**COs: CO5**

Board of Studies	Basic Science & Humanities (Mathematics)	
Approved in : BoS No. VI		
Approved in : ACM No. VIII		
Expert talk (To be delivered by SMEs from industries)	**COs**	**POs**

1	Design Thinking-Overview	CO1-CO5	PO2, PO3
2	Success Stories of Companies benefited from Design Innovations	CO5	PO2, PO3

Textbooks:

1. Tim Brown,Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lidwell,Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Online Learning Resources:

https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/preview

Internal Assessment Pattern

Cognitive Level	Internal Assessment #1 (%)	Internal Assessment #2 (%)
L1	15	15
L2	55	55
L3	20	20
L4	10	10
Total (%)	100	100

Sample Short and Long Answer Questions of Various Cognitive Levels

L1: Remember

1. What do you mean by Design Thinking?
2. What are the tools of design Thinknig?
3. What are the new materials in the industry?

L2: Understand

1. Explain the elements of Design
2. Differentiate between innovation and creativity
3. Why new materials are important for industry?

L3: Apply

1. How design thinking helped financial sector to gain the customer trust?
2. Explain the method of implementing Design thinking process driving inventions
3. What are some contemporary examples of design thinking in action.

L4: Analyze

1. How can organizations capture and evaluate the value of creativity in their design innovations?
2. Evaluate the impact and value of creativityin the context of design innovations?

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