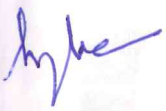
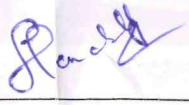
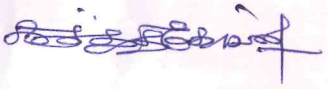
Department of Mechanical Engineering

Minutes of Board of Studies

The first Board of Studies meeting of Department of Mechanical Engineering was held on 17th July 2020 at 10:00 A.M in the R&D Lab, Department of Mechanical Engineering, Sri Manakula Vinayagar Engineering College with the Head of the Department in the Chair.

The following members were present for the BoS meeting:

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	Dr. K.Velmurugan Professor and Head Department of MECH, SMVEC	Chairman	
External Members			
2	Dr. N. Alagumurthi, Ph.D, Professor & Head Department of Mechanical Engineering, Pondicherry Engineering College, Puducherry-605014. Email id: alagumurthi@pec.edu Mobile No.: 9486143090	University Nominee	
3	Dr. M. Leenus Jesu Martin, Ph.D, Professor & Head, Department of Automobile Engineering, SRM Institute of Science and Technology, Tamil Nadu – 603203 Email id: hod.auto@ktr.srmuniv.ac.in Mobile No.: 9940036021	Member	
4	Dr. A.T. Ravichandran, Ph.D, Dean School of Mechanical and Construction Vel Tech Rangarajan Dr.Sagunthala R & D Institute of Science and Technology, Avadi, Chennai – 600062 Email id: hodmech@veltech.edu.in Mobile No.: 9942940600	Member	

Internal Members			
5	Dr.G.G.Sozhamannan, Professor, **Specialization:** ***Manufacturing Engineering***	Member	
6	Dr.R.Ravisankar, Associate Professor, **Specialization:** ***Thermal Engineering***	Member	
7	Dr.K.Hemalatha, Associate Professor, **Specialization:** ***Engineering Design***	Member	
8	Dr.A.Thiagarajan, Associate Professor, **Specialization:** ***Product Design & Manufacturing***	Member	
9	Prof. N.Vijayan, Assistant Professor, **Specialization:** ***Mathematics***	Member	
10	Prof. K.Oudayakumar Associate Professor, **Specialization:** ***Physics***	Member	
11	Dr.K.Karthikeyan Associate Professor, **Specialization:** ***Chemistry***	Member	
12	Dr.D.Jaichithra, Professor, **Specialization:** ***English***	Member	
Industrial Member			
13	Dr. Anand Gurupatham Deputy General Manager, CAE-Department Head at Renault Nissan, Technology & Business Center, Chennai, Tamil Nadu, India	Industrial Member	
Alumni			
14	Mr.P.Madavan, Research Scholar MIT, Anna university, Chennai.	Alumni Member	

Agenda of the Meeting

1) Discuss about the curriculum Structure of B.Tech – Mechanical Engineering
2) To discuss and approve the B.Tech. Degree Regulations 2020 (R-2020), Curriculum and Syllabi from I to VIII semesters for the B.Tech – Mechanical Engineering and the students admitted in the Academic Year 2020-21(First Year)
3) To discuss and approve the B.Tech. Degree Regulation 2019, Curriculum, syllabi from I to VIII semesters under for the B.Tech – Mechanical Engineering and the students admitted in the Academic Year 2019-20 (Second Year)
4) To discuss and approve the B.Tech. Degree Curriculum and Syllabi from I to VIII semesters under Pondicherry University Regulations 2013 for the B.Tech – Mechanical Engineering and the students admitted in the Academic Year 2017-18 (Final Year) and in the Academic Year 2018-19 (Third Year)
5) To discuss about the uniqueness of the Curriculum (R-2020)
6) To discuss and approve Evaluation Systems
7) To discuss about the Innovative Teaching / Practices Methodology adopted to handle the emerging / Advanced Technological concept courses
8) Any other item with the permission of chair

UG Minutes of the Meeting

Dr. K.Velmurugan, Chairman, BoS opened the meeting by welcoming and introducing the external members, to the internal and co-opted members and thanked them for accepting to become the member of the Board of Studies and the meeting thereafter deliberated on agenda items that had been approved by the Chairman.

Item:1 **Recommended to approve** the curriculum Structure of B.Tech – Mechanical Engineering

Item:2

Recommended to approve the B.Tech. Degree Regulations 2020 (R-2020), Curriculum from I to VIII semesters and syllabus for I to IV the B.Tech – Mechanical Engineering for the students going to be admitted in the Academic Year 2020-21 (First Year) with few suggestion

1. Credit per semester is more. May be reduced
2. **Fundamental of Mechanical Engineering** can be removed for Mechanical Students as they are studying it as their domain
3. Laboratory 0.5 credit should be given for each hour, lab credits should be increased
4. U20MET201 Manufacturing Processes – Metal Removal Processes – Basic Machining like Lathe, Drilling may be added instead of Surface machining Processes which may be kept in advanced course
5. The software name may be removed from course title/contents
6. Reappearances of topics in syllabus under various courses may be removed
7. Study experiments may be removed when students are doing experiments in the machine tool/equipment

8. In Engineering Practice lab exercises like dismantling and assembly of washing machine, sewing machine, bi-cycle, wet grinder can be included as exercises which will attract the students to enjoy their learning, these exercises will be useful for the students for doing their projects
9. In Numerical methods lab experiments related to Mechanical application has to be kept
10. IPR, copy rights, trade and patent making concepts to be included in syllabus
11. Mandatory courses like Indian constitution, Essence of Indian Traditional Knowledge, Professional ethics, Induction program should be made compulsory for all students
12. The experiment title should not start with the word Determination
13. Students doing industrial projects can attend the review through on-line with his industrial guide
14. Skype interviews can be conducted for students doing projects in industries

Item:3	**Recommended to approve** the B.Tech. Degree Regulations 2019 (R-2019), Curriculum from I to VIII semesters and syllabus for I to IV the B.Tech – Mechanical Engineering for the students admitted in the Academic Year 2019-20 with minor correction
Item:4	**Recommended to approve** the B.Tech. Degree Curriculum and Syllabi from I to VIII semesters under Pondicherry University Regulations 2013 for the B.Tech – Mechanical Engineering
Item:5	Discussion was done on the uniqueness of the Curriculum (R-2020) • The curriculum felicitates the development, dissemination and application of engineering knowledge • The curriculum has good frame work with strong fundamentals, Hand on training, inter-disciplinary knowledge with connectivity to societal awareness
Item:6	**Discussions were done on various** innovative Teaching practices Methodology adopted to handle the emerging / Advanced Technological concept courses
Item:7	**Recommended to approve** the Evaluation Systems of our curriculum with few suggestions Blooms Taxonomy knowledge levels should be adopted while setting the question papers
Item:8	**Other points Discussed** **Recommended to approve** the panel of examiners CO-PO mapping, PSO and PEO to be included along with syllabus **Overall the committee experts were satisfied with our curriculum structure and syllabus framing**

The meeting was concluded at 12:00PM with vote of thanks by Dr. K.Velmurugan, Head of Department, Mechanical Engineering

HoD/Mech
Chairman BoS

Dr. K. Velmurugan, M.E., Ph.D.,
Professor & Head
Department of Mechanical Engineering
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry - 605107

Director cum Principal

Director cum Principal
SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
Madagadipet, Puducherry - 605 107.

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
(As per UGC -2018 Regulations, Affiliated to Pondicherry University)
(Accredited by NBA – AICTE, Accredited by NAAC with “A” Grade)

PUDUCHERRY – 605107

B.TECH.

MECHANICAL ENGINEERING

(REGULATION - 2019)

CURRICULUM AND SYLLABI

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl. No	Course Category	AICTE Suggested Breakdown of Credits		SMVEC Suggested Breakdown of Credits	
		Credits	% of Credits	Credits	% of Credits
1	Humanities and Social Sciences (HS)	12	7.5	9	4.9
2	Basic Sciences (BS)	25	15.6	40	21.9
3	Engineering Sciences (ES)	24	15	30	16.3
4	Professional Core (PC)	48	30	65	35.6
5	Professional Electives (PE)	18	11.3	18	9.8
6	Open Electives (OE)	18	11.3	9	4.9
7	Project Work (PW) / Internship	15	9.3	12	6.6
8	Employability Enhancement Courses (EEC) *	-	-	-	-
9	Mandatory courses (MC) *	-	-	-	-
Total		**160**	**160**	**183**	**100**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No	Course Category	Credits per Semester								Total Credits	% of credits
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities and Social Sciences (HS)	-	4	-	-	-	3	1	1	9	4.9
2	Basic Sciences (BS)	14	16	3	3	4	-	-	-	40	21.9
3	Engineering Sciences (ES)	16	10	4	-	-	-	-	-	30	16.3
4	Professional Core (PC)	-	-	14	12	12	15	9	3	65	35.6
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18	9.8
6	Open Electives (OE)	-	-	-	3	3	-	3	-	9	4.9
7	Project Work (PW) / Internship	-	-	-	-	-	-	4	8	12	6.6
8	Employability Enhancement Courses (EEC) *	-	-	-	-	-	-	-	-	-	-
9	Mandatory courses (MC) *	-	-	-	-	-	-	-	-	-	-
Total		**30**	**30**	**21**	**21**	**22**	**21**	**20**	**18**	**183**	**100**

SEMESTER WISE CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	TOTAL
Credits	30	30	21	21	22	21	20	18	183

SEMESTER – I										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	T101	Mathematics– I	BS	3	1	0	4	25	75	100
2	T102	Physics	BS	4	0	0	4	25	75	100
3	T103	Chemistry	BS	4	0	0	4	25	75	100
4	T104	Basic Electrical and Electronics Engineering	ES	3	1	0	4	25	75	100
5	T105	Engineering Thermodynamics	ES	3	1	0	4	25	75	100
6	T106	Computer Programming	ES	3	1	0	4	25	75	100
Practical										
7	P101	Computer Programming Lab	ES	0	0	3	2	50	50	100
8	P102	Engineering Graphics	ES	2	0	3	2	50	50	100
9	P103	Basic Electrical and Electronics Lab	ES	0	0	3	2	50	50	100
							30	**300**	**600**	**900**

SEMESTER – II										
Sl. No.	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory										
1	T107	Mathematics–II	BS	3	1	0	4	25	75	100
2	T108	Material Science	BS	4	0	0	4	25	75	100
3	T109	Environmental Science	BS	4	0	0	4	25	75	100
4	T110	Basic Civil and Mechanical Engineering	ES	4	0	0	4	25	75	100
5	T111	Engineering Mechanics	ES	3	1	0	4	25	75	100
6	T112	Communicative English	HS	4	0	0	4	25	75	100
Practical										
7	P104	Physics Laboratory	BS	0	0	3	2	50	50	100
8	P105	Chemistry Laboratory	BS	0	0	3	2	50	50	100
9	P106	Workshop Practice	ES	0	0	3	2	50	50	100
10	P107	NSS/NCC*	-	-	-	-	-	--	-	-
							30	**300**	**600**	**900**

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19BST320	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100
2	U19EST301	Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
3	U19MET301	Mechanics of Solids	PC	2	2	0	3	25	75	100
4	U19MET302	Applied Thermodynamics	PC	2	2	0	3	25	75	100
5	U19MET303	Fluid Mechanics and Machinery	PC	2	2	0	3	25	75	100
6	U19MET304	Engineering Metallurgy	PC	3	0	0	3	25	75	100
Practical										
7	U19ESP301	Electrical and Electronics Engineering Lab	ES	0	0	2	1	50	50	100
8	U19MEP301	Material Testing and Metallurgy Lab	PC	0	0	2	1	50	50	100
9	U19MEP302	Fluid Mechanics and Machinery Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course *										
10	U19EEC301	Employability Enhancement Course -1 (Catia/ Creo / Solid works /Fusion 360)	EEC	0	0	2	-	100	-	100
11	U19EEC302	Skill Development Program -1	EEC	0	0	2	-	100	-	100
12	U19EEC303	General Proficiency - I	EEC	0	0	2	-	100	-	100
Mandatory Course *										
13	U19MEM301	Physical Education	MC	0	0	3	-	100	-	100
							21	**700**	**600**	**1300**

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19BST431	Probability and Queuing Theory	BS	2	2	0	3	25	75	100
2	U19MET401	Kinematics of Machinery	PC	2	2	0	3	25	75	100
3	U19MET402	Heat and Mass Transfer	PC	2	2	0	3	25	75	100
4	U19MET403	Machining Processes	PC	3	0	0	3	25	75	100
5	U19MEE40X	Professional Elective - I	PE	3	0	0	3	25	75	100
6	U19MEO40X	Open Elective - I	OE	3	0	0	3	25	75	100
Practical										
7	U19MEP401	Computer Aided Machine Drawing Lab	PC	0	0	2	1	50	50	100
8	U19MEP402	Heat Transfer Lab	PC	0	0	2	1	50	50	100
9	U19MEP403	Manufacturing Processes Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course *										
10	U19EEC401	Employability Enhancement Course -2 (Catia/ Creo/ Solid works /Fusion 360)	EEC	0	0	2	-	100	-	100
11	U19EEC402	Skill Development Program- 2	EEC	0	0	2	-	100	-	100
12	U19HSP403	General Proficiency - II	EEC	0	0	2	-	100	-	100
Mandatory Course *										
13	U19MEM401	Indian Constitution	MC	0	0	2	-	100	-	100
							21	**700**	**600**	**1300**

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19BST547	Numerical Methods and Statistics	BS	2	2	0	3	25	75	100
2	U19MET501	Design of Machine Elements	PC	2	2	0	3	25	75	100
3	U19MET502	Dynamics of Machinery	PC	2	2	0	3	25	75	100
4	U19MET503	Metrology and Measurement	PC	3	0	0	3	25	75	100
5	U19MEE50X	Professional Elective - II	PE	3	0	0	3	25	75	100
6	U19MEO50X	Open Elective - II	OE	3	0	0	3	25	75	100
Practical										
7	U19BSP548	Numerical Methods Lab	BS	0	0	2	1	50	50	100
8	U19MEP501	Metrology and Measurements Lab	PC	0	0	2	1	50	50	100
9	U19MEP502	Dynamics Lab	PC	0	0	2	1	50	50	100
10	U19MEP503	CAD/CAM Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course *										
11	U19EEC501	Employability Enhancement Course-3 (Automation-I/Ansys)	EEC	0	0	2	-	100	-	100
12	U19EEC502	Foreign Language/ IELTS/ Indian Constitution	EEC	0	0	2	-	100	-	100
13	U19EEC503	Skill Development Program-3	EEC	0	0	2	-	100	-	100
Mandatory Course *										
14	U19MEM501	Essence of Indian Traditional Knowledge	MC	0	0	2	-	100	-	100
							22	**750**	**650**	**1400**

SEMESTER – VI										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19MET601	Thermal Engineering	PC	2	2	0	3	25	75	100
2	U19MET602	Design of Transmission System	PC	2	2	0	3	25	75	100
3	U19MET603	Finite Element Analysis	PC	3	0	0	3	25	75	100
4	U19MET604	Advanced Manufacturing Technology	PC	3	0	0	3	25	75	100
5	U19MEE60X	Professional Elective - III	PE	3	0	0	3	25	75	100
6	U19MEO60X	Open Elective – III	HS	3	0	0	3	25	75	100
Practical										
7	U19MEP601	Thermal Engineering lab	PC	0	0	2	1	50	50	100
8	U19MEP602	Computational Fluid Dynamics Lab	PC	0	0	2	1	50	50	100
9	U19MEP603	Manufacturing Technology Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course *										
10	U19EEC601	Employability Enhancement Course-4 (Automation–II/CFD)	EEC	0	0	2	-	100	-	100
11	U19EEC602	Technical Seminar	EEC	0	0	2	-	100	-	100
12	U19EEC603	Foreign Language/ IELTS	EEC	0	0	2	-	100	-	100
13	U19EEC604	NPTEL/MOOC-I	EEC	0	0	2	-	100	-	100
Mandatory Course *										
14	U19MEM601	Professional Ethics	MC	0	0	2	-	100	-	100
							21	**800**	**600**	**1400**

SEMESTER – VII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19MET701	Production Planning and Cost Estimation	PC	3	0	0	3	25	75	100
2	U19MET702	Industrial Automation and Robotics	PC	3	0	0	3	25	75	100
3	U19MEE70X	Professional Elective – IV	PE	3	0	0	3	25	75	100
4	U19MEO70X	Open Elective – IV	OE	3	0	0	3	25	75	100
Practical										
5	U19MEP701	Automation and Robotics lab	PC	0	0	2	1	50	50	100
6	U19MEP702	Product Development Lab	PC	0	0	2	1	50	50	100
7	U19MEP703	Comprehensive Viva Voce	PC	0	0	2	1	100	-	100
8	U19HSP703	Business Basics Entrepreneur	HS	0	0	2	1	100	-	100
Project Work										
9	U19MEW701	Project Phase - I	PW	0	0	4	2	40	60	100
10	U19MEI701	Internship / Inplant Training	PW	0	0	4	2	100	-	100
							20	**640**	**460**	**1100**

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U19MET801	Power Plant Engineering	PC	3	0	0	3	25	75	100
2	U19MEE80X	Professional Elective – V	PE	3	0	0	3	25	75	100
3	U19MEE80X	Professional Elective – VI	PE	3	0	0	3	25	75	100
Project Work										
4	U19MEW801	Project Phase - II	PW	0	0	16	8	40	60	100
5	U19HSP804	Entrepreneurship Management	HS	0	0	2	1	100	-	100
Employability Enhancement Course *										
6	U19EEC801	NPTEL/MOOC-II	MC	0	0	2	-	100	-	100
							18	**315**	**285**	**600**

BASIC SCIENCE (BS) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
Theory									
1	T101	Mathematics – I	3	1	0	4	25	75	100
2	T102	Physics	4	0	0	4	25	75	100
3	T103	Chemistry	4	0	0	4	25	75	100
4	T107	Mathematics – II	3	1	0	4	25	75	100
5	T108	Material Science	4	0	0	4	25	75	100
6	T109	Environmental Science	4	0	0	4	25	75	100
7	U19BST320	Complex Analysis and Applications of Partial Differential Equations	2	2	0	3	25	75	100
8	U19BST431	Probability and Queuing Theory	2	2	0	3	25	75	100
9	U20BST547	Numerical Methods and Statistics	2	2	0	3	25	75	100
Laboratory									
10	P104	Physics Laboratory	0	0	2	1	50	50	100
11	P105	Chemistry Laboratory	0	0	2	1	50	50	100
12	U20BSP548	Numerical Methods Lab	0	0	2	1	50	50	100

ENGINEERING SCIENCE (ES) COURSES

Sl. No	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
Theory									
1	T104	Basic Electrical and Electronics Engineering	3	1	0	4	25	75	100
2	T105	Engineering Thermodynamics	3	1	0	4	25	75	100
3	T106	Computer Programming	3	1	0	4	25	75	100
4	T110	Basic Civil and Mechanical Engineering	4	0	0	4	25	75	100
5	T111	Engineering Mechanics	3	1	0	4	25	75	100
6	U19EST301	Electrical and Electronics Engineering	3	0	0	3	25	75	100
Laboratory									
7	P101	Computer Programming Lab	0	0	3	2	50	50	100
8	P102	Engineering Graphics	2	0	3	2	50	50	100
9	P103	Basic Electrical and Electronics Lab	0	0	3	2	50	50	100
10	P106	Workshop Practice	0	0	3	2	50	50	100
11	U19ESP301	Electrical and Electronics Engineering Lab	0	0	2	1	50	50	100

HUMANITIES AND SOCIAL SCIENCES (HS) COURSES

Sl. No	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
1	T112	Communicative English	4	0	0	4	25	75	100
2	U19HSP703	Business Basics Entrepreneur	0	0	2	1	100	-	100
3	U19HSP804	Entrepreneurship Management	0	0	2	1	100	-	100

PROFESSIONAL CORE (PC) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
Theory									
1	U19MET301	Mechanics of Solids	2	2	0	3	25	75	100
2	U19MET302	Applied Thermodynamics	2	2	0	3	25	75	100
3	U19MET303	Fluid Mechanics and Machinery	2	2	0	3	25	75	100
4	U19MET304	Engineering Metallurgy	3	0	0	3	25	75	100
5	U19MET401	Kinematics of Machinery	2	2	0	3	25	75	100
6	U19MET402	Heat and Mass Transfer	2	2	0	3	25	75	100
7	U19MET403	Machining Processes	3	0	0	3	25	75	100
8	U19MET501	Design of Machine Elements	2	2	0	3	25	75	100
9	U19MET502	Dynamics of Machinery	2	2	0	3	25	75	100
10	U19MET503	Metrology and Measurement	3	0	0	3	25	75	100
11	U19MET601	Thermal Engineering	2	2	0	3	25	75	100
12	U19MET602	Design of Transmission System	2	2	0	3	25	75	100
13	U19MET603	Finite Element Analysis	3	0	0	3	25	75	100
14	U19MET604	Advanced Manufacturing Technology	3	0	0	3	25	75	100
15	U19MET701	Production Planning and Cost Estimation	3	0	0	3	25	75	100
16	U19MET702	Industrial Automation and Robotics	3	0	0	3	25	75	100
17	U19MET801	Power Plant Engineering	3	0	0	3	25	75	100
Laboratory									
19	U19MEP301	Material Testing and Metallurgy Lab	0	0	2	1	50	50	100
20	U19MEP302	Fluid Mechanics and Machinery Lab	0	0	2	1	50	50	100
21	U19MEP401	Computer Aided Machine Drawing Lab	0	0	2	1	50	50	100
22	U19MEP402	Heat Transfer Lab	0	0	2	1	50	50	100
23	U19MEP403	Manufacturing Processes Lab	0	0	2	1	50	50	100
24	U19MEP501	Metrology and Measurements Lab	0	0	2	1	50	50	100
25	U19MEP502	Dynamics Lab	0	0	2	1	50	50	100
26	U19MEP503	CAD/CAM Lab	0	0	2	1	50	50	100
27	U19MEP601	Thermal Engineering lab	0	0	2	1	50	50	100
28	U19MEP602	Computational Fluid Dynamics Lab	0	0	2	1	50	50	100
29	U19MEP603	Manufacturing Technology Lab	0	0	2	1	50	50	100
30	U19MEP701	Automation and Robotics lab	0	0	2	1	50	50	100
31	U19MEP702	Product Development Lab	0	0	2	1	50	50	100
32	U19MEP703	Comprehensive Viva Voce	0	0	2	1	100	-	100
Project Work									
34	U19MEW701	Project Phase - I	0	0	4	2	40	60	100
35	U19MEI701	Internship / Inplant Training	0	0	4	2	100	-	100
36	U19MEW801	Project Phase - II	0	0	16	8	40	60	100

PROFESSIONAL ELECTIVE (PE) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESM	Total
Professional Elective – I									
1	U19MEE401	Gas Dynamics and Jet propulsion	3	0	0	3	25	75	100
2	U19MEE402	Computer Aided Design	3	0	0	3	25	75	100
3	U19MEE403	Product design and Development	3	0	0	3	25	75	100
4	U19MEE404	Industrial Casting Technology	3	0	0	3	25	75	100
5	U19MEE405	Non-Conventional Energy Sources	3	0	0	3	25	75	100
Professional Elective – II									
1	U19MEE501	Turbo machinery	3	0	0	3	25	75	100
2	U19MEE502	Powder Metallurgy and Surface Coating	3	0	0	3	25	75	100
3	U19MEE503	Green Manufacturing	3	0	0	3	25	75	100
4	U19MEE504	Fluid Power Automation	3	0	0	3	25	75	100
5	U19MEE505	IOT and Smart Manufacturing	3	0	0	3	25	75	100
Professional Elective – III									
1	U19MEE601	Automobile Engineering	3	0	0	3	25	75	100
2	U19MEE602	Computational Fluid Dynamics	3	0	0	3	25	75	100
3	U19MEE603	Fuzzy Logic And Neural Networks	3	0	0	3	25	75	100
4	U19MEE604	Additive Manufacturing	3	0	0	3	25	75	100
5	U19MEE605	Energy And Climate Change	3	0	0	3	25	75	100
Professional Elective – IV									
1	U19MEE701	Industrial Tribology	3	0	0	3	25	75	100
2	U19MEE702	Advanced Welding Technology	3	0	0	3	25	75	100
3	U19MEE703	Artificial Intelligence and Machine Learning	3	0	0	3	25	75	100
4	U19MEE704	Nano Technology	3	0	0	3	25	75	100
5	U19MEE705	Modelling and Simulation of Manufacturing Systems	3	0	0	3	25	75	100
Professional Elective – V									
1	U19MEE801	Lean Manufacturing	3	0	0	3	25	75	100
2	U19MEE802	Cryogenic Engineering	3	0	0	3	25	75	100
3	U19MEE803	Autotronics	3	0	0	3	25	75	100
4	U19MEE804	Optimization Techniques in Engineering Design	3	0	0	3	25	75	100
5	U19MEE805	Total Quality Management	3	0	0	3	25	75	100
Professional Elective – VI									
1	U19MEE806	Composites Material	3	0	0	3	25	75	100
2	U19MEE807	Alternative Fuels	3	0	0	3	25	75	100
3	U19MEE808	Hydrogen Fuels	3	0	0	3	25	75	100
5	U19MEE809	Maintenance and Safety Engineering	3	0	0	3	25	75	100
5	U19MEE810	Non-Destructive Evaluation and Testing	3	0	0	3	25	75	100

OPEN ELECTIVES (OE) COURSES

S.No	Course Code	Course Title	Offering Department	Permitted for the students of following departments only
Open Elective – I (Offered in 4th Semester)				
1	U19EEO41	Solar Photovoltaic Fundamental and Applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE
2	U19EEO42	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE
3	U19ECO41	Engineering Computation with MATLAB	ECE	ICE, EEE, MECH, CIVIL, CCE, BME, AD, Mechatronics
4	U19ECO42	Consumer Electronics	ECE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME, Mechatronics, FT
5	U19CSO41	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
6	U19CSO42	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
7	U19ITO41	Database System: Design & Development	IT	EEE, ECE, ICE, CCE, BME, CCE
8	U19ITO42	R programming	IT	EEE, ECE, ICE, CCE, BME, CCE
9	U19ICO41	Sensors and Transducers	ICE	EEE, ECE, CSE, IT, MECH, CIVIL, CCE, BME, Mechatronics, AD, FT
10	U19ICO41	Control System Engineering	ICE	ECE, EEE, MECH, Mechatronics, ME
11	U19MEO41	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME, FT
12	U19MEO42	Material Handling System	MECH	EEE, ICE, CIVIL
13	U19CEO41	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT
14	U19CEO42	Building Science and Engineering	CIVIL	EEE, MECH
15	U19BMO41	Medical Electronics	BME	EEE, ECE, IT, ICE, CCE
16	U19BMO42	Telemedicine	BME	EEE, ECE, IT, ICE, CCE
17	U19CCO41	Basic DBMS	CCE	EEE,ECE,MECH,CIVIL,ICE, Mechatronics, BME,
18	U19CCO42	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics, BME,
19	U19ADO41	Knowledge Representation and Reasoning	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics
20	U19ADO42	Introduction to Data Science	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics
21	U19CSO43	Programming in JAVA	CSE	MECH

Open Elective – II (Offered in 5th Semester)				
1	U19HSO51	Product Development and Design	MBA	Common to B.Tech – EEE, ECE, ICE, BME, CCE, CIVIL
2	U19HSO52	Intellectual Property and Rights	MBA	
3	U19HSO53	Marketing Management and Research	MBA	
4	U19HSO54	Project Management for Engineers	MBA	
5	U19HSO55	Finance for Engineers	MBA	

Open Elective – II (Offered in 5th Semester)				
1	U19EEO53	Conventional and Non-Conventional Energy Sources	EEE	MECH, Mechatronics, AD
2	U19EEO54	Industrial Drives and Control	EEE	MECH, Mechatronics, AD
3	U19ECO53	Electronic Product Design and Packaging	ECE	CSE, IT, MECH
4	U19ECO54	Automotive Electronics	ECE	MECH
5	U19CSO53	Platform Technology	CSE	MECH, BME
6	U19CSO54	Graphics Designing	CSE	MECH
7	U19ITO53	Essentials of Data Science	IT	MECH
8	U19ITO54	Mobile App Development	IT	MECH
9	U19ICO53	Fuzzy logic and neural networks	ICE	MECH, CSE, IT, Mechatronics, AD
10	U19ICO54	Measurement and Instrumentation	ICE	MECH, Mechatronics
11	U19CEO53	Disaster Management	CIVIL	CSE, IT, MECH, AD, CSBS, FT
12	U19CEO54	Air Pollution and Solid Waste Management	CIVIL	CSE, IT, MECH, AD, CSBS, FT
13	U19BMO53	Biometric Systems	BME	IT
14	U19BMO54	Medical Robotics	BME	IT
15	U19CCO53	Network Essentials	CCE	MECH, Mechatronics
16	U19CCO54	Web Programming	CCE	MECH, Mechatronics
17	U19ADO53	Principle of Artificial Intelligence and Machine Learning	AD	CSE, IT, MECH, CSBS, Mechatronics
18	U19ADO54	Data science Application of Vision	AD	CSE, MECH, CSBS, Mechatronics

Open Elective – III(Offered in 6th Semester)				
1	U19HSO61	Product Development and Design	MBA	Common to the B.Tech– CSE, IT, MECH, Mechatronics, AD
2	U19HSO62	Intellectual Property and Rights	MBA	
3	U19HSO63	Marketing Management and Research	MBA	
4	U19HSO64	Project Management for Engineers	MBA	
5	U19HSO65	Finance for Engineers	MBA	

Open Elective – III (Offered in 6th Semester)				
1	U19EEO63	Conventional and Non-Conventional Energy Sources	EEE	ECE, ICE, CIVIL, BME, CCE, AD
2	U19EEO64	Industrial Drives and Control	EEE	ECE, ICE,
3	U19ECO63	Electronic Product Design and Packaging	ECE	EEE, ICE, CCE, BME
4	U19ECO64	Automotive Electronics	ECE	EEE, ICE
5	U19CSO63	Platform Technology	CSE	EEE, ECE, ICE, CIVIL, BME

6	U19CSO64	Graphics Designing	CSE	EEE, ECE, ICE, CIVIL, BME
7	U19ITO63	Essentials of Data Science	IT	EEE, ECE, ICE, CIVIL, BME
8	U19ITO64	Mobile App Development	IT	EEE, ECE, ICE, CIVIL, BME
9	U19ICO63	Fuzzy Logic and Neural Networks	ICE	EEE, ECE, ICE, CIVIL, BME
10	U19ICO64	Measurement and Instrumentation	ICE	EEE, ECE, BMI
11	U19MEO63	Heating, ventilation, and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL
12	U19MEO64	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL
13	U19CEO63	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, BME, CCE, CSBS, FT
14	U19CEO64	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, ICE, BME, CCE, CSBS, FT
15	U19BMO63	Biometric Systems	BME	EEE, ECE, IT, ICE, CCE
16	U19BMO64	Medical Robotics	BME	EEE, ECE, IT, ICE, CCE
17	U19CCO63	Network Essentials	CCE	EEE,CIVIL,ICE, BME,
18	U19CCO64	Web Programming	CCE	EEE,ECE,CIVIL,ICE, BME,
19	U19ADO63	Principle of Artificial Intelligence and Machine Learning	AD	EEE, ECE, ICE, CIVIL, CCE, BME, CSBS
20	U19ADO64	Data Science Application of Vision	AD	EEE, ECE, ICE, CIVIL, CCE, BME, CSBS,

Open Elective – IV (Offered in 7th Semester)				
1	U19EEO75	Hybrid and Electrical Vehicle	EEE	ECE, ICE, Mechatronics , MECH
2	U19EEO76	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics, CCE, AD
3	U19ECO75	IoT and its Applications	ECE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
4	U19ECO76	Cellular and Mobile Communications	ECE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
5	U19CSO75	Artificial Intelligence	CSE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
6	U19CSO76	Cloud Technology and its Applications	CSE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
7	U19ITO75	Automation Techniques & Tools-DevOps	IT	EEE, ECE, ICE, CSE MECH, CIVIL, CCE, BME
8	U19ITO76	Augmented and Virtual Reality	IT	EEE, ECE, ICE, CSE MECH, CIVIL, CCE, BME
9	U19ICO75	Process Automation	ICE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME, Mechatronics.
10	U19ICO76	Virtual Instrumentation	ICE	EEE, ECE, MECH, Mechatronics. BMI
11	U19MEO75	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL
12	U19MEO76	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
13	U19CEO75	Energy Efficient Buildings	CIVIL	EEE, ECE, MECH

14	U19CEO76	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AD, CSBS, FT
15	U19BMO75	Internet of Things Healthcare	BME	EEE, ECE, ICE, CCE
16	U19BMO76	Telehealth Technology	BME	EEE, ECE, ICE, CCE
17	U19CCO75	Data Science using python	CCE	EEE,ECE,MECH,CIVIL,ICE, Mechatronics, BME,
18	U19CCO76	Mobile Applications Development using Android	CCE	EEE,ECE,MECH,CIVIL,ICE, Mechatronics, BME,
19	U19ADO75	Data Science Application of NLP	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics
20	U19ADO76	Artificial Intelligence Applications	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics

EMPLOYABILITY ENHANCEMENT COURSES *

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
1	U19EEC301	Employability Enhancement Course -1 (Catia/ Creo / Solid works /Fusion 360)	0	0	2	-	100	-	100
2	U19EEC303	General Proficiency - I	0	0	2	-	100	-	100
3	U19EEC401	Employability Enhancement Course - 2 (Catia/ Creo/ Solid works /Fusion 360)	0	0	2	-	100	-	100
4	U19EEC403	General Proficiency - II	0	0	2	-	100	-	100
5	U19EEC501	Employability Enhancement Course-3 (Automation-I/Ansys)	0	0	2	-	100	-	100
6	U19EEC502	Foreign Language/ IELTS/ Indian Constitution	0	0	2	-	100	-	100
7	U19EEC601	Employability Enhancement Course-4 (Automation–II/CFD)	0	0	2	-	100	-	100
8	U19EEC602	Technical Seminar	0	0	2	-	100	-	100
9	U19EEC603	Foreign Language/ IELTS	0	0	2	-	100	-	100
10	U19EEC604	NPTEL/MOOC-I	0	0	2	-	100	-	100
11	U19EEC801	NPTEL/MOOC-II	0	0	2	-	100	-	100

MANDATORY COURSES *

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
1	U19MEM301	Physical Education	0	0	2	-	100	-	100
2	U19MEM401	Indian Constitution	0	0	2	-	100	-	100
3	U19MEM501	Essence of Indian Traditional Knowledge	0	0	2	-	100	-	100
4	U19MEM601	Professional Ethics	0	0	2	-	100	-	100

SKILL DEVELOPMENT PROGRAM *

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
1	U19EEC302	Skill Development Program - 1 (Trouble and Troubleshooting of Two wheeler)	0	0	2	-	100	-	100
2	U19EEC402	Skill Development Program - 2 (Trouble and Troubleshooting of Four wheeler)	0	0	2	-	100	-	100
3	U19EEC503	Skill Development Program - 3 (Hands-on Training in 3D Printing)	0	0	2	-	100	-	100

SEMESTER III

U19BST320	COMPLEX ANALYSIS AND APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To understand the analytic functions of complex variables.
- To apply the analytic function techniques to transform irregular geometry into regular geometry.
- Expose to the concept of complex integration.
- To understand the nature of wave equations.
- To know the solutions of one dimensional and two dimensional heat flow equations.

Course Outcomes

On successful completion of this course, the students will be able to

CO1 - Understand the concepts of function of a complex variable.
CO2 - Transform complex functions from one plane to another plane.
CO3 - Evaluate complex integration over contour.
CO4 - Understand the concept of initial and boundary value and able to find the solutions of wave equations.
CO5 - Solve the one and two dimensional heat equation using Fourier series.

UNIT I FUNCTION OF A COMPLEX VARIABLE (12 Hrs)

Continuity, derivative and analytic functions – Necessary conditions – Cauchy-Riemann equations and sufficient conditions – Harmonic and orthogonal properties of analytic function – Construction of analytic function

UNIT II CONFORMAL MAPPINGS (12 Hrs)

Conformal mapping – Simple and standard transformations like $w = z+c$, cz, z^2, e^z, $\sin z$, $\cosh z$ and $z+1/z$ – Bilinear transformation and cross ratio property - Taylor's and Laurent's theorem – Series expansion of complex valued functions – classification of singularities.

UNIT III COMPLEX INTEGRATION (12 Hrs)

Cauchy's integral theorem and its application – Cauchy's integral formula and problems – Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma – Application of residue theorem to evaluate real integrals – unit circle and semicircular contour.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions of one dimensional wave equation – Transverse vibration of an elastic string.

UNIT V ONE AND TWO DIMENSIONAL HEAT EQUATIONS (12 Hrs)

Fourier series solutions of one dimensional heat flow equation – Fourier series solutions of two dimensional heat flow equation under steady state conditions.

Text Books

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2020.
2. Bali N.P. and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. P. Sivaramakrishna Das and C. Vijayakumar, "Engineering Mathematics", Pearsons, New Delhi, 2017.

Reference Books

1. Gupta C.B., Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2015.
2. Dass H.K. & Dr. Rama Verma, "Introduction to Engineering Mathematics", S. Chand & Co, New Delhi, 2019.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. Ravish R. Singh and Mukul Bhatt, "Engineering Mathematics", Tata McGraw Hill, 1st Edition, New Delhi, 2016.
5. Ramana B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill, New Delhi 2018.

Web References

1. https://nptel.ac.in/courses/122107036/
2. https://swayam.gov.in/nd1_noc20_ma17/preview
3. https://nptel.ac.in/courses/111107119/
4. https://youtu.be/W3HXK1Xe4nc

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

U19EST301 **ELECTRICAL AND ELECTRONICS ENGINEERING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To get familiar with the performance characteristics of single and three phase transformer.
- To equip the students to understand and analyze the characteristics of single and three phase induction motor.
- To get the clear knowledge of alternator and analyze its characteristics.
- To familiarize the characteristics of OP AMP 741 and its basic application circuits.
- To impart knowledge on the fundamental blocks and applications of IC 555.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Evaluate the performance of single phase transformers using phasor diagrams and equivalent circuits.
CO2 - Analyze the performance of AC machines and special machines.
CO3 - Analyze the Performance and characteristics of alternator and compute the voltage regulation with different methods.
CO4 - Design and analyze the OP AMP based circuits and its characteristics.
CO5 - Design the multi-vibrators and counters using IC 555 timer

UNIT I TRANSFORMERS (9 Hrs)

EMF Equation – Equivalent circuit – Voltage regulation - OC and SC Test – Efficiency – condition for maximum efficiency – All day efficiency – Autotransformer – introduction to three phase Transformer.

UNIT II AC MACHINES (9 Hrs)

Theory and operation of 3 phase Induction motor - constructional details – starting methods – speed control methods – principle of operation of single – phase Induction motor – stepper motor – AC series motor – Applications.

UNIT III ALTERNATORS (9 Hrs)

Alternators - construction - Operating principle - alternators on No load – Alternators on Load - Phasor diagram - voltage regulation – Losses – Efficiency – Parallel operation of alternators.

UNIT IV ELECTRONICS (9 Hrs)

Op. amp. – Characteristics – Inverting amplifier - Non-inverting amplifier – differentiation integration I/V converter - V/I converter - Instrumentation amplifier – adder – substractor – First order low pass filter and High pass filter using op. Amp.

UNIT V IC 555 (9 Hrs)

Advantages of ICs - pin configurations of 555 IC - Design of astable and mono-stable multivibrator using 555 IC - design of counters using FF-UP/DOWN counters BCD counters shift Registers – simple applications.

Text Books

1. I.J.Nagrath & D.P.Kothari, “Electric Machines”, Tata McGraw Hill, New Delhi, 5th Edition, 2017.
2. R.K.Rajput,”Electrical Machines”,Laxmi publications Pvt.Ltd, New delhi, 6th Edition, 2008.
3. Ramakant A Gayakward, Operational Amplifiers and Linear Integrated circuits, Person Education (Singapore) Pvt. Ltd., Delhi, 2003.

Reference Books

1. A.Malvino and P.Leach, “Digital principles and Applications”, IV edition, Tata McGraw Hill, 1998.
2. B.L.Theraja & A.K.Theraja, “Electrical Technology”, Vol. - II, Nirja Construction & Development Co. (P) Ltd., New Delhi, 1995.
3. Sergio Franco, “Design with operational amplifiers and analog integrated circuits”, McGraw Hill, 1st Edition, 2018.

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	2	-	3	2	2
CO2	3	3	3	3	2	-	-	-	-	-	2	2	3	3	3
CO3	3	3	3	3	-	-	-	-	-	-	2	-	3	2	2
CO4	3	3	3	2	2	-	-	-	2	-	2	3	3	3	2
CO5	3	3	3	2	2	-	-	-	2	-	2	3	3	3	3

U19MET301 **MECHANICS OF SOLIDS**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the fundamental concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To compute slopes and deflections in determinate beams by various methods.
- To understand the effect of torsion on shafts and springs
- To learn about the buckling failure in columns and calculate the stresses, deformations induced in thin and thick shells.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Compute the concepts of stress and strain in simple and compound bars and understand the importance of principal stresses and principal planes.

CO2 - Comprehend the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.

CO3 - Calculate the slope and deflection in beams using different methods.

CO4 - Estimate the effect of torsion in shafts and helical spring

CO5 - Calculate the stresses and strains associated with thin and thick cylinder

UNIT I STRESSES AND STRAINS (9 Hrs)

Stress and Strain: Basic of stress & strain, Elastic constant, Stress-strain diagram - Hook's law- Factor of safety- stresses and strain in uniformly varying sections- stresses in composite bar- Relation between three modulus and Poisson's ratio – Thermal stresses.

Biaxial state of stress – Stress at a point – stresses on inclined planes – Principal stresses and Principal strains and Mohr's circle of stress.

UNIT II BEAMS AND SIMPLE BENDING (9 Hrs)

Beams: Cantilever, Simply supported: Shear Force and Bending Moment Diagrams. Theory of simple bending – Bending stress and shear stress in beams.

UNIT III DEFLECTION OF BEAMS (9 Hrs)

Deflection of beams: Cantilever and simply supported beam by Double integration method – Macaulay's method – Area moment theorems for computation of slopes and deflections in beams.

UNIT IV TORSION & SPRING (9 Hrs)

Torsion: Introduction - Derivation of torsion equation - stresses and deformations in circular and hollow shafts - Shafts in Series and parallel - Combined bending and torsion- Strain energy due to axial force – Resilience.

Spring: Open and closed coil helical springs, Leaf Springs, Application of Torsion springs.

UNIT V COLUMNS AND CYLINDERS (9 Hrs)

Theory of columns – Long column and short column - Euler's formula – Rankine's formula.

Thin cylinders and shells – Deformation of thin cylinders and shells; Thick Cylinders, Compound Cylinder.

Text Books

1. R.K. Bansal, "Strength of Materials", Laxmi Publications, 6th edition 2019.
2. D.S. Bedi, "Strength of Materials", Khanna Publishing, 6th edition 2019.
3. R.K. Rajput, "Strength of Materials", S. Chand Publications, 7th edition 2018.

Reference Books

1. Punmia, Jain and Jain, "Mechanics of Materials" , Laxmi Publications .2019
2. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, 9th Edition, 2018
3. Egor. P.Popov "Mechanics of Materials" Pearson Education, 2nd Edition, 2016.
4. S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 3rd Edition, 2016
5. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., 2nd edition New Delhi, 2018.

Web References

1. https://nptel.ac.in/courses/112107146/#

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-	2	1	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
CO5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-

U19MET302 **APPLIED THERMODYNAMICS**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- Understand the concepts of ideal and real gases, gas mixtures and properties of pure substances.
- Identify the first law, second law and entropy concepts in the energy systems.
- Recognize the concepts of exergy and its applications in energy systems.
- Analyze the basics of thermodynamic property relations.
- Review the basic concepts of the combustion.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Describe the concepts of ideal and real gases, gas mixtures and pure substances.
CO2 - Illustrate the first law, second law and entropy concepts in the thermodynamic devices.
CO3 - Apply the basic concepts of exergy for solving problems in open and closed system
CO4 - Categorize thermodynamic property relations for different thermodynamic applications.
CO5 - Solve problems of combustion in thermodynamic systems.

UNIT I IDEAL AND REAL GASES, GAS MIXTURES AND PURE SUBSTANCES (9 Hrs)

Ideal and Real gases: Laws of perfect gases – Boyle's law – Charle's law – Gay Lussac law – Joule's law – Avogadro's law – state equation of gases – specific heat of gases. Vander Walls equation, Redlich Kwong equation, Dieterici equation, compressibility charts.
Gas mixtures: Mole fraction, mass fraction – calculation of mixture properties.
Pure substances: Phase change, 2D and 3D thermodynamic charts of pure substances – properties of steam – property tables – Mollier diagram.

UNIT II ENERGY AND ENTROPY (9 Hrs)

I law of thermodynamics – energy balance of closed and open systems. Steady and unsteady flow systems. II Law of thermodynamics – Entropy generation principle, its application, entropy balance of closed and open systems.

UNIT III EXERGY (9 Hrs)

Introduction to exergy – reversible work – useful work – decrease of exergy in processes – dead state – availability – irreversibility – exergy balance of closed and open systems – second law efficiencies of thermal equipments.

UNIT IV THERMODYNAMIC PROPERTY RELATIONS (9 Hrs)

General thermodynamic property relations: Maxwell equations – Tds equations –property relations of gases – Clausius - Clapeyron equation – Joule-Thomson coefficient – Gibbs phase rule – equilibrium condition.

UNIT V COMBUSTION (9 Hrs)

Combustion: Stoichiometry – reactant and product quantities – Enthalpy of formation – Steady flow analysis of reacting mixtures – Adiabatic Flame temperature – Enthalpy of reaction and heating values – availability in chemical reactions.– combustion analysis.

Text Books

1. Cengel.Y and M.Boles, "Thermodynamics - An Engineering Approach", 9th Edition, McGraw Hill, 2019.
2. Nag.P.K., "Engineering Thermodynamics", 6th Edition, McGraw-Hill, New Delhi, 2017.

Reference Books

1. C.Borgnakke, R.E. Sonntag, "Fundamentals of Thermodynamics, 10th Edition, John Wiley & Sons, Inc., 2019.
2. M.J.Moran, H.N.Shapiro, D.D.Boettner and M.B. Bailey., "Fundamentals of Engineering Thermodynamics, 9th Edition, John Wiley & Sons, Inc., 2018.
3. Arora C.P, "Thermodynamics", 25th Reprint, McGraw-Hill, New Delhi, 2013.
4. Rajput.R.K, "Thermal Engineering, Laxmi Publications (P) Ltd, 9th Edition, 2013.
5. Rathakrishnan.E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, 10th Reprint, Prentice- Hall of India Pvt. Ltd, 2013.

Web References

1. https://nptel.ac.in/courses/112105266/
2. https://nptel.ac.in/courses/112108148/
3. https://nptel.ac.in/courses/112/103/112103275/
4. https://nptel.ac.in/courses/112/105/112105123/
5. https://nptel.ac.in/courses/101/104/101104063/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO2	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO3	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO4	2	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO5	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2

U19MET303 **FLUID MECHANICS AND MACHINERY**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the properties of the fluid and flow characteristics.
- To emphasize the concept of dimensional analysis.
- To understand the concept of flow through circular pipes and boundary layer flows.
- To provide knowledge on the working principle and performance curves of hydraulic turbines.
- To educate the working principles and performance analysis of fluid pumps.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Understand the basic fluid property and its application.
CO2 - To apply the concepts of dimensional analysis on the fluid structure.
CO3 - To calculate the rate of flow and energy losses in flow through pipes.
CO4 - To evaluate the operating characteristics of hydraulic turbines
CO5 - Understand the working principles of hydraulic pumps and performances

UNIT I FLUID PROPERTIES AND FLUID STATICS (9 Hrs)

Units and dimensions - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity, fluid statics, manometers, Hydrostatic Forces, buoyancy, forces on submerged bodies, stability of floating bodies

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS (9 Hrs)

Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation. Bernoulli's equation, applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis -Buckingham's π theorem applications - similarity laws and models.

UNIT III INCOMPRESSIBLE FLUIDS & FLOW THROUGH PIPES (9 Hrs)

Viscous flow - laminar flow between parallel plates, - Laminar and Turbulent flow, Reynold's experiment flow through Circular pipes - Darcy - Weisbach equation - friction factor minor losses – flow through pipes in series and in parallel - power transmission - boundary layer flows, boundary layer thickness, boundary layer separation.

UNIT IV HYDRAULIC MACHINE & TURBINES (9 Hrs)

Principles of Turbo Machinery: Fluid Machines – Classification – Introduction to Impact of jet Stationary plates, Moving Plates and Vanes - Construction of Velocity Vector Diagram– Unit and Specific Quantities. Turbine - Classification – Impulse Turbine – Pelton Wheel – Reaction Turbines – Francis and Kaplan Turbines – Draft Tube Theory – Velocity Triangle – Estimation of force, Power and efficiency – General Characteristics of Turbine – Similarity Study – Governing of Turbine – Cavitation in Turbine.

UNIT V HYDRAULIC PUMPS (9 Hrs)

Classification - Centrifugal Pump – Velocity Triangle – Estimation of Power Required and efficiency – General characteristics - Similarity study – Cavitation in Pump – Reciprocating Pump – Air Vessels – Ideal and Actual Indicator Diagram – Estimation of Power Required, percentage Slip and Efficiency – Cavitation - special purpose pumps.

Text Books

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi publications (P) Ltd., New Delhi, 10th Edition, 2018
2. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 9thEdition, 2010.
3. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, 8thEdition, 2009.

Reference Books

1. S.S.Rattan - Fluid Mechanics and Hydraulic Machines- Khanna Publishers, 2019
2. S.M. Yahya, Turbine, Fans and Compressors, Tata McGraw-Hill- 4th Edition 2017.
3. Yunus Çengel, John M. Cimbala - Fluid Mechanics Fundamentals and Applications-Mc Graw Hill, 4th Edition, 2017
4. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, New Delhi, 8th Edition, 2016.
5. Modi P.N, & Seth S.M, "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 20th Edition, 2015.

Web References

1. https://nptel.ac.in/courses/112104118/
2. https://nptel.ac.in/courses/112104118/
3. http://fm-nitk.vlabs.ac.in
4. https://www.coursera.org/courses?query=fluid%20mechanics
5. https://apm.iitm.ac.in/fluid_mechanics.html

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	1	1	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	1	-	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	1	-	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	1	-	-	-	-	-	-	-	-	2	2	2

U19MET304 **ENGINEERING METALLURGY**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To learn solidification structure, solid solution and allotropy of metals
- To learn the phase diagrams, various reactions and properties of steel
- To learn about the heat treatment and its importance real applications.
- To learn about Recovery, Recrystallization and Grain Growth .
- To learn the deformation and failures of metals.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Understand the fundamentals of solidification, metal structure, solid solution metals
CO2 - Recognize the phase diagram and equilibrium diagram with reactions
CO3 - Understand the basic fundamentals of heat treatment and importance in metals
CO4 - Recognize crystal structure, nucleation, recovery and grain growth
CO5 - Understand and analysis the behavior of engineering materials and prevention the failures

UNIT I SOLIDIFICATION AND THEORY OF ALLOYS (9 Hrs)

Mechanism of crystallization, solidification of metals: pure metals and alloys, concept of super cooling, Nucleation: homogenous nucleation and heterogeneous nucleation. Solid solutions : Substitution solid solution-Interstitial solid solution, Hume-Rothery Rule, Lever Rule-Allotropy

UNIT II PHASE DIAGRAM AND IRON- CARBON EQUILIBRIUM DIAGRAM (9 Hrs)

Construction and interpretation of binary phase diagrams – Types – Eutectic, Eutectoid, Peritectic and Peritectoid systems – Iron Carbon equilibrium diagrams – classification of steels and alloy steels – types, manufacturing methods, properties and applications of cast irons.

UNIT III HEAT TREATMENT OF STEELS (9 Hrs)

Introduction to heat treatment- Classifications, Heat treatment of ferritic steels: constant temperature transformation-Continuous cooling curves-Important of heat treatment of steels- Surface Hardening process: classifications- Martempering and Austempering - Heat treatment of stainless steel: austenite stainless steel and Duplex stainless steel- shot peening-laser peening

UNIT IV RECOVERY , RECRYSTALLIZATION AND GRAIN GROWTH (9 Hrs)

Introduction to recovery and recrystallization , recrystallization of time and temperature, Degree of cold work and hot work, recrystallization of original grain growth, laws of recrystallization, Factors affecting rate of recrystallization - Grain growth - normal grain growth and abnormal grain growth- grain orientation- Factors affecting rate of grain growth

UNIT V DEFORMATION AND FAILURES OF METALS (9 Hrs)

Introduction deformation- types-strengthening mechanism of alloys, - ductile and brittle behavior of metals-Ductile to brittle transition- fracture modes – mechanism creep behavior- creep life predictions- fatigue behavior- S-N Curve-design against creep and fatigue

Text Books

1. A.Lavakumar, Concept of in physical metallurgy, Morgan & clay publication,2017
2. Srinivasan, Engg Materials And Mettalurgy, Tata McGraw-Hill Education,2nd edition,2015
3. S. K. Mandal, Steel Metallurgy: Properties, Specifications and Applications, McGraw-Hill Education,2014

Reference Books

1. Romesh C. Sharma, Principles of heat treatment of steels, New Age International, 2010
2. Sidney H. Avner, Introduction to Physical Metallurgy, Tata Mcgraw-Hill Publishing company Ltd, 2nd Edition 2008
3. Kannadi Palankeezhe Balan, Metallurgical Failure Analysis, Elsevier,2018
4. L. Krishna reddy, Principles of Engineering Metallurgy, New Age Publishing Company Ltd, 10th Edition 2011
5. William E. Hosford, Physical Metallurgy, Taylor and Francis , 1st Edition 2018

Web References

1. https://nptel.ac.in/courses/113106088/
2. https://nptel.ac.in/courses/113104074/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	-	1	-	1	-	1	1	1	1
CO2	3	1	-	-	1	-	-	1	-	1	-	1	1	1	1
CO3	3	-	-	-	-	1	-	1	-	1	-	2	-	-	1
CO4	3	-	2	1	-	1	1	1	-	1	1	2	1	1	1
CO5	3	2	2	1	2	1	-	1	2	2	1	2	1	1	1

U19ESP301	ELECTRICAL AND ELECTRONICS ENGINEERING LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To learn and predetermine the equivalent circuits of single phase transformer.
- To equip the students to test and evaluate the performance and characteristics of single and three phase transformer.
- To learn the performance characteristics of single phase and three phase induction motor.
- To analyze and calculate the three phase power measurement and predetermine the voltage regulation of alternator.
- To understand and analyze the characteristics of IC741 and IC 555

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Predetermine the equivalent circuits of single phase transformer.
CO2 - Analyze the different performance characteristics of single phase and three phase transformers.
CO3 - Experiment and analyze the performance of single phase and three phase rotating transformer.
CO4 - Predetermine the voltage regulation of alternator by using different methods.
CO5 - Design and test various waveform generation circuits using IC 741 and IC 555.

List of Experiments

1. OC and SC Test on Single Phase Transformer
2. Load Test on Single Phase Transformer
3. Load Test on 3 Phase Transformer
4. Load Test on Single Phase Induction Motor
5. Two Wattmeter Method of Power Measurement
6. Load test on three phase squirrel cage induction motor.
7. Predetermine the voltage regulation of alternator by using EMF method.
8. Inverting and Non-Inverting Amplifier Using IC 741
9. Astable Multivitbrator Using IC 555
10. Adder / Substractor Using IC 741

Text Books

1. D. P. Kothari, B. S. Umre, “Laboratory Manual for Electrical Machines”, I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
2. D.R Kohli & S.K Jain, “A laboratory course in electrical machines”, New Chand & Bros, Roorkee, 2nd Edition, 2000.
3. Dr. DK. Chaturvedi, “Electrical Machines Lab Manual with MATLAB Programs”, Laxmi Publications Pvt Limited, 1st Edition 2015.
4. Ramakant A. Gayakward, “Op-amps and Linear Integrated Circuits”, Pearson Education, 5th Edition, 2015

References Books

1. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, “Electric Machinery”, Tata McGraw Hill, New Delhi, 7th Edition, 2013.
2. Stephen J. Chapman, “Electric Machinery Fundamentals”, McGraw Hill Education Pvt. Ltd, 5th Edition, 2012.
3. Vincent Del Toro, “Basic Electric Machines”, Pearson India Education, 1st Edition, 2016.
4. Irving. L. Kosow, “Electrical Machines and Transformers”, PHI, 2nd Edition, 2007.
5. James M. Fiore, “OPAMP’s and Linear Integrated Circuits Concepts and Applications”, Cengage learning, 1st Edition, 2010.

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	1	1	-	2	-	-	-	2	2	2
CO2	2	3	2	1	-	1	1	-	2	-	-	-	3	3	3
CO3	2	2	2	1	-	1	1	-	2	-	-	-	3	2	2
CO4	2	2	2	1	-	1	1	-	2	-	-	-	2	3	3
CO5	2	3	2	1	-	1	1	-	2	-	-	-	3	3	3

U19MEP301 **MATERIAL TESTING AND METALLURGY LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To understand mechanical behavior of various engineering materials by conducting standard tests.
- To perform the characterization of materials like microstructures.
- To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment process.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Acquire experimentation skills in the field of material testing and develop theoretical understanding of the mechanical properties of materials by performing experiments.

CO2 - Analysis the procedure of microstructure studies of various materials

CO3 - Execute the various heat treatment processes for different stages

List of Experiments

Materials Testing Laboratory

1. Tension test
2. Torsion test
3. Compression test
4. Impact test on a metallic specimen- Izod test
5. Impact test on a metallic specimen- Charpy test
6. Hardness test on metallic specimen (Brinell, Rockwell)
7. Ductility test: Sheet metals (Al, GI and MS)

Metallurgy Laboratory

8. Identification of the Metals using optical microscope
9. Jominy end quenching test

References Books

1. Material Testing Laboratory, by Ravichawla , C. Kukreja, Kishore K, standard publishers, 2016
2. Engineering Materials and Metallurgy, R K Rajput, S. Chand Publishing,2006
3. ASM Handbook Volume 8: Mechanical Testing and Evaluation, Published by ASM International

Web References

1. https://virtlabs.tech/strength-of-materials/
2. http://sm-nitk.vlabs.ac.in/index.html

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	-	-	-	1	1	2	-	3	1	1
CO2	3	2	1	1	1	-	-	-	1	1	2	-	3	1	1
CO3	3	3	1	1	1	-	-	-	1	1	2	-	3	1	1

U19MEP302	FLUID MECHANICS AND MACHINERY LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To understand the properties of the fluid.
- To impart training to use various flow measuring devices.
- To understand the conservation of laws to flow through pipes.
- To understand the principles and working of hydraulics machines and its applications.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Analyse and Interpret fluid flow parameters by conducting experiments on venture and orifice experimental setups.

CO2 - Analyse and Interpret the performance characteristic of various types of pumps

CO3 - Analyse and Interpret the performance characteristic of various types of turbine

List of Experiments

1. Determination of the coefficient of discharge of given Orifice meter.
2. Determination of the coefficient of discharge of given Venturi meter.
3. Visualizing the flow structures through various models.
4. Conducting experiments and drawing the characteristics curves of centrifugal pump.
5. Conducting experiments and drawing the characteristics curves of submersible pump.
6. Conducting experiments and drawing the characteristics curves of jet pump.
7. Conducting experiments and drawing the characteristics curves of pump in series and parallel.
8. Conducting experiments and drawing the characteristics curves of reciprocating pump.
9. Conducting experiments and drawing the characteristics curves of Gear pump.
10. Conducting experiments and drawing the characteristics curves of Turbine pump
11. Conducting experiments and drawing the characteristics curves of Pelton wheel.
12. Conducting experiments and drawing the characteristics curves of Francis turbine.

Reference Books

1. CWR, Hydraulics Laboratory Manual,2004
2. N. Kumarasamy, Fluid Mechanics and Machinery laboratory manual, Charotar Publishing House Pvt. Ltd. 2008.
3. S C Gupta, Fluid Mechanics and Hydraulic Machines, Pearson Education India, 2006.

Web References

1. http://fmc-nitk.vlabs.ac.in.

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	2	-	3	1	1
CO2	3	3	1	1	1	-	-	-	-	-	2	-	3	1	1
CO3	3	3	1	1	1	-	-	-	-	-	2	-	3	1	1

SEMESTER – IV

U19BST431	PROBABILITY AND QUEUEING THEORY	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- Apply fundamental knowledge of the basic probability concepts.
- To introduce knowledge of standard discrete distributions.
- To acquire knowledge on Probability Distributions.
- To understand strengths and weaknesses of Queuing model.
- To gain strong knowledge in principles of Queuing theory.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Understand the fundamental knowledge of the probability concepts.
CO2 - Apply the basic rules of discrete random variables
CO3 - Apply the fundamentals of probability theory and random processes.
CO4 - Understand and extend Queuing models to analyze real world systems
CO5 - Apply the knowledge of Queuing theory in computer field.

UNIT I PROBABILITY AND RANDOM VARIABLE (12 Hrs)

Axioms of probability - Conditional probability - Total probability – Baye's theorem – Moments –Moment generating functions and their properties

UNIT II DISCRETE RANDOM VARIABLES (12 Hrs)

Random Variables and their event spaces, Random variable – Probability mass function – Probability density function - Distribution functions, Binomial, Geometric, Negative Binomial, Poisson.

UNIT III CONTINUOUS RANDOM VARIABLES (12 Hrs)

Some important distributions: Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties – Functions of a random variable.

UNIT IV QUEUING MODELS (12 Hrs)

Markovian queues – Birth and Death processes – Single and multiple server queuing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging. (M/M/I):(∞ /FIFO), (M/M/I):(N/FIFO), (M/M/C):(∞/FIFO), (M/M/C):(N/FIFO)

UNIT V ADVANCED QUEUING MODELS (12 Hrs)

Finite source models – M/G/1 queue – PollaczekKhinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

Text Books

1. Bali N.P. and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
2. T. Veerarajan," Probability and Statistics, Random Process and Queuing Theory", McGraw Hill Education, 2018.
3. P. Sivaramakrishna Das, C. Vijayakumari , "Probability and Queuing Theory", Pearson Education, 6th Edition, 2019.
4. G. Balaji, "Probability and Queuing Theory", Balaji Publication, Revised Edition, 2017.

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1. Gupta .C.B, Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2015
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi,10th Edition 2019
3. John F. Shortle, James M. Thomson, Donald Gross, "Fundamental of Queuing theory", 5th Edition, Wiley series May 2018
4. M.Bhatt and Ravish R Singh, "Probability and Statistics", McGraw Hill Education, 2017.
5. P.Kandasamy, Thilagavathi.K and Gunavathi.K, "Probability and Queuing Theory",S. Chand & Co. Pvt. Ltd, 2015

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2. https://nptel.ac.in/courses/117/103/117103017/
3. https://youtu.be/COI0BUmNHT8
4. https://nptel.ac.in/courses/111107119/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	2	-	-	-	-

U19MET401 **KINEMATICS OF MACHINERY**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the basics components and layout of linkages in the assembly of a system and machine to visualize simple mechanisms and its applications
- To Illustrate students about Kinematic Analysis (Instantaneous center method and relative velocity method) of simple mechanisms
- To provide students an understanding of different types of mechanisms.
- To teach students about different types of specified contour and derived contour cams and its kinematic analyses.
- To explain about kinematic advantages, problems and explain about epicyclic gear train and its speed calculation.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Demonstrate an understanding of the concepts of various mechanisms and pairs.
CO2 - Solve velocity and acceleration in simple mechanism by Graphical Method.
CO3 - Develop a simple mechanism such as Four Bar and slider crank Mechanism.
CO4 - Design a layout of cam for specified motion.
CO5 - Solve problem on gears and gear Train.

UNIT I BASICS OF MECHANISMS (9 Hrs)

Mechanisms and machines; Elements of kinematic chain, mobility and range of movements, Definition and Concept - inversion of single and double slider chain and four bar chain and its applications Mechanism with lower pairs -Pantograph, Straight line mechanism- exact and approximate Motion-Mini projects.

UNIT II KINEMATIC ANALYSIS OF MECHANISMS (9 Hrs)

Analysis of displacement, velocity and acceleration diagrams of simple planar mechanisms by graphical (Instantaneous center method and relative velocity method), analytical and computer aided methods (for four-bar and slider crank mechanism only.

UNIT III KINEMATIC SYNTHESIS OF MECHANISMS (9 Hrs)

Kinematic synthesis, graphical method using relative pole method, Inversion method and overlay 3 point synthesis problems - Motion, path and function generation, Chebyshev's spacing of accuracy points - Freudenstein Method of 3 point synthesis of four link mechanism and slider crank Mechanism- Coupler curves.

UNIT IV CAMS (9 Hrs)

Classification-Displacement diagrams-Uniform velocity, SHM, uniform acceleration and retardation and cycloidal motions-layout of profile of plate cams of the above types with reciprocating, oscillating, knife edge, roller and flat faced followers.

UNIT V GEARS AND GEAR TRAIN (9 Hrs)

Classification and terminology used Fundamental law of gearing – friction wheel, teeth for positive action and condition for constant velocity ratio. Conjugate profiles cycloidal and involute teeth profiles. Involute construction, properties and computation of path of contact and contact ratio. Interference and undercutting-Minimum number of teeth to avoid Interference, methods to avoid Interference. Introduction, classification, examples, gear ratio in simple and compound gear trains.

Text Books

1. J.J. Uicker, Jr., G.R. Pennock, and J.E. Shigley - Theory of Machines and Mechanisms, Oxford University Press, 5th Edition, 2016.
2. Khurmi,R.S.,Gupta,.J.K., "Theory of Machines",S.Chand&Company,2009
3. S S.Rattan - Theory of Machines, McGraw Hill, 5th Editon, 2020

Reference Books

1. J.S.Rao and R.V.Dukkipati - Mechanism and Machine Theory, New Age International, 2014.
2. Thomas Bevan - Theory of Machines, 3rd Edition, Pearson education, 2009,
3. P.L.Ballaney - Mechanics of Machines, Khanna Publishers, 2012.
4. Cho W. S. To , Introduction to Kinematics and Dynamics of Machinery, Morgan and Claypool publishers, 2018.
5. B. V. R. Gupta, Theory of Machines: Kinematics and Dynamics, I.K. Publishing house ltd.,2011

Web References

1. http://mm-nitk.vlabs.ac.in/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	1	2	-	2	-	-	-	2	2	1
CO2	3	2	2	-	-	1	-	-	2	-	-	-	2	2	1
CO3	3	2	2	-	2	1	-	-	2	-	-	-	2	2	1
CO4	3	2	3	-	-	1	-	-	2	-	-	-	2	2	1
CO5	3	2	2	-	-	1	-	-	2	-	-	-	2	2	1

U19MET402 **HEAT AND MASS TRANSFER**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To teach the students to understand the conduction type of heat transfer in steady and transient condition.
- To enable the students to expose the mechanisms of free and forced convection type of heat transfer.
- To develop the radiation shape factor for black and grey body radiations.
- To demonstrate the phase change heat transfer and calculate the performance of heat exchanging devices.
- To understand the phenomenon of diffusion and convective mass transfer.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Understand the basic concepts of heat transfer and solve steady and unsteady conduction heat transfer problems.

CO2 - Determine the temperature variation and rate of heat flow in convection heat transfer problems.

CO3 - Explain basic laws for Radiation and Determine the radiative properties of a black and grey body radiation.

CO4 - To integrate the concepts of phase change heat transfer and compare the thermal performance of heat exchangers using LMTD and NTU approach

CO5 - Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications

UNIT I CONDUCTION (9 Hrs)

Introduction of heat transfer – conduction - convection and radiation – Laws – General equation of heat conduction – Derivation in Cartesian - cylindrical and spherical coordinates – One dimensional steady state heat conduction in simple geometries – plane wall - cylinder and sphere – Heat transfer composite walls - composite cylinders and composite spheres – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts.

UNIT II CONVECTION (9 Hrs)

Boundary layer theory – Hydrodynamic and Thermal Boundary Layer- Dimensional Analysis-Flow over a flat– Flow over cylinders -spheres - tube bank – Internal flow through pipes in forced heat transfer – Natural convection in vertical - inclined and horizontal surfaces – Mixed convection.

UNIT III RADIATION (9 Hrs)

Radiation heat transfer –Thermal radiation – Laws of radiation – Black body concept – Grey body radiation - Emissive power – Radiation shape factor-radiation heat exchange between surfaces – Electrical Analogy – Radiation Shields-Radiation through gases.

UNIT IV PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS (9 Hrs)

Condensation and Boiling – Film wise and drop wise condensation – Film condensation on a Vertical plate – Regimes of Boiling – Forced convection boiling. Heat Exchangers – Types and practical applications – Use of LMTD – Effectiveness – NTU method – Compact heat exchangers – Plate heat exchangers – Fouling factor.

UNIT V MASS TRANSFER (9 Hrs)

Introduction of Mass Transfer – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations-Evaporation of water into air.

Text Books

1. R. C. Sachdeva, Fundamentals of Heat and Mass Transfer, New Age International Publishers. 2017
2. C. P. Kothandaraman and S. Subramanyan, ,Fundamental of Heat and Mass Transfer, New Age International Publishers, 2012.
3. P. K. Nag, Heat and Mass Transfer, McGraw Hill Education India Pvt. Ltd. 2011.

References Books

1. C. P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers, 2018.
2. Frank P. Incropera and David P. Dewitt, Incropera's principles of Heat and Mass Transfer, Wiley India Edition, 2018
3. Yunus A. Cengel, Heat and Mass Transfer: Fundamentals and Applications, McGraw Hill Education, 2016.
4. P. S. Ghoshdastidar, Heat Transfer, Oxford University Press. 2012
5. J. P. Holman, Heat Transfer, 10th Edition, McGraw-Hill Publishing Company Limited. 2011

Web References

1. https://nptel.ac.in/courses/112108149
2. https://nptel.ac.in/courses/112106170
3. https://nptel.ac.in/courses/112105248

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO2	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO3	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2

U19MET403 **MACHINING PROCESSES**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To impart knowledge in Lathe machine types, specification and working.
- To study about various Drilling machine types, specification and working principle.
- To learn about the principle of operations of shaper, Planar and slotter machine tool.
- To understand the milling and grinding machining operations.
- To learn about the nomenclature of cutting tools, cutting fluids, types and tool materials.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Understand the working principle of machine tools and work holding devices
CO2 - Understand the principles of Drilling machining process and its applications
CO3 - Understand the various machining processes such as Shaping, Planar and Slotting.
CO4 - Understand the various principles of milling and grinding machining operations.
CO5 - Select cutting fluid for different machining process.

UNIT I TURNING OPERATIONS (9 Hrs)

Lathe - Types, Designation, Work holding devices – Cutting Speed, Feed and Depth of Cut, MRR - Operations, Machining Time.

UNIT II DRILLING AND ALLIED OPERATIONS (9 Hrs)

Drilling Machines - Types, Operations, Machining Time - Boring, Reaming and Tapping (Definition of operations only)

UNIT III SHAPING MACHINING (9 Hrs)

Shaper, Types, Shaping Operations, Planner, Types, Planning Operation, Slotting Machine Operations.

UNIT IV MILLING AND GRINDING MACHINING (9 Hrs)

Milling Machine, Types, Milling Process, Milling Operations, MRR, Machining Time. Types of Grinding, Shapes and Size of a Grinding Wheel, Various Elements of a Grinding Wheel, Parameters of Grinding Operation. Balancing of Grinding Wheel.

UNIT V CUTTING TOOLS (9 Hrs)

Tool Materials, Nomenclature and Geometry of Cutting Tools, Tool wear Mechanisms, Tool Life – Tool Life Criteria. Cutting Fluids - Categories, Desirable Properties, Selection of Cutting Fluids.

Text Books

1. R.K.Singal, Mridul Singal, Rishi Singal. “Fundamentals of Machining and Machine Tools” -I.K.International Publishing Home Pvt. Ltd; New Delhi, 2008.
2. B.S.Nagendra Parashar, R.K.Mittal. “Elements of Manufacturing Processes”, Prentice - Hall of India Pvt. Ltd; New Delhi, 2012.
3. Hassan El-Hofy, ‘‘Fundamentals of Machining Processes: Conventional and Nonconventional Process’’, CRC Press, 2018.

Reference Books

1. R. K. Rajput “A Textbook of Manufacturing Technology: Manufacturing Processes “, Laxmi Publications (P) Ltd; New Delhi, 2007.
2. Serope Kalpakjian “Manufacturing Processes for Engineering Materials”, Pearson Education, 2009.
3. J. P. Kaushish “Manufacturing Processes”, PHI Learning Pvt Ltd, New Delhi- 2010.
4. H. N. Gupta “Manufacturing Processes”, New Age International, 2012.
5. David Fenner,’’Mini-Lathe Tools and Projects’’, Fox Chapel Publishing, 2018.

Web Resources

1. https://nptel.ac.in/courses/112/107/112107219/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	-	-	-	-	-	-	-	1	1	1
CO2	3	2	1	-	1	-	-	-	-	-	-	-	2	2	1
CO3	3	1	1	1	1	-	-	-	-	-	-	-	1	2	1
CO4	3	2	2	1	1	-	-	-	-	-	-	-	2	1	2
CO5	3	2	1	-	1	-	-	-	-	-	-	-	2	1	1

U19MEP401 **COMPUTER AIDED MACHINE DRAWING LAB**

L	T	P	C	Hrs
0	0	2	1	30

Course Objectives

- To expose the students to CAD /CAE software in the design and drawing of machine components
- Create 2-D Sketches
- To draw various permanent and temporary joints
- To be able to understand and find mistakes in the diagrams drawn by draughtsman
- Create assembly models of simple machine

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Design and drawing of machine Choose the loops and decision making statements to solve the problem
CO2 - Draw 2-D Sketches and various joints
CO3 - 2D Assembly models of simple machine
CO4 - Apply the concept of GD andT in drawings

List of Experiments

1. Preparation of Drawings for Parts and Assembly of the following by using Drafting software.
2. Gear coupling, spring loaded safety valve, lever safety valve, blow-off cock, cast iron flange joint, hydraulic joint, feed check valve, foot step bearing, ball valve, stuffing box- minimum 5 exercises
3. Preparation of Production Drawings with tolerances limits and fits using Drafting software - Minimum one exercise
4. Introduction to Geometric Dimensioning and Tolerancing, Geometric Tolerances Symbols- Tolerance Zone, Run-out, Feature Control Frame and its components, Straightness, Flatness, Circularity and Cylindricity, Parallelism, Perpendicularity and Angularity, Material Conditions- MMC and LMC, Position Tolerance and Datums, Twelve Degrees of Freedoms & Datum Planes, Surface Symbols – Roughness- Applying Feature Control Frame usage in drawings

References/ Manuals/ Software

1. Ajeet Singh, Machine Drawing, Tata McGraw-Hill Publishing Company, New Delhi, 2nd Edition, 2012.
2. Bhatt.N.D. “Machine Drawing”, Charotar Publishing House, 50th Edition, 2016.
3. Narayana, K.L., Bheemanjaneyulu, S, "Engineering Drawing with AutoCAD 2016", New Age International, 1st Edition, 2018.
4. Venugopal, K., Prabhu Raja, V. "Engineering Drawing + AutoCAD", New Age International 5th Edition, 2011.
5. Goutam Pohit, Goutam Ghosh, Machine drawing with AutoCAD, Pearson Education, 1st Edition, 2007.
6. P.S. Gill, Geometric Dimensioning & Tolerancing, S. K. Kataria & Sons, 2009.
7. https://mech.iitm.ac.in/Production%20Drawing.pdf

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO2	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO3	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO4	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO5	3	3	3	2	1	-	-	-	-	-	-	1	2	2	-

U19MEP402 **HEAT TRANSFER LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To apply conduction and convection heat transfer concepts to do experimentation on heat transfer equipment and improve practical knowledge of the systems.
- To apply radiation heat transfer concept to find Stefan Boltzmann constant and emissivity.
- To teach the principle of parallel flow, Counter flow and Plate type heat exchangers

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Analyse and Interpret heat transfer parameters by conducting experiments on conduction and convection experimental setups.

CO2 - Analyse and Interpret heat transfer parameters by conducting experiments on radiation experimental setups.

CO3 - Analyse and Interpret heat transfer parameters by conducting experiments on Heat exchanger experimental setups.

List of Experiments

1. Heat transfer on cylindrical surface by natural convection
2. Heat transfer on cylindrical surface by forced convection
3. Heat transfer from Pin fin by natural convection
4. Heat transfer from Pin fin by forced convection
5. Heat transfer on a composite wall
6. Determination of Stefan Boltzmann constant
7. Determination of emissivity of a specimen
8. Experiment on Parallel flow heat exchanger
9. Experiment on Counter flow heat exchanger
10. Experiment on plate type heat exchanger

Reference Books

1. C. P. Kothandaraman and S. Subramanyan, (2018), Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers.
2. R. C. Sachdeva, (2017), Fundamentals of Heat and Mass Transfer, New Age International (P) Ltd.
3. J. P. Holman, (2011), Heat Transfer, 9th Edition, McGraw-Hill Publishing Company Limited.

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	2	2	2	2
CO2	3	2	2	1	1	-	-	-	-	-	-	2	2	2	2
CO3	3	2	2	1	1	-	-	-	-	-	-	2	2	2	2

U19MEP403 **MANUFACTURING PROCESSES LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To study foundry tools and preparation of solid pattern.
- To study and practice the various operations that can be performed in milling machine.
- To study and practice the various operations that can be performed in shaping and grinding machine.
- To impart students the fundamental knowledge of CNC machines.
- To practice part programming for turning and milling operations.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Understand the mould preparations using solid and split patterns.
CO2 - Understand the principle of gear generation
CO3 - Perform operations in Grinding machine tool
CO4 - understand the functions of G and M codes in CNC Machines
CO5 - Generate CNC program for turning and milling

List of Experiments

FOUNDRY:

1. Demo and practices of foundry tools
2. Mould preparation using solid patterns
3. Mould preparation using split patterns

GEAR CUTTING:

4. Demonstration of gear hobbing machine and safety related to each machines
5. Spur gear hobbing
6. Spur gear milling
7. Helical gear milling

TOOL GRINDING:

8. Demonstration of cutter grinder and safety related to grinding machines
9. Grinding of single point cutting tool

CNC PROGRAMMING:

10. Demonstration of CNC turning and milling machines
11. CNC Part Programming for turning
12. CNC Part Programming for milling
13. APT Programming for drilling
14. APT Programming for milling

Reference Books

1. R.K.Singal, Mridul Singal, Rishi Singal. “Fundamentals of Machining and Machine Tools” -I.K.International Publishing Home Pvt. Ltd; New Delhi,2008.
2. Vajpayee S. Kant, “Principles of Computer Integrated Manufacturing”, Prentice Hall of India Learning, 2009.
3. Mikell P.Groover, “Automation, Production systems and Computer Integrated Manufacturing” PHI Learning Pvt. Ltd., 3rd Edition,2009.
4. Harshal Dhawas, ‘‘CNC Programming For Lathe & Milling: Siemens Sinumerik Control’’, Kindle Edition,2019.
5. **Kumar**, Kaushik, **Ranjan**, Chikesh, **Davim**, J. Paulo, ‘‘CNC Programming for Machining’’, Springer, 2020.

Web References

1. https://mie.umass.edu/materials-and-processes-lab
2. https://nptel.ac.in/content/storage2/courses/108105063/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	2	1	2	1
CO2	3	1	2	-	2	-	-	-	-	-	-	1	1	2	2
CO3	3	1	2	-	1	-	-	-	-	-	-	1	2	1	2
CO4	3	2	2	-	2	-	-	-	-	-	-	2	2	2	2
CO5	3	2	2	1	2	-	-	-	-	-	-	3	2	2	2

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
(As per UGC -2018 Regulations, Affiliated to Pondicherry University)
(Accredited by NBA – AICTE, Accredited by NAAC with “A” Grade)

PUDUCHERRY – 605107

B.TECH.

MECHANICAL ENGINEERING

(REGULATION - 2020)

CURRICULUM AND SYLLABI

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM

Sl. No	Course Category	AICTE Suggested Breakdown of Credits		SMVEC Suggested Breakdown of Credits	
		Credits	% of Credits	Credits	% of Credits
1	Humanities and Social Sciences (HS)	12	7.5	7	4.3
2	Basic Sciences (BS)	25	15.6	22	13.4
3	Engineering Sciences (ES)	24	15	25	15.2
4	Professional Core (PC)	48	30	71	43.3
5	Professional Electives (PE)	18	11.3	18	11
6	Open Electives (OE)	18	11.3	9	5.5
7	Project Work (PW) / Internship	15	9.3	12	7.3
8	Employability Enhancement Courses (EEC) *	-	-	-	-
9	Mandatory courses (MC) *	-	-	-	-
Total		**160**	**100**	**164**	**100**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No	Course Category	Credits per Semester								Total Credits	% of credits
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities and Social Sciences (HS)	-	-	1	1	-	3	1	1	7	4.3
2	Basic Sciences(BS)	9	3	3	3	4	-	-	-	22	13.4
3	Engineering Sciences (ES)	9	5	7	4	-	-	-	-	25	15.2
4	Professional Core (PC)	-	13	11	8	12	15	9	3	71	43.3
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18	11
6	Open Electives (OE)	-	-	-	3	3	-	3	-	9	5.5
7	Project Work (PW) / Internship	-	-	-	-	-	-	4	8	12	7.3
8	Employability Enhancement Courses (EEC) *	-	-	-	-	-	-	-	-	-	-
9	Mandatory courses (MC) *	-	-	-	-	-	-	-	-	-	-
Total		**18**	**21**	**22**	**22**	**22**	**21**	**20**	**18**	**164**	**100**

SEMESTER WISE CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	TOTAL
Credits	18	21	22	22	22	21	20	18	164

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST101	Engineering Mathematics – I (Calculus and Linear Algebra)	BS	2	2	0	3	25	75	100
2	U20BST106	Physics For Mechanical Engineering	BS	3	0	0	3	25	75	100
3	U20BST107	Material Science and Engineering	BS	3	0	0	3	25	75	100
4	U20EST117	Basic Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
5	U20EST119	Engineering Mechanics	ES	2	2	0	3	25	75	100
Practical										
6	U20ESP118	Basic Electrical and Electronics Engineering Lab	ES	0	0	2	1	50	50	100
7	U20ESP120	Engineering Mechanics Lab	ES	0	0	2	1	50	50	100
8	U20ESP121	Engineering Practice Lab	ES	0	0	2	1	50	50	100
Employability Enhancement Course *										
9	U20EEC101	Employability Enhancement Course -1 (AutoCad)	EEC	0	0	2	-	100	-	100
Mandatory Course *										
10	U20MEM101	Induction Program	MC	3 Weeks			-	-	-	-
11	U20MEM102	Demonstration in Civil Engineering	MC	0	0	2	-	100	-	100
							18	**475**	**525**	**1000**

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST215	Engineering Mathematics - II (Multiple Integrals and Transforms)	BS	2	2	0	3	25	75	100
2	U20EST201	Programming in C	ES	3	0	0	3	25	75	100
3	U20MET201	Manufacturing Processes	PC	3	0	0	3	25	75	100
4	U20MET202	Engineering Metallurgy	PC	3	0	0	3	25	75	100
5	U20MET203	Concepts of Engineering Design	PC	3	0	0	3	25	75	100
6	U20MET204	Engineering Thermodynamics	PC	2	2	0	3	25	75	100
Practical										
7	U20ESP202	Programming in C Lab	ES	0	0	2	1	50	50	100
8	U20ESP212	Engineering Graphics using Auto CAD	ES	0	0	2	1	50	50	100
9	U20MEP201	Manufacturing Processes Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course *										
10	U20EEC201	Employability Enhancement Course -2 (Python)	EEC	0	0	2	-	100	-	100
Mandatory Course *										
11	U20MEM201	Environmental Science	MC	0	0	2	-	100	-	100
							21	**500**	**600**	**1100**

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST320	Complex Analysis and Applications of Partial Differential Equations	BS	2	2	0	3	25	75	100
2	U20EST359	Data Structures	ES	3	0	0	3	25	75	100
3	U20EST345	Electronic Devices and Circuits	ES	3	0	0	3	25	75	100
4	U20MET301	Mechanics of Solids	PC	2	2	0	3	25	75	100
5	U20MET302	Computer Aided Design	PC	2	2	0	3	25	75	100
6	U20MET303	Fluid Mechanics and Machinery	PC	2	2	0	3	25	75	100
Practical										
7	U20ESP360	Data Structures Lab	ES	0	0	2	1	50	50	100
8	U20MEP301	Material Testing and Metallurgy Lab	PC	0	0	2	1	50	50	100
9	U20MEP302	Fluid Mechanics and Machinery Lab	PC	0	0	2	1	50	50	100
10	U20HSP301	General Proficiency - I	HS	0	0	2	1	100	-	100
Employability Enhancement Course *										
11	U20EEC301	Employability Enhancement Course -3(Catia/ Creo/ Solidworks /Fusion 360)	EEC	0	0	2	-	100	-	100
12	U20EEC302	Skill Development Program -1	EEC	0	0	2	-	100	-	100
Mandatory Course *										
13	U20MEM301	Physical Education	MC	0	0	2	-	100	-	100
							22	**700**	**600**	**1300**

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST431	Probability and Queuing Theory	BS	2	2	0	3	25	75	100
2	U20EST470	Programming in JAVA	ES	3	0	0	3	25	75	100
3	U20MET401	Kinematics of Machinery	PC	2	2	0	3	25	75	100
4	U20MET402	Heat and Mass Transfer	PC	2	2	0	3	25	75	100
5	U20MEE40X	Professional Elective - I	PE	3	0	0	3	25	75	100
6	U20MEO40X	Open Elective - I	OE	3	0	0	3	25	75	100
Practical										
7	U20ESP471	Programming in JAVA Lab	ES	0	0	2	1	50	50	100
8	U20MEP401	Computer Aided Machine Drawing Lab	PC	0	0	2	1	50	50	100
9	U20MEP402	Heat Transfer Lab	PC	0	0	2	1	50	50	100
10	U20HSP402	General Proficiency - II	HS	0	0	2	1	100	-	100
Employability Enhancement Course *										
10	U20EEC401	Employability Enhancement Course - 4 (Catia/ Creo/ Solidworks /Fusion 360)	EEC	0	0	2	-	100	-	100
12	U20EEC402	Skill Development Program-2	EEC	0	0	2	-	100	-	100
Mandatory Course *										
13	U20MEM401	Indian Constitution	MC	0	0	2	-	100	-	100
							22	**700**	**600**	**1300**

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20BST547	Numerical Methods and Statistics	BS	2	2	0	3	25	75	100
2	U20MET501	Design of Machine Elements	PC	2	2	0	3	25	75	100
3	U20MET502	Dynamics of Machinery	PC	2	2	0	3	25	75	100
4	U20MET503	Metrology and Measurement	PC	3	0	0	3	25	75	100
5	U20MEE50X	Professional Elective - II	PE	3	0	0	3	25	75	100
6	U20MEO50X	Open Elective-II	OE	3	0	0	3	25	75	100
Practical										
7	U20BSP548	Numerical Methods Lab	BS	0	0	2	1	50	50	100
8	U20MEP501	Metrology and Measurements Lab	PC	0	0	2	1	50	50	100
9	U20MEP502	Dynamics Lab	PC	0	0	2	1	50	50	100
10	U20MEP503	CAD/CAM Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course *										
11	U20EEC501	Employability Enhancement Course-5(Automation-I/Ansys)	EEC	0	0	2	-	100	-	100
12	U20EEC502	Foreign Language/ IELTS	EEC	0	0	2	-	100	-	100
13	U20EEC503	Skill Development Program-3	EEC	0	0	2	-	100	-	100
Mandatory Course *										
14	U20MEM501	Essence of Indian Traditional Knowledge	MC	0	0	2	-	100	-	100
							22	**750**	**650**	**1400**

SEMESTER – VI										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20MET601	Thermal Engineering	PC	2	2	0	3	25	75	100
2	U20MET602	Design of Transmission System	PC	2	2	0	3	25	75	100
3	U20MET603	Finite Element Analysis	PC	3	0	0	3	25	75	100
4	U20MET604	Advanced Manufacturing Technology	PC	3	0	0	3	25	75	100
5	U20MEE60X	Professional Elective - III	PE	3	0	0	3	25	75	100
6	U20MEO60X	Open Elective – III	HS	3	0	0	3	25	75	100
Practical										
7	U20MEP601	Thermal Engineering lab	PC	0	0	2	1	50	50	100
8	U20MEP602	Computational Fluid Dynamics Lab	PC	0	0	2	1	50	50	100
9	U20MEP603	Manufacturing Technology Lab	PC	0	0	2	1	50	50	100
Employability Enhancement Course *										
10	U20EEC601	Employability Enhancement Course-6(Automation–II/CFD)	EEC	0	0	2	-	100	-	100
11	U20EEC602	Technical Seminar	EEC	0	0	2	-	100	-	100
12	U20EEC603	Foreign Language/ IELTS	EEC	0	0	2	-	100	-	100
13	U20EEC604	NPTEL/MOOC-I	EEC	0	0	2	-	100	-	100
Mandatory Course *										
14	U20MEM601	Professional Ethics	MC	0	0	2	-	100	-	100
							21	**700**	**600**	**1300**

SEMESTER – VII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20MET701	Production Planning and Cost Estimation	PC	2	2	0	3	25	75	100
2	U20MET702	Industrial Automation and Robotics	PC	3	0	0	3	25	75	100
3	U20MEE70X	Professional Elective – IV	PE	3	0	0	3	25	75	100
4	U20MEO70X	Open Elective – IV	OE	3	0	0	3	25	75	100
Practical										
5	U20MEP701	Automation and Robotics lab	PC	0	0	2	1	50	50	100
6	U20MEP702	Product Development Lab	PC	0	0	2	1	50	50	100
7	U20MEP703	Comprehensive Viva Voce	PC	0	0	2	1	100	-	100
8	U20HSP703	Business Basics Entrepreneur	HS	0	0	2	1	100	-	100
Project Work										
9	U20MEW701	Project Phase - I	PW	0	0	4	2	40	60	100
10	U20MEI701	Internship / Inplant Training	PW	0	0	4	2	100	-	100
							20	**540**	**460**	**1100**

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U20MET801	Power Plant Engineering	PC	2	2	0	3	25	75	100
2	U20MEE80X	Professional Elective – V	PE	3	0	0	3	25	75	100
3	U20MEE80X	Professional Elective – VI	PE	3	0	0	3	25	75	100
Project Work										
4	U20MEW801	Project Phase - II	PW	0	0	16	8	40	60	100
5	U20HSP804	Entrepreneurship Management	HS	0	0	2	1	100	-	100
Employability Enhancement Course *										
6	U20EEC801	NPTEL/MOOC-II	EEC	0	0	2	-	100	-	100
							18	**315**	**285**	**600**

BASIC SCIENCE (BS) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
Theory									
1	U20BST101	Engineering Mathematics – I (Calculus and Linear Algebra)	2	2	0	3	25	75	100
2	U20BST106	Physics For Mechanical Engineering	3	0	0	3	25	75	100
3	U20BST107	Material Science and Engineering	3	0	0	3	25	75	100
4	U20BST215	Engineering Mathematics - II (Multiple Integrals and Transforms)	2	2	0	3	25	75	100
5	U20BST320	Complex Analysis and Applications of Partial Differential Equations	2	2	0	3	25	75	100
6	U20BST431	Probability and Queuing Theory	2	2	0	3	25	75	100
7	U20BST547	Numerical Methods and Statistics	2	2	0	3	25	75	100
Laboratory									
8	U20BSP548	Numerical Methods Lab	0	0	2	1	50	50	100

ENGINEERING SCIENCE (ES) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
Theory									
1	U20EST117	Basic Electrical and Electronics Engineering	3	0	0	3	25	75	100
2	U20EST119	Engineering Mechanics	2	2	0	3	25	75	100
3	U20EST201	Programming in C	3	0	0	3	25	75	100
4	U20EST345	Electronic Devices and Circuits	3	0	0	3	25	75	100
5	U20EST359	Data Structures	3	0	0	3	25	75	100
6	U20EST470	Programming in JAVA	3	0	0	3	25	75	100
Laboratory									
7	U20ESP118	Basic Electrical and Electronics Engineering Lab	0	0	2	1	50	50	100
8	U20ESP120	Engineering Mechanics Lab	0	0	2	1	50	50	100
9	U20ESP121	Engineering Practice Lab	0	0	2	1	50	50	100
10	U20ESP202	Programming in C Lab	0	0	2	1	50	50	100
11	U20ESP212	Engineering Graphics using Auto CAD	0	0	2	1	50	50	100
12	U20ESP360	Data Structures Lab	0	0	2	1	50	50	100
13	U20ESP471	Programming in JAVA Lab	0	0	2	1	50	50	100

HUMANITIES AND SOCIAL SCIENCES (HS) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
1	U20HSP301	General Proficiency - I	0	0	2	1	100	-	100
2	U20HSP402	General Proficiency - II	0	0	2	1	100	-	100
3	U20HSP703	Business Basics Entrepreneur	0	0	2	1	100	-	100
4	U20HSP804	Entrepreneurship Management	0	0	2	1	100	-	100

PROFESSIONAL CORE (PC) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
Theory									
1	U20MET201	Manufacturing Processes	3	0	0	3	25	75	100
2	U20MET202	Engineering Metallurgy	3	0	0	3	25	75	100
3	U20MET203	Concepts of Engineering Design	3	0	0	3	25	75	100
4	U20MET204	Engineering Thermodynamics	3	0	0	3	25	75	100
5	U20MET301	Mechanics of Solids	2	2	0	3	25	75	100
6	U20MET302	Computer Aided Design	2	2	0	3	25	75	100
7	U20MET303	Fluid Mechanics and Machinery	2	2	0	3	25	75	100
8	U20MET401	Kinematics of Machinery	2	2	0	3	25	75	100
9	U20MET402	Heat and Mass Transfer	2	2	0	3	25	75	100
10	U20MET501	Design of Machine Elements	2	2	0	3	25	75	100
11	U20MET502	Dynamics of Machinery	2	2	0	3	25	75	100
12	U20MET503	Metrology and Measurement	3	0	0	3	25	75	100
13	U20MET601	Thermal Engineering	2	2	0	3	25	75	100
14	U20MET602	Design of Transmission System	2	2	0	3	25	75	100
15	U20MET603	Finite Element Analysis	3	0	0	3	25	75	100
16	U20MET604	Advanced Manufacturing Technology	3	0	0	3	25	75	100
17	U20MET701	Production Planning and Cost Estimation	2	2	0	3	25	75	100
18	U20MET702	Industrial Automation and Robotics	3	0	0	3	25	75	100
19	U20MET801	Power Plant Engineering	2	2	0	3	25	75	100
Laboratory									
20	U20MEP201	Manufacturing Processes Lab	0	0	2	1	50	50	100
21	U20MEP301	Material Testing and Metallurgy Lab	0	0	2	1	50	50	100
22	U20MEP302	Fluid Mechanics and Machinery Lab	0	0	2	1	50	50	100
23	U20MEP401	Computer Aided Machine Drawing Lab	0	0	2	1	50	50	100
24	U20MEP402	Heat Transfer Lab	0	0	2	1	50	50	100
25	U20MEP501	Metrology and Measurements Lab	0	0	2	1	50	50	100
26	U20MEP502	Dynamics Lab	0	0	2	1	50	50	100
27	U20MEP503	CAD/CAM Lab	0	0	2	1	50	50	100
28	U20MEP601	Thermal Engineering lab	0	0	2	1	50	50	100
29	U20MEP602	Computational Fluid Dynamics Lab	0	0	2	1	50	50	100
30	U20MEP603	Manufacturing Technology Lab	0	0	2	1	50	50	100
31	U20MEP701	Automation and Robotics lab	0	0	2	1	50	50	100
32	U20MEP702	Product Development Lab	0	0	2	1	50	50	100
33	U20MEP703	Comprehensive Viva Voce	0	0	2	1	100	-	100
Project Work									
34	U20MEW701	Project Phase - I	0	0	4	2	40	60	100
35	U20MEI701	Internship / Inplant Training	0	0	4	2	100	-	100
36	U20MEW801	Project Phase - II	0	0	16	8	40	60	100

PROFESSIONAL ELECTIVE (PE) COURSES

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESM	Total
Professional Elective – I									
1	U20MEE401	Gas Dynamics and Jet propulsion	3	0	0	3	25	75	100
2	U20MEE402	Geometric Tolerance and Dimensioning	3	0	0	3	25	75	100
3	U20MEE403	Product design and Development	3	0	0	3	25	75	100
4	U20MEE404	Industrial Casting Technology	3	0	0	3	25	75	100
5	U20MEE405	Non-Conventional Energy Sources	3	0	0	3	25	75	100
Professional Elective – II									
1	U20MEE501	Turbomachinery	3	0	0	3	25	75	100
2	U20MEE502	Powder Metallurgy and Surface Coating	3	0	0	3	25	75	100
3	U20MEE503	Green Manufacturing	3	0	0	3	25	75	100
4	U20MEE504	Fluid Power Automation	3	0	0	3	25	75	100
5	U20MEE505	IOT and Smart Manufacturing	3	0	0	3	25	75	100
Professional Elective – III									
1	U20MEE601	Automobile Engineering	3	0	0	3	25	75	100
2	U20MEE602	Computational Fluid Dynamics	3	0	0	3	25	75	100
3	U20MEE603	Fuzzy Logic And Neural Networks	3	0	0	3	25	75	100
4	U20MEE604	Additive Manufacturing	3	0	0	3	25	75	100
5	U20MEE605	Energy And Climate Change	3	0	0	3	25	75	100
Professional Elective – IV									
1	U20MEE701	Industrial Tribology	3	0	0	3	25	75	100
2	U20MEE702	Advanced Welding Technology	3	0	0	3	25	75	100
3	U20MEE703	Artificial Intelligence and Machine Learning	3	0	0	3	25	75	100
4	U20MEE704	Nano Technology	3	0	0	3	25	75	100
5	U20MEE705	Modelling and Simulation of Manufacturing Systems	3	0	0	3	25	75	100
Professional Elective – V									
1	U20MEE801	Lean Manufacturing	3	0	0	3	25	75	100
2	U20MEE802	Cryogenic Engineering	3	0	0	3	25	75	100
3	U20MEE803	Autotronics	3	0	0	3	25	75	100
4	U20MEE804	Optimization Techniques in Engineering Design	3	0	0	3	25	75	100
5	U20MEE805	Total Quality Management	3	0	0	3	25	75	100
Professional Elective – VI									
1	U20MEE806	Composites Material	3	0	0	3	25	75	100
2	U20MEE807	Alternative Fuels	3	0	0	3	25	75	100
3	U20MEE808	Hydrogen Fuels	3	0	0	3	25	75	100
5	U20MEE809	Maintenance and Safety Engineering	3	0	0	3	25	75	100
5	U20MEE810	Non-Destructive Evaluation and Testing	3	0	0	3	25	75	100

OPEN ELECTIVES (OE) COURSES

S.No	Course Code	Course Title	Offering Department	Permitted for the students of following departments only
Open Elective – I (Offered in 4th Semester)				
1	U20EEO41	Solar Photovoltaic Fundamental and Applications	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE
2	U20EEO42	Electrical Safety	EEE	ECE, ICE, MECH, CIVIL, Mechatronics, CCE
3	U20ECO41	Engineering Computation with MATLAB	ECE	ICE, EEE, MECH, CIVIL, CCE, BME, AD, Mechatronics
4	U20ECO42	Consumer Electronics	ECE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME, Mechatronics, FT
5	U20CSO41	Web Development	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
6	U20CSO42	Analysis of Algorithms	CSE	EEE, ECE, ICE, MECH, CIVIL, BME
7	U20ITO41	Database System: Design & Development	IT	EEE, ECE, ICE, CCE, BME, CCE
8	U20ITO42	R programming	IT	EEE, ECE, ICE, CCE, BME, CCE
9	U20ICO41	Sensors and Transducers	ICE	EEE, ECE, CSE, IT, MECH, CIVIL, CCE, BME, Mechatronics, AD, FT
10	U20ICO42	Control System Engineering	ICE	ECE, EEE, MECH, Mechatronics, ME
11	U20MEO41	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME, FT
12	U20MEO42	Material Handling System	MECH	EEE, ICE, CIVIL
13	U20CEO41	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT
14	U20CEO42	Building Science and Engineering	CIVIL	EEE, MECH
15	U20BMO41	Medical Electronics	BME	EEE, ECE, IT, ICE, CCE
16	U20BMO42	Telemedicine	BME	EEE, ECE, IT, ICE, CCE
17	U20CCO41	Basic DBMS	CCE	EEE,ECE,MECH,CIVIL,ICE, Mechatronics, BME,
18	U20CCO2	Introduction to Communication Systems	CCE	EEE, CSE, IT, MECH, CIVIL, ICE, Mechatronics, BME,
19	U20ADO41	Knowledge Representation and Reasoning	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics
20	U20ADO42	Introduction to Data Science	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics

Open Elective – II (Offered in 5th Semester)				
1	U20HSO51	Product Development and Design	MBA	Common to B.Tech – EEE, ECE, ICE, BME, CCE, CIVIL
2	U20HSO52	Intellectual Property and Rights	MBA	
3	U20HSO53	Marketing Management and Research	MBA	
4	U20HSO54	Project Management for Engineers	MBA	
5	U20HSO55	Finance for Engineers	MBA	

Open Elective – II (Offered in 5th Semester)				
1	U20EEO53	Conventional and Non-Conventional Energy Sources	EEE	MECH, Mechatronics, AD
2	U20EEO54	Industrial Drives and Control	EEE	MECH, Mechatronics, AD
3	U20ECO53	Electronic Product Design and Packaging	ECE	CSE, IT, MECH
4	U20ECO54	Automotive Electronics	ECE	MECH
5	U20CSO53	Platform Technology	CSE	MECH, BME
6	U20CSO54	Graphics Designing	CSE	MECH
7	U20ITO53	Essentials of Data Science	IT	MECH
8	U20ITO54	Mobile App Development	IT	MECH
9	U20ICO53	Fuzzy logic and neural networks	ICE	MECH, CSE, IT, Mechatronics, AD
10	U20ICO54	Measurement and Instrumentation	ICE	MECH, Mechatronics
11	U20CEO53	Disaster Management	CIVIL	CSE, IT, MECH, AD, CSBS, FT
12	U20CEO54	Air Pollution and Solid Waste Management	CIVIL	CSE, IT, MECH, AD, CSBS, FT
13	U20BMO53	Biometric Systems	BME	IT
14	U20BMO54	Medical Robotics	BME	IT
15	U20CCO53	Network Essentials	CCE	MECH, Mechatronics
16	U20CCO54	Web Programming	CCE	MECH, Mechatronics
17	U20ADO53	Principle of Artificial Intelligence and Machine Learning	AD	CSE, IT, MECH, CSBS, Mechatronics
18	U20ADO54	Data science Application of Vision	AD	CSE, MECH, CSBS, Mechatronics

Open Elective – III(Offered in 6th Semester)				
1	U20HSO61	Product Development and Design	MBA	Common to the B.Tech– CSE, IT, MECH, Mechatronics, AD
2	U20HSO62	Intellectual Property and Rights	MBA	
3	U20HSO63	Marketing Management and Research	MBA	
4	U20HSO64	Project Management for Engineers	MBA	
5	U20HSO65	Finance for Engineers	MBA	

Open Elective – III (Offered in 6th Semester)				
1	U20EEO63	Conventional and Non-Conventional Energy Sources	EEE	ECE, ICE, CIVIL, BME, CCE, AD
2	U20EEO64	Industrial Drives and Control	EEE	ECE, ICE,
3	U20ECO63	Electronic Product Design and Packaging	ECE	EEE, ICE, CCE, BME

4	U20ECO64	Automotive Electronics	ECE	EEE, ICE
5	U20CSO63	Platform Technology	CSE	EEE, ECE, ICE, CIVIL, BME
6	U20CSO64	Graphics Designing	CSE	EEE, ECE, ICE, CIVIL, BME
7	U20ITO63	Essentials of Data Science	IT	EEE, ECE, ICE, CIVIL, BME
8	U20ITO64	Mobile App Development	IT	EEE, ECE, ICE, CIVIL, BME
9	U20ICO63	Fuzzy Logic and Neural Networks	ICE	EEE, ECE, ICE, CIVIL, BME
10	U20ICO64	Measurement and Instrumentation	ICE	EEE, ECE, BMI
11	U20MEO63	Heating, ventilation, and air conditioning system (HVAC)	MECH	EEE, ECE, ICE, CIVIL
12	U20MEO64	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL
13	U20CEO63	Disaster Management	CIVIL	EEE, ECE, CSE, IT, ICE, BME, CCE, CSBS, FT
14	U20CEO64	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, ICE, BME, CCE, CSBS, FT
15	U20BMO63	Biometric Systems	BME	EEE, ECE, IT, ICE, CCE
16	U20BMO64	Medical Robotics	BME	EEE, ECE, IT, ICE, CCE
17	U20CCO63	Network Essentials	CCE	EEE,CIVIL,ICE, BME,
18	U20CCO64	Web Programming	CCE	EEE,ECE,CIVIL,ICE, BME,
19	U20ADO63	Principle of Artificial Intelligence and Machine Learning	AD	EEE, ECE, ICE, CIVIL, CCE, BME, CSBS
20	U20ADO64	Data science Application of Vision	AD	EEE, ECE, ICE, CIVIL, CCE, BME, CSBS

Open Elective – IV (Offered in 7th Semester)				
1	U20EEO75	Hybrid and Electrical Vehicle	EEE	ECE, ICE, Mechatronics , MECH
2	U20EEO76	Electrical Energy Conservation and auditing	EEE	ECE, ICE, MECH, CIVIL, BME, Mechatronics, CCE, AD
3	U20ECO75	IoT and its Applications	ECE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
4	U20ECO76	Cellular and Mobile Communications	ECE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
5	U20CSO75	Artificial Intelligence	CSE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
6	U20CSO76	Cloud Technology and its Applications	CSE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME
7	U20ITO75	Automation Techniques & Tools-DevOps	IT	EEE, ECE, ICE, CSE MECH, CIVIL, CCE, BME
8	U20ITO76	Augmented and Virtual Reality	IT	EEE, ECE, ICE, CSE MECH, CIVIL, CCE, BME
9	U20ICO75	Process Automation	ICE	EEE, ICE, CSE MECH, IT, CIVIL, CCE, BME, Mechatronics.

10	U20ICO76	Virtual Instrumentation	ICE	EEE, ECE, MECH, Mechatronics. BMI
11	U20MEO75	Principles of Hydraulic and Pneumatic System	MECH	EEE, ECE, ICE, CIVIL
12	U20MEO76	Supply Chain Management	MECH	EEE, ECE, CIVIL, Mechatronics
13	U20CEO75	Energy Efficient Buildings	CIVIL	EEE, ECE, MECH
14	U20CEO76	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AD, CSBS, FT
15	U20BMO75	Internet of Things Healthcare	BME	EEE, ECE, ICE, CCE
16	U20BMO76	Telehealth Technology	BME	EEE, ECE, ICE, CCE
17	U20CCO75	Data Science using python	CCE	EEE,ECE,MECH,CIVIL,ICE, Mechatronics, BME,
18	U20CCO76	Mobile Applications Development using Android	CCE	EEE,ECE,MECH,CIVIL,ICE, Mechatronics, BME,
19	U20ADO75	Data Science Application of NLP	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics
20	U20ADO76	Artificial Intelligence Applications	AIS	EEE, ECE, CSE, IT, ICE, MECH, CIVIL, CCE, BME, CSBS, Mechatronics

EMPLOYABILITY ENHANCEMENT COURSES *

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
1	U20EEC101	Employability Enhancement Course -1 (AutoCad)	0	0	2	-	100	-	100
2	U20EEC201	Employability Enhancement Course -2 (Python)	0	0	2	-	100	-	100
3	U20EEC301	Employability Enhancement Course - 3(Catia/ Creo/ Solidworks /Fusion 360)	0	0	2	-	100	-	100
4	U20EEC401	Employability Enhancement Course - 4 (Catia/ Creo/ Solidworks /Fusion 360)	0	0	2	-	100	-	100
5	U20EEC501	Employability Enhancement Course-5(Automation-I/Ansys)	0	0	2	-	100	-	100
6	U20EEC502	Foreign Language/ IELTS	0	0	2	-	100	-	100
7	U20EEC601	Employability Enhancement Course-6(Automation–II/CFD)	0	0	2	-	100	-	100
8	U20EEC602	Technical Seminar	0	0	2	-	100	-	100
9	U20EEC603	Foreign Language/ IELTS	0	0	2	-	100	-	100
10	U20EEC801	NPTEL/MOOC-II	0	0	2	-	100	-	100

MANDATORY COURSES *

Sl. No.	Course Code	Course Title	Periods			Credits	Max. Marks		
			L	T	P		CAM	ESE	Total
1	U20MEM101	Induction Program	-	-	-	-	-	-	-
2	U20MEM102	Demonstration in Civil Engineering Lab	0	0	2	-	100	-	100
3	U20MEM201	Environmental Science	0	0	2	-	100	-	100
4	U20MEM301	Physical Education	0	0	2	-	100	-	100
5	U20MEM401	Indian Constitution	0	0	2	-	100	-	100
6	U20MEM501	Essence of Indian Traditional Knowledge	0	0	2	-	100	-	100
7	U20MEM601	Professional Ethics	0	0	2	-	100	-	100

SKILL DEVELOPMENT PROGRAM *

1	U20EEC302	Skill Development Program - 1 (Trouble and Troubleshooting of Two wheeler)	0	0	2	-	100	-	100
2	U20EEC402	Skill Development Program - 2 (Trouble and Troubleshooting of Four wheeler)	0	0	2	-	100	-	100
3	U20EEC503	Skill Development Program - 3 (Hands-on Training in 3D Printing)	0	0	2	-	100	-	100

SEMESTER - I

U20BST101	ENGINEERING MATHEMATICS - I (CALCULUS AND LINEAR ALGEBRA)	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To familiarize the concept of matrices.
- To introduce mathematical tools to solve first order differential equations.
- To learn linear differential equations of higher order with constant coefficients.
- To understand the concept of partial differentiation.
- To introduce the concepts of curl, divergence and integration of vectors in vector calculus.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Find eigen values and eigen vectors, diagonalization of a matrix.
CO2 - Solve differential equations.
CO3 - Solve higher order differential equations.
CO4 - Solve different types of partial differential equation.
CO5 - Understand the use of vector calculus.

UNIT I MATRICES (12 Hrs)

Rank of a Matrix- Consistency of system of equations. Eigen values and Eigen vectors of a real matrix - Characteristic equation - Properties of Eigen values and Eigen vectors. Cayley-Hamilton Theorem - Diagonalization of matrices.

UNIT II DIFFERENTIAL EQUATIONS (12 Hrs)

Exact equations, First order linear equations, Bernoulli's equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT III DIFFERENTIAL EQUATIONS (HIGHER ORDER) (12 Hrs)

Linear differential equations of higher order with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients, Solution by variation of parameter method.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Partial derivatives, Total derivatives, Differentiation of implicit functions, Maxima and Minima of two variables. Partial differential equations of higher order with constant coefficients.

UNIT V VECTOR CALCULUS (12 Hrs)

Gradient, divergence and curl - Directional derivative- Irrotational and Solenoidal vector fields - Gauss Divergence Theorem and Stoke's Theorem.

Text Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics ", Wiley, Tenth edition, 2019
2. B.V.Ramana," Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, Sixth edition 2018.
3. N.P. Bali and Manish Goyal," A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 2007.

Reference Books

1. C W. Evans, Engineering Mathematics: A Programmed Approach, 3th Edition,2019
2. Singaravelu. A., "Engineering Mathematics for first year", Meenakshi publications, Tamil Nadu.
3. M.K. Venkataraman, "Engineering Mathematics (Third Year-Part A)", The National Publishing Company, Madras, 2016.
4. S. Narayanan," Differential Equations and Its Applications", Viswanathan, S., Printers & Publishers Pvt Ltd , 2009.
5. Dr.G Balaji., " Engineering Mathematics-I", G.Balaji publishers, 2017

Web References

1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linearalgebra–slides-systemsofquation-handout.pdf
2. http://www.math.cum.edu/~wn0g/2ch6a.pdf
3. https://nptel.ac.in/courses/122/104/122104017/
4. https://nptel.ac.in/courses/111/106/111106051/
5. https://nptel.ac.in/courses/111/108/111108081/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	1	1	-	-	-	-	1	-	-	-
CO2	3	3	2	-	-	-	1	-	-	-	-	1	-	-	-
CO3	3	3	2	-	-	-	1	-	-	-	-	1	-	-	-
CO4	3	2	2	-	-	-	1	-	-	-	-	-	-	-	-
CO5	2	2	1	-	-	-	1	-	-	-	-	-	-	-	-

U20BST106 **PHYSICS FOR MECHANICAL ENGINEERING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- The purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications.
- In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - To understand the general scientific concepts required for technology
CO2 - To apply the Physics concepts in solving engineering problems
CO3 - To educate scientifically the new developments in engineering and technology
CO4 - To emphasize the significance of Green technology through Physics principles

UNIT I SEMICONDUCTOR PHYSICS (9 Hrs)

Semiconductor Physics: Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Carrier transport: Velocity-electric field relations – drift and diffusion transport - Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions – tunnel diode - Schottky diode.

UNIT II ACOUSTICS (9 Hrs)

Acoustics: Intensity – Loudness – Absorption coefficient and its determination – Reverberation – Reverberation time – Factors affecting acoustics of buildings and their remedies – Sources and impacts of noise – Sound level meter – Strategies on controlling noise pollution – Ultrasonic waves and properties – Methods of Ultrasonic production (Magnetostriction and Piezoelectric) – Applications of Ultrasonic in Engineering and medicine.

UNIT III LASERS AND FIBER OPTICS (9 Hrs)

Lasers: Characteristics of Lasers – Einstein's coefficients and their relations – Lasing action – Working principle and components of CO2 Laser, Nd-YAG Laser, Semiconductor diode Laser, Excimer Laser and Free electron Laser – Applications in Remote sensing, holography and optical switching – Mechanism of Laser cooling and trapping.

Fiber Optics: Principle of Optical fiber – Acceptance angle and acceptance cone – Numerical aperture – V-number – Types of optical fibers (Material, Refractive index and mode) – Photonic crystal fibers – Fiber optic communication – Fiber optic sensors.

UNIT IV QUANTUM MECHANICS (9 Hrs)

Quantum mechanics: Inadequacies of Classical Mechanics – Duality nature of electromagnetic radiation – De Broglie hypothesis for matter waves –Heisenberg's uncertainty principle –Schrödinger's wave equation – Particle confinement in 1D box (Infinite Square well potential).

UNIT V GREEN ENERGY PHYSICS (9 Hrs)

Introduction to Green energy – Solar energy: Energy conversion by photovoltaic principle – Solar cells – Wind energy: Basic components and principle of wind energy conversion systems – Ocean energy: Wave energy – Wave energy conversion devices – Tidal energy – single and double basin tidal power plants – Ocean Thermal Electric Conversion (OTEC) – Geothermal energy: Geothermal sources (hydrothermal, geo-pressurized hot dry rocks, magma) – Biomass: Biomass and bio-fuels – bio-energies from wastages – Fuel cells: H2O2 – Futuristic Energy: Hydrogen – Methane Hydrates – Carbon capture and storage (CCS).

Text Books

1. Thiruvadigal.J.D, Ponnusamy.S, Sudha.D. and Krishnamohan.M, "Physics for Technologists", Vibrant Publication, Chennai, 2013
2. DattuR.Joshi, "Engineering Physics", Tata McGraw- Hill, New Delhi, 2010.
3. Gaur, R.K. & Gupta,S.L.Engineering Physicsǁ. Dhanpat Rai Publishers, 2012.

Reference Books

1. Frank Fahy, “Foundations of Engineering Acoustics”, Elsevier Academic Press, 2005.
2. Alberto Sona, “Lasers and their applications”, Gordon and Breach Science Publishers Ltd., 1976.
3. Leonard. I. Schiff, “Quantum Mechanics”, Third Edition, Tata McGraw Hill, 2010.
4. Charles Kittel, "Introduction to Solid State Physics", Wiley India Pvt. Ltd, 7th ed., 2007.
5. Godfrey Boyle, “Renewable Energy: Power sustainable future”, 2nd edition, Oxford University Press, UK, 2004.

Web References

1. https://swayam.gov.in/nd1_noc20_ph15/preview
2. https://swayam.gov.in/nd1_noc20_ph22/preview

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	1	1	-	1	-	1	-	2	-	1	1
CO2	3	2	1	1	-	1	-	-	1	1	-	2	2	1	1
CO3	3		1	-	1	1	-	1	1	1	-	1	1	1	1
CO4	3	1	1	-	-	1	-	-	-	1	-	1	1	-	1
CO5	3	1	-	-	1	2	2	1	1	1	1	2	1	1	1

U20BST107 **MATERIAL SCIENCE AND ENGINEERING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the fundamental concepts of engineering materials, applications and selection of materials.
- To discuss the crystal structure and crystal imperfections
- To compare the difference between ferrous and non-ferrous metals
- To explain the basic fundamentals of polymers and composites
- To illustrate the working of testing machines of materials and its material properties

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Understand the basic fundamentals of engineering materials, structure- properties relations
CO2 - Recognize the basic crystal structure ,metallography , structure identification
CO3 - Select suitable ferrous and non-ferrous materials for Engineering application
CO4 - Understand the polymers, composite properties and its applications
CO5 - Understand the relationship between Microstructure – Properties of materials and evaluate properties of engineering materials

UNIT I INTRODUCTION TO MATERIAL SCIENCE (9 Hrs)

Basics of Engineering Materials, Classifications and Application, Basics of Advance Engineering Materials, Engineering requirements of materials, Structure- Property relationships in Materials- Selection of materials for engineering Applications

UNIT II CRYSTAL STRUCTURE AND DEFECTS (9 Hrs)

Crystal Systems – Bravais Lattices – Coordination Number, Atomic Radius, and Packing Factor for FCC & HCP structures – Miller Indices for a cubic crystal– Metallography – Metallurgical microscopes – specimen preparation- Cooling curves

UNIT III FERROUS AND NON FERROUS METALS (9 Hrs)

Ferrous – steel, cast iron, stainless steel - types- properties & application, Non Ferrous - classification of alloy metals , Copper and its alloy, Aluminum and its alloy, Nickel and its alloy and Lead based alloys, Titanium and its applications

UNIT IV POLYMERS AND COMPOSITE MATERIALS (9 Hrs)

Introduction – Preparation – types - PMMA, PET, PVC- Processing of polymers, Extrusion, Injection molding, Blow molding, Transfer molding, Transfer Molding – Properties of polymers and Applications Composites: Introduction – classification – Polymer Composites - Metal Matrix Composites - Ceramic Matrix Composites – Properties-Applications- Nano Materials- applications

UNIT V PROPERTIES MATERIALS AND TESTING (9 Hrs)

Mechanical properties of materials - Deformation – types - Testing of materials - Destructive: Tensile, compression, torsion, hardness (micro & macro) and impact testing - Non-destructive: Visual inspection, Magnetic Particle Inspection (MPI), Liquid penetrate Inspection (LPI), Eddy current inspection (ECI), Ultra sonic inspection, Radiographic inspection.

Text Books

1. V.Raghavan, Materials Science And Engineering: A First Course, Prentice Hall India Pvt. Ltd., New Delhi, 6th edition, 2016
2. R. K. Rajput, Engineering Materials & Metallurgy, S. Chand Limited, 2010
3. O.P.Khanna , - Material Science & Metallurgy 2nd Edition, DhanpatRai& Co, 2nd Edition, 2014

Reference Books

1. George E.Dieter -Mechanical Metallurgy, McGraw hill 3rd Edition, 2017
2. Sidney H Avner, “Introduction to Physical Metallurgy, Tata McGraw Hill Publishing Company Limited, 2009
3. Donald R. Askeland, Wendelin J. Wright - The Science and Engineering of Materials, Global Engineering publication, seventh edition, 2017
4. Sidney Avner, Introduction to Physical Metallurgy, Tata McGraw Hill, Second Edition, 2017

5. William D. Callister, David G. Rethwisch - Fundamentals of Materials Science and Engineering: An Integrated Approach, 5th Edition, 2016

Web References

1. https://nptel.ac.in/courses/113102080/
2. https://nptel.ac.in/courses/113105021/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	1	-	1	-	1	-	1	1	1	1
CO2	3	1	-	-	1	-	-	1	-	1	-	1	1	1	1
CO3	3	-	-	-	-	1	-	1	-	1	-	2	-	-	1
CO4	3	-	2	1	-	1	1	1	-	1	1	2	1	1	1
CO5	3	2	2	1	2	1	-	1	2	2	1	2	1	1	1

U20EST117	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	48

Course Objectives

- To introduce fundamental concepts, various laws and principles associated with electrical circuits and its analysis.
- To provide knowledge about the various factors in AC circuits and resonance condition.
- To introduce the concept of electrical safety, power system and working of transformers and motors.
- To understand the characteristics and applications of semiconductor devices
- To provide the basic knowledge in analog electronics
- To understand the purpose of communication and acquire knowledge on different communication systems

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Analyze the basic concepts, various laws and theorems used in DC circuits.
CO2 - Analyze and solve the AC circuits and develop resonance circuits for transmitter and receiver circuits.
CO3 - Gain the knowledge of power system, importance of electrical safety measures and application of transformers and motors in real time.
CO 4 - Understand the importance of semiconductor devices and its applications
CO 5 - Understand the characteristics and operation of BJT and FETs.
CO 6 - Awareness towards different Communication Systems.

PART A - ELECTRICAL ENGINEERING

UNIT I D.C CIRCUITS AND NETWORK THEOREMS (8 Hrs)

Concept of Potential difference, voltage, current, work, Power, Energy, Electric networks, voltage source and current sources, linear passive and active elements, current-voltage relation, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Simplifications of networks using series-parallel, Star/Delta transformation. Network Theorem – Superposition, Thevenin's, Norton's and Maximum Power Transfer.

UNIT II AC CIRCUITS (8 Hrs)

AC waveform- definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in Polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, Resonance in series and parallel circuits, bandwidth and quality factors,3 phase Balanced AC Circuits (Y-Δ & Y-Y)-power Measurement –two Wattmeter method

UNIT III ELECTRICAL SAFETY AND ELECTRICAL MACHINES (8Hrs)

Layout of electrical power system and its functions, Safety devices and systems, Types of domestic wiring, Wiring Accessories, Necessity of earthing, insulators, cables, fuse and circuit breakers.

Law of Electromagnetic induction, Auto transformer, Single phase transformer- load test –OC and SC test, Fleming's Right & Left hand rule – construction, principle, load test and performance characteristics of rotating machines – DC Motor & DC Generator - single phase/three phase induction motor , Alternator and synchronous motor (Qualitative approach only)

PART B - ELECTRONICS ENGINEERING

UNIT IV SEMICONDUCTOR DIODES AND APPLICATIONS (8 Hrs)

Introduction semiconductor materials-Doping-Intrinsic and Extrinsic Semiconductor –PN junction diode, structure, characteristics-diffusion and depletion capacitance-Rectifier, Half wave and Full wave rectifier-zener diode characteristics-zener diode as regulator –Light Emitting Diode(LED)-Solar Panel

UNIT V TRANSISTORS (8 Hrs)

Bipolar Junction Transistor-construction-operation-Common Base, Common Emitter, Common collector Configuration-characteristics - Biasing- numerical application- Junction Field Effect Transistor(JFET), Metal oxide semiconductor Field Effect Transistor, EMOSFET-DMOSFET operation characteristics-Numerical applications

UNIT VI COMMUNICATION SYSTEMS (8 Hrs)

Need for Modulation – Block diagram of analog communication System - AM, FM, PM Definitions and Waveforms – Comparison of digital and analog communication system- Block diagram of digital communication system – Electromagnetic Spectrum. Wired and wireless Channel – Block diagram of communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.

Text Books

1. Sudhakar.A and Shyam Mohan.S.P, “Circuits and Networks Analysis and Synthesis”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th edition, 2010.
2. D.P.Kothari and I.J. Nagrath, “Electric Machines”, Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. A.E.Fitzgerald, Charles Kingsley, Stephen. D. Umans, “Electric Machinery”, Tata Mcgraw Hill, New Delhi, 7th Edition, 2013.
4. Theraja B. L and Theraja A. K., “A Textbook of Electrical Technology”, Vol. II, S Chand & Co. Ltd., New Delhi, 2009
5. V. K. Metha, Rohit Metha, “Basic Electrical Engineering”, S. Chand & Co, 5th Edition, 2012.
6. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, “Electrical and Electronics Technology”, Pearson Education Limited, New Delhi, 2010.

Reference Books

1. V. Del Toro, “Electrical Engineering Fundamentals”, Pearson Education India, New Delhi, 2nd Edition, 2015.
2. A.E.Fitzgerald, Charles Kingsley, Stephen. D. Umans, “Electric Machinery”, Tata Mcgraw Hill, New Delhi, 7th Edition, 2013.
3. William H Hayt, J. E. Kemmerly and Steven M Durbin, “Engineering Circuit Analysis”, McGraw Hill, 8th Edition, 201
4. A T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011
5. S.K. Sahdev, “Fundamentals of Electrical Engineering and Electronics”, DhanpatRai and Co, 2013.
6. Wayne Tomasi, “Electronic Communication Systems- Fundamentals Theory Advanced”, Fourth Edition, Pearson Education, 2001.

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1. https://www.electrical4u.com/
2. https://nptel.ac.in/courses/108/102/108102146/
3. http://electrical-engineering-portal.com/
4. https://www.javatpoint.com/electrical-machines-tutorial
5. http://www.electronics-tutorials.ws
6. http://www.eeweb.com/articles

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	1	-	-	1	-	2	1	2	2	1
CO2	3	3	3	3	-	1	-	-	1	-	2	1	2	2	1
CO3	3	3	3	2	-	-	2	-	1	-	1	2	2	2	1
CO4	3	3	3	2	-	-	-	-	1	-	1	-	2	2	1
CO5	3	2	3	3	-	1	-	-	-	-	1	-	2	2	1
CO6	3	3	3	3	-	1	-	-	1	-	2	1	2	2	1

U20EST119 **ENGINEERING MECHANICS**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the basics of force and moment, static equilibrium of particles in two and three dimensions.
- To examine the equilibrium of rigid bodies and components of a moment.
- To discuss the properties of surfaces and solids.
- To integrate the relationship between the motion of bodies
- To associate the various structural analysis and load on system of rigid bodies.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Recognize the basics of equilibrium of particles in 2D and 3D
CO2 - Review the requirements of equilibrium of rigid bodies in 2D and 3D
CO3 - Compute the center of mass and moment of inertia of surfaces and solids
CO4 - Predict displacement, velocity and acceleration of dynamic particles
CO5 - Solve for friction force and rigid body dynamics

UNIT I BASICS AND STATICS OF PARTICLES (9 Hrs)

Introduction - Units and Dimensions - Vectorial representation of forces and moments –Coplanar Forces - Laws of Mechanics - Lame's theorem, Parallelogram and triangular Law of forces -Resolution and Composition of forces -Equilibrium of a particle - Principle of transmissibility -Single equivalent force - Free body diagram

UNIT II EQUILIBRIUM OF RIGID BODIES (9 Hrs)

Types of supports and their reactions -requirements of stable equilibrium -Moments and Couples -Moment of a force about a point and about an axis -Vectorial representation of moments and couples - Scalar components of a moment -Varignon's theorem -Equilibrium of Rigid bodies in two dimensions –Forces in space -Equilibrium of a particle in space - Equivalent systems of forces - Equilibrium of Rigid bodies in three dimensions –Examples.

UNIT III PROPERTIES OF SURFACES AND SOLIDS (9 Hrs)

Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas- Parallel axis theorem and perpendicular axis theorem, radius of gyration of area- product of inertia- mass moment of inertia.

UNIT IV DYNAMICS OF PARTICLES AND FRICTION (9 Hrs)

Displacements, Velocity and acceleration, their relationship - Relative motion -Curvilinear motion -Newton's law -Work Energy Equation of particles -Impulse and Momentum -Impact of elastic bodies.

Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction -wedge friction- Rolling resistance

UNIT V STRUCTURAL ANALYSIS OF TRUSSES AND RIGID BODY DYNAMICS (9 Hrs)

Trusses: - Definition of a truss - Simple Trusses - Analysis of Trusses - Method of joints- Method of sections. - Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

Text Books

1. Beer, F.P and Johnston Jr. E.R. "Vector Mechanics for Engineers", McGraw-Hill Education 11th Edition (India) Pvt Ltd. (2016). (Unit I,II,III,IV,V)
2. J.L.Meriam & L.G. Karidge, Engineering Volume I) and Engineering Mechanics: Dynamics, 8th edition, Wiley student edition, 2016. (I,II,III)
3. Hibbeller, R.C., "Engineering Mechanics", 14th edition, Prentice hall (2016). (Unit I,II,III,IV,V)

Reference Books

1. Arthur P. Boresi and Richard J. Schmidt, "Engineering Mechanics: Statics and Dynamics", Thomson Asia Private Limited, Singapore, 2010. (Unit I,II,III,IV,V)
2. D.P.Sharma "Engineering Mechanics", Dorling Kindersley (India) Pvt. Ltd, New Delhi (Unit ,II,III,IV,V), 2010

3. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2012. (Unit I,II,III,IV,V)
4. Bhavikatti,S.S and K.G. Rajashekarappa, Engineering Mechanics, New Age International(p) Ltd, New Delhi, 2019,7th Edition (Unit I,II,III,IV,V)
5. Dr.I.SGujral “Engineering Mechanical” second edition, Lakshmi Publication (P).Ltd. (Unit I,II,III,IV,V), 2011
6. Vela Murali, “Engineering Mechanics”, Oxford University Press(Unit I,II,III,IV,V), 2010

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2. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR / engg. mechanics /ui/ Table of Contents.html

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO2	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO3	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO4	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO5	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1

U20ESP118	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To introduce practical knowledge for the analysis of laws and theorems.
- To provide the methods to evaluate and test the devices and machines.
- To study VI characteristics of Diodes
- To understand Input and output characteristics of Transistors and FETs

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Implement the network theorems and validate the results through simulation.
CO2 - Develop the various wiring diagrams for house, industries etc
CO3 - Estimate the performance of DC and induction motor by conducting load and no load tests.
CO4 - Describe characteristics of semiconductor diode and utilize it for different applications
CO5 - Impart characteristics of transistor for various applications

List of Experiments

PART – A ELECTRICAL EXPERIMENTS

Demonstration on Sources, Ammeters, Voltmeters, Wattmeters, Energy meters and Transducers are Pre Requisite for conducting this electrical engineering Lab.

1. Domestic Wiring Practice
    - Staircase wiring
    - Doctor's room wiring
    - Godown wiring
    - Ceiling fan and fluorescent lamp wiring
2. Verification of Network Theorems (simulation and experimental)
3. Determination of resistance temperature coefficient
4. Simulation of R-L-C Series Circuit for XL>XC, XC<XL
5. Load test on single phase transformer.
6. Measurement of 3-phase power using two wattmeter methods.
7. Load test on DC shunt motor.
8. Load test on single phase induction motor.

PART – B ELECTRONICS EXPERIMENTS

1. Study of Electronic components and equipments: Resistor, Capacitor
2. Measurement of AC signal parameter (Peak-Peak, rms period, frequency) using CRO.
3. VI Characteristics of PN junction diode, Zener diode
4. Input and output characteristics of Common Emitter configuration of BJT
5. Characteristics of JFET
6. Measurement of Ripple factor of HWR

Reference Books

1. Sudhakar.A and Shyam Mohan.S.P, "Circuits and Networks Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th edition, 2010.
2. D.P.Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, Electrical and Electronics Technology, Pearson Education Limited, New Delhi, 10 th edition 2010.
4. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, "Electrical and Electronics Technology", Pearson Education Limited, New Delhi, 10 th edition 2010
5. David Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	2	-	2	2	1
CO2	3	3	3	3	2	-	1	-	2	-	3	1	2	2	1
CO3	3	3	2	3	-	-	1	-	2	-	2	-	2	2	1
CO4	3	2	2	2	-	-	-	-	-	-	2	-	2	2	1
CO5	3	2	2	3	-	-	-	-	1	-	1	-	2	2	1

U20ESP120	ENGINEERING MECHANICS LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To learn the law of forces, principle of moments and equilibrium of forces
- To interpret the axial forces acting in the truss members and compute centroid of a lamina
- To compute the coefficient of friction and verify Newton's law of motion
- To study the concept of moment of inertia of a flywheel
- To understand the concept of conservation of energy

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Applies the concept of law of forces, principle of moments and equilibrium of forces
CO2 - Computes the axial forces acting in the truss members and centroid of a lamina
CO3 - Applies the coefficient of friction and Newton's law of motion
CO4 - Infers about the concept of moment of inertia of a flywheel
CO5 - Demonstrates the concept of conservation of energy

List of Experiments

1. Verification of triangle law & parallelogram law of forces
2. Verification of polygon law of forces
3. Verification of the Principle of Moments using the Bell Crank Lever apparatus
4. Verification of support reactions of a simply supported beam
5. Verification of condition of equilibrium of a system of forces
6. Verification of equilibrium of three dimensional forces.
7. Verification of axial forces in the members of a truss
8. Verification of centroid of different lamina
9. Determination of coefficient of friction between two surfaces
10. Verification of newton's laws of motion
11. Determination of moment of inertia of a flywheel
12. Verification of motion parameters using conservation of energy.

Reference Books

1. Dr.A.K.Gupta, Mohit Bhoot, Engineering mechanics laboratory manual, Scientific Publishers, 2015
2. A.K.Sharma, Engineering mechanics practicals, University Science Press, 2009
3. U.C.Jindal, Basics of Engineering Mechanics, Galgotia Publications,2002

Web Resources

1. https://nptel.ac.in/courses/112/106/112106286/
2. https://www.coursera.org/learn/engineering-mechanics-statics

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO2	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO3	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO4	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1
CO5	3	2	2	1	1	-	-	-	-	-	-	1	2	2	1

U20ESP121 **ENGINEERING PRACTICE LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To provide exposure to the students with hands on experience on basic engineering practices in Mechanical Engineering.
- To impart knowledge and skill to use tools, machines, equipment, and measuring instruments.
- Educate students of Safe handling of machines and tools.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Get exposure regarding pipe connection for pumps & turbines

CO2 - Students will get hands on experience on basic machining techniques

CO3 - Illustrate on centrifugal pump, Air conditioner and Lathe.

List of Experiments

BASIC MACHINING

(a) Plain Turning and Facing
(b) Step Turning
(c) Taper turning
(d) Thread cutting
(e) Eccentric turning
(f) Drilling and boring
(g) Tapping

MACHINE ASSEMBLY PRACTICE

(a) Study of centrifugal pump
(b) Study of air conditioner

DEMONSTRATION ON

(a) Fitting – Exercises – Preparation of square fitting and V – fitting models.

Reference Books

1. HS Bawa, Workshop Practices, Tata Mc Graw Hill Publishing Co Ltd, 2015
2. S.K. Hajra Choudhury, A. K. Hajra Choudhury, “Elements of Workshop Technology”, Vol I:Manufacturing Processes, 15th Edition Reprinted, Media Promoters & Publishers Pvt Ltd.,2013
3. D.Sathish, Engineering Workshop Practices Laboratory Manual, Notion press publisher, 2019
4. R.K. Rajput, Workshop Practice, Published by Laxmi Publications Pvt. Ltd. 2011
5. RS Khurmi and JK Gupta, Basics of Workshop Practice, S Chand Publisher, 2011

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	3	1	1	1	3	-	-	2	3	-	1
CO2	2	1	-	-	3	1	1	1	3	-	-	2	3	-	1
CO3	2	1	-	-	3	1	1	1	3	-	-	2	3	-	1

SEMESTER II

U20BST215	ENGINEERING MATHEMATICS II (MULTIPLE INTEGRALS AND TRANSFORMS)	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To develop logical thinking and analytic skills in evaluating multiple integrals.
- To equip themselves familiar with Laplace transform and solve the differential equations using Laplace transform techniques.
- To enable the students to expand functions into Fourier series using change of intervals.
- To gain good knowledge in application of Fourier transform.
- To inculcate the computational knowledge in Z-transforms.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Understand the concept of double and triple integrals.
CO2 - Find Laplace transform and inverse transform of simple functions.
CO3 - Convert a periodic function into series form.
CO4 - Compute Fourier transforms of various functions.
CO5 - Solve difference equations using Z- transforms.

UNIT I MULTIPLE INTEGRALS (12 Hrs)

Multiple Integrals, change of order of integration and change of variables in double integrals (Cartesian to polar). Applications: Areas by double integration and volumes by triple integration (Cartesian and polar).

UNIT II LAPLACE TRANSFORMS AND INVERSE LAPLACE TRANSFORMS (12 Hrs)

Definition, Transforms of elementary functions, properties. Transform of derivatives and integrals. Multiplication by t and division by t. Transform of unit step function, transform of periodic functions. Initial and final value theorems, Methods for determining inverse Laplace Transforms, Convolution theorem, Application to differential equations and integral equations. Evaluation of integrals by Laplace transforms.

UNIT III FOURIER SERIES (12 Hrs

Dirichlet's conditions – General Fourier series – Expansion of periodic function into Fourier series – Fourier series for odd and even functions – Half-range Fourier cosine and sine series – Change of interval – Related problems.

UNIT IV FOURIER TRANSFORMS (12 Hrs)

Fourier Integral theorem Fourier transform and its inverse, properties. Fourier sine and cosine transforms their properties, Convolution and Parseval's identity.

UNIT V Z - TRANSFORMS (12 Hrs)

Difference equations, basic definition, z-transform - definition, Standard z-transforms, Damping rule, Shifting rule, Initial value and final value theorems and problems, Inverse z-transform. Applications of z-transforms to solve difference equations.

Text Books

1. Ravish R Singh and Mukul Bhatt, "Engineering Mathematics", Tata McGraw Hill, 1st Edition, New Delhi, 2016.
2. Sivaramakrishna Das P. and Vijayakumar C., "Engineering Mathematics", Pearsons, New Delhi, 2017.
3. Ramana B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill, New Delhi 2018
4. M.D.Petale, "A text book on Z- Transforms (Engineering Mathematics)", Bames and Noble, New Edition, 2020.
5. Dr.G.Balaji, "Transforms and Partial Differential Equations", Balaji Publication,11th Edition,2017

Reference Books

1. Dass .H.K, “Advanced Engineering Mathematics”, S. Chand & co, New Delhi, 2019.
2. Bali N.P. and Dr. Manish Goyal, “Engineering Mathematics”, Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, New Delhi, 10th Edition. 2019.
4. Gupta .C.B, Shree Ram Singh, M. Kumar, “Engineering Mathematics for semester I & II”, Tata McGraw Hill, New Delhi, 2015.
5. Ramana B.V.”Higher Engineering Mathematics”, Tata Mc Graw Hill, New Delhi 2018.

Web References

1. https://nptel.ac.in/courses/111105121**/**
2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/111107119/
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103/111103021/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	-	-	-	-	1	1	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	1	1	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	1	1	-	-	-	-
CO4	3	2	2	1	-	-	-	-	-	1	1	-	-	-	-
CO5	2	2	1	1	-	-	-	-	-	1	1	-	-	-	-

U20EST201 **PROGRAMMING IN C**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the Fundamentals of Computers and introduction to C language.
- To study about the programs using Control structures.
- To understand programs using looping and arrays.
- To understand the concepts of Functions and Pointers.
- To study about Structure, Union and File Management Operations in C.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Develop simple applications in C using basic constructs.
CO2 - Incorporating the use of sequential, selection and repetition control structures into a program.
CO3 - Develop simple programs using looping and arrays.
CO4 - Design and develop programs using Functions and Pointers.
CO5 - Design and develop programs using Structure, Union and understand the concepts of file management operations.

UNIT I INTRODUCTION TO C (9 Hrs)

C programming: Overview of C- Visual Studio code - Constants- Compiling a C Program -Variables and Data Types-Technical Difference between Keywords and Identifiers--Types of C Qualifiers and format specifies - Operators and Expressions-Operators Precedence-Type conversion-Input-Output Statements.

UNIT II DECISION MAKING (9 Hrs)

Decision making and branching- Relational operators – Logical operators- if – if else-if else if –nested if. Switch-case.

UNIT III LOOPING AND ARRAYS (9 Hrs)

Looping: while - do while – for – break – continue - nested loop. Arrays: One Dimensional Arrays-Two-Dimensional Arrays-Multi-Dimensional Array-Dynamic arrays-Character Arrays and String-Sorting - Searching.

UNIT IV FUNCTIONS, POINTERS (9 Hrs)

Functions: Introduction - Definition – Declaration – Categories of Functions - Nesting of Functions, Recursive functions - Passing Arrays to Functions - Strings – String library function. Pointers: Introduction - Declaring Pointer Variables - Initialization of Pointer Variables - Accessing the address of a variable - Accessing a variable thorough Pointer - Chain of Pointers - Pointer Expressions - Pointers and arrays – Pointers and functions – Call by Reference - Pointers and character strings - Array of Pointers - Pointers and Structures.

UNIT V STRUCTURES AND UNIONS, FILE MANAGEMENT (9 Hrs)

User defined data types: Introduction – Structure: definition - declaration - Arrays of Structures – Nested structures – Passing structures to functions –– Union - Enumeration and Typedef. Introduction to File Handling in C, Input and Output operations on a file – Error Handling - Random access to files – command line arguments. Introduction to pre-processor – Macro substitution directives – File inclusion directives –conditional compilation directives – Miscellaneous directives.

Text Books

1. E.Balagurusamy, “Programming in ANSI C”, Tata McGraw Hill, 8th Edition, 2019.
2. Herbert Schildt,” C: The Complete Reference”, McGraw Hill, Fourth Edition, 2014.
3. Yashvant Kanetkar, “Let us C”, BPB Publications, 16th Edition, 2017.

Reference Books

1. Ashok N Kamthane, “Computer Programming”, Pearson education, Second Impression, 2012.
2. Vikas Verma, “A Workbook on C “, Cengage Learning, Second Edition, 2012.
3. Dr. P. Rizwan Ahmed, “Office Automation”, Margham Publications, 2016.
4. P.Visu, R.Srinivasan and S.Koteeswaran, “Fundamentals of Computing and Programming”, Fourth Edition, Sri Krishna Publications, 2012.
5. Pradip Dev, Manas Ghoush, “Programming in C”, Second Edition, Oxford University Press, 2011.

Web References

1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c
5. https://nptel.ac.in/courses/106/104/106104128/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	2	2	-	2	1	2	2	3	1	3	2
CO2	3	3	3	3	2	1	1	3	3	-	3	3	3	3	3
CO3	3	3	3	3	2	1	2	3	-	-	3	-	3	3	3
CO4	3	3	3	3	2	1	2	-	-	3	3	-	3	3	3
CO5	3	3	3	3	2	1	2	3	3	3	3	3	3	3	3

U20MET201 **MANUFACTURING PROCESSES**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To impart knowledge in casting technology and foundry shop
- To familiarize various metal joining processes
- To specify the bulk deformation processes
- To impart knowledge on various surface finishing processes
- To learn about the various plastics manufacturing techniques

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Acquire complete knowledge about casting
CO2 - Manipulate the principles of metal joining processes
CO3 - Identify the process of bulk deformation
CO4 - Understand the various surface finishing processes
CO5 - Classify the manufacturing methods of plastics

UNIT I CASTING PROCESSES (9 Hrs)

Introduction to Molding and Casting. Molding sand: types, properties, preparation of dry and green sand molding. Pattern making: Pattern materials, types and allowances. Core making: types of core, core materials, making of cores. Casting methods: Die casting, Centrifugal Castings, Investment Casting and Shell mold Casting. Defects in casting.

UNIT II JOINING PROCESSES (9 Hrs)

Fusion welding processes-Types of Gas Welding-, Oxy-Acetylene Welding Equipment-Flame characteristics - Electric-Arc Welding, Electrodes, manual metal arc welding, Carbon Arc Welding, Inert-Gas Shielded Arc Welding, Tungsten Inert-Gas Welding (TIG), Gas Metal-Arc Welding (GMAW), Submerged Arc-Welding (SAW), Resistance Welding and its types and applications-Welding Defects. Soldering and Brazing- welding of non-metals.

UNIT III BULK DEFORMATION PROCESSES (9 Hrs)

Hot working and cold working of metals-Forging processes-Open, impression and closed die forging-types of Forging machines-Typical forging operations-Swaging-Rolling of metals-Types of rolling mills- Defects in rolled parts-principle of rod and wire drawing-Tube drawing-Principles of extrusion-Types of Extrusion-hot and cold extrusion-Equipment's used. Sheet metal work– Shearing- Bending – Drawing.

UNIT IV SURFACE FINISHING PROCESSES (9 Hrs)

Surface finishing processes- surface finish and Roughness-Honing-Lapping- Abrasive belt finishing. Polishing-Buffing-Grinding-Types-size and specification of grinding - Grinding fluids- grinding speed, feed and Depth of cut.

UNIT V PLASTIC MANUFACTURING (9 Hrs)

Plastics and polymers – structure of polymers – additives in plastics – thermoplastics and thermosetting plastics – manufacturing of plastic products – different moulding methods – forming or shaping methods – laminating methods – machining of plastics – joining plastics – industrial applications of plastics.

Text Books

1. Rao P.N., "Manufacturing Technology, Volume I & II", Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition, 2018.
2. B.S.Nagendra Parashar & R.K.Mittal – Elements of Manufacturing Processes, Prentice Hall India Pvt. Ltd., 2003.
3. P.C Sharma, "A Text Book of Manufacturing - I" S Chand & Company Pvt Ltd, 2008
4. Rajput R.K., "A Text Book of Manufacturing Technology", Laxmi Publications, New Delhi, 2nd edition, 2017

Reference Books

1. Kaushish J.P., “Manufacturing Processes”, Second Edition, PHI Learning Pvt. Ltd., 2013.
2. Kalpakjian. S and Schmid. R, “Manufacturing Engineering and Technology”, Seventh Edition, Pearson Education India Edition, 2013.
3. Adithan. M and Gupta. A.B., “Manufacturing Technology”, New Age, Fifth Edition, 2012.
4. H.M.T. Production Technology – Handbook”, Tata McGraw-Hill, First Edition, 2001.
5. Jain. R.K. and S.C. Gupta, “Production Technology”, Khanna Publishers, Sixteenth Edition, 2001.
6. S.K.Hajra Choudry - Workshop Technology, Vol. - I, & II, Media Promoters and Publishers Pvt. Ltd., 2009.

Web References

1. https://nptel.ac.in/courses/112/107/112107219/#

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	2	2	1	1	-	1	-	2	1	2	2
CO2	3	1	2	2	2	3	2	1	1	1	-	2	2	2	2
CO3	3	2	2	1	2	2	1	1	1	1	-	1	1	1	2
CO4	3	2	2	2	1	2	2	1	1	1	1	1	1	2	1
CO5	3	2	2	2	2	2	2	1	2	1	1	2	2	1	2

U20MET202 **ENGINEERING METALLURGY**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To learn solidification structure, solid solution and allotropy of metals
- To learn the phase diagrams, various reactions and properties of steel
- To learn about the heat treatment and its importance real applications.
- To learn about Recovery, Recrystallization and Grain Growth .
- To learn the deformation and failures of metals.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Understand the fundamentals of solidification, metal structure, solid solution metals
CO2 - Recognize the phase diagram and equilibrium diagram with reactions
CO3 - Understand the basic fundamentals of heat treatment and importance in metals
CO4 - Recognize crystal structure, nucleation, recovery and grain growth
CO5 - Understand and analysis the behavior of engineering materials and prevention the failures

UNIT I SOLIDIFICATION AND THEORY OF ALLOYS (9 Hrs)

Mechanism of crystallization, solidification of metals: pure metals and alloys, concept of super cooling, Nucleation: homogenous nucleation and heterogeneous nucleation. Solid solutions : Substitution solid solution-Interstitial solid solution, Hume-Rothery Rule, Lever Rule-Allotropy

UNIT II PHASE DIAGRAM AND IRON- CARBON EQUILIBRIUM DIAGRAM (9 Hrs)

Construction and interpretation of binary phase diagrams – Types – Eutectic, Eutectoid, Peritectic and Peritectoid systems – Iron Carbon equilibrium diagrams – classification of steels and alloy steels – types, manufacturing methods, properties and applications of cast irons.

UNIT III HEAT TREATMENT OF STEELS (9 Hrs)

Introduction to heat treatment- Classifications, Heat treatment of ferritic steels: constant temperature transformation-Continuous cooling curves-Important of heat treatment of steels- Surface Hardening process: classifications- Martempering and Austempering - Heat treatment of stainless steel: austenite stainless steel and Duplex stainless steel- shot peening-laser peening

UNIT IV RECOVERY , RECRYSTALLIZATION AND GRAIN GROWTH (9 Hrs)

Introduction to recovery and recrystallization , recrystallization of time and temperature, Degree of cold work and hot work, recrystallization of original grain growth, laws of recrystallization, Factors affecting rate of recrystallization - Grain growth - normal grain growth and abnormal grain growth- grain orientation- Factors affecting rate of grain growth

UNIT V DEFORMATION AND FAILURES OF METALS (9 Hrs)

Introduction deformation- types-strengthening mechanism of alloys, - ductile and brittle behavior of metals-Ductile to brittle transition- fracture modes – mechanism creep behavior- creep life predictions- fatigue behavior- S-N Curve-design against creep and fatigue

Text Books

1. A.Lavakumar, Concept of in physical metallurgy, Morgan & clay publication,2017
2. Srinivasan, Engg Materials And Mettalurgy, Tata McGraw-Hill Education,2nd edition,2015
3. S. K. Mandal, Steel Metallurgy: Properties, Specifications and Applications, McGraw-Hill Education,2014

Reference Books

1. Romesh C. Sharma, Principles of heat treatment of steels, New Age International, 2010
2. Sidney H. Avner, Introduction to Physical Metallurgy, Tata Mcgraw-Hill Publishing company Ltd, 2nd Edition 2008
3. Kannadi Palankeezhe Balan, Metallurgical Failure Analysis, Elsevier,2018
4. L. Krishna reddy, Principles of Engineering Metallurgy, New Age Publishing Company Ltd, 10th Edition 2011
5. William E. Hosford, Physical Metallurgy, Taylor and Francis , 1st Edition 2018

Web References

1. https://nptel.ac.in/courses/113106088/
2. https://nptel.ac.in/courses/113104074/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	1	1	-	1	-	2	2	1	2
CO2	3	2	-	2	-	1	-	1	-	1	-	2	-	1	2
CO3	3	1	2	2	-	1	1	1	-	1	-	2	1	1	2
CO4	3	1	-	-	-	1	-	1	-	1	-	2	1	2	1
CO5	3	2	2	2	2	2	-	1	2	2	2	3	1	2	2

U20MET203 **CONCEPTS OF ENGINEERING DESIGN**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To provide a board overview of generic concept of design, weld symbols and standards.
- To enable students to attain knowledge on design principles.
- To define various engineering materials and properties.
- To impart knowledge on stress, strain and various failures theory.
- To understand the applications of green design in manufacturing industry.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Comprehend the concepts of work, energy, torque, power and free body diagrams.
CO2 - Understand various design principles.
CO3 - Explain different classes of material and their properties
CO4 - Illustrate the various loading and failures theory methods.
CO5 - Exposed to light engineering product and green design process.

UNIT I DESIGN CONSIDERATION (9 Hrs)

Review of basics of work, energy, torque, power, load analysis, equilibrium equations, free-body diagrams, internal loads, force flow concept, locating critical sections, practical considerations, Fits and tolerances, surface roughness, weld symbols, process capability.

UNIT II DESIGN PRINCIPLES (9 Hrs)

Occam's Razor, Saint-Venant's Principle, Golden Rectangle, Abbe's Principle, Maxwell's Reciprocity Theorem, Self-Principles, Stability, Symmetry, Parallel Axis theorem, Accuracy, Repeatability, Resolution, Sensitivity direction, Fool Proofing, mind maps.

UNIT III MATERIALS AND THEIR PROPERTIES (9 Hrs)

Engineering materials and their classification: Metals, Ceramics and polymers, Stress-strain diagrams of metallic, Ceramics and polymers materials, Moduli of elasticity, Poisson's ratio, shear modulus – material strength, resilience & toughness, thermal conductivity, linear thermal expansion coefficient, specific heat capacity.

UNIT IV TYPES OF LOADING AND FRACTURE MECHANICS (9 Hrs)

Normal stress & strain, torsion, power transfer, bending stress & strain, curved member, transverse shear stress & strain, stress concentration. Modes of crack displacement, fracture toughness, failure prediction – maximum shear-stress theory, distortion – energy theory, maximum normal stress theory, modified Mohr theory.

UNIT V GREEN DESIGN PROCESS (9 Hrs)

Comparison of materials, material saving by form design, possible weight and cost reduction, design concepts for light engineering products, Material life cycle, embodied energy, 80-20 rule, carbon footprint, green design in industry, sustainability, biomimetics.

Text Books

1. Dieter, George E., Engineering Design - "A Materials and Processing Approach", McGraw Hill International Editions, Singapore, 3rd Edition, 2000.
2. Karl T. Ulrich and Steven D. Eppinger "Product Design and Development" McGraw Hill Edition 4 th edition 2009.
3. Mark N. Horenstein. ''Design Concepts for Engineers'' 5th Edition, Pearson. 2016.
4. Sumesh Krishnan and Mukul Shukla. ''Concepts in Engineering Design'' 1st Edition Notion Press,Inc 2016.
5. Atif Aziz. ''Concepts in Engineering Design'' 1st Edition New Age International, 2017.

Reference Books

1. Michael Ashby, Hugh Shercliff and David Cebon, "Materials Engineering, Science, Processing and Design", Butterworth Heinemann, 2009.

2. Robert C Juvinall, “Fundamentals of Machine Component Design”, Wiley, 2011.
3. George Dieter,Linda Schmidt, ‘‘Engineering Design’ ‘ Fifth Edition McGraw 2012.
4. Yousef Haik, Tamer M. Shahin, ‘‘Engineering Design Process’’ Second Edition .Cengage learning, 2016.
5. Aarron Walter,’’ Principles of product design’ Design better, 2019.

Web References

1. https://nptel.ac.in/courses/107/108/107108010/
2. https://nptel.ac.in/courses/113/104/113104096/
3. https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-842

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	2	1	-	1	2	-	3	1	2	2
CO2	3	1	1	2	2	2	1	2	1	2	-	2	1	2	1
CO3	3	1	2	2	2	1	2	1	2	2	-	2	2	1	1
CO4	3	2	2	2	3	2	2	1	2	2	-	2	2	1	2
CO5	3	2	2	3	2	2	2	2	2	2	2	3	2	2	2

U20MET204 **ENGINEERING THERMODYNAMICS**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the basic concepts and the laws of thermodynamics.
- To know the second law of thermodynamics and energy concepts in the energy systems.
- To know the properties of pure substances and vapour power cycles.
- To gain the basic knowledge of ideal gas, real gas and thermodynamic relations.
- To learn basic concepts of the psychometric and refrigeration cycles.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Explain the basic concepts and laws of thermodynamics
CO2 - Illustrate the second law and energy concepts in the thermodynamic devices.
CO3 - Apply the concepts of pure substances in vapour power cycles.
CO4 - Categorize ideal gas, real gas and thermodynamic relations.
CO5 - Evaluate problems in the psychometric and refrigeration cycles.

UNIT I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS (9 Hrs)

Systems and control volume – Properties, processes and cycles – Thermodynamic equilibrium – Path function and point function – Quasi-static process – Zeroth law of thermodynamics – Work transfer – pdV work or displacement work – Heat transfer – Heat transfer, a path function – Specific heats – First law for a closed system undergoing a cycle and a change of state – Energy-a property of the system – Enthalpy – Energy of an isolated system – Perpetual Motion Machine of the First kind – First law applied to non-flow and flow processes.

UNIT II SECOND LAW OF THERMODYNAMICS AND EXERGY (9 Hrs)

Energy reservoirs – Heat engines – Kelvin-Planck and Clausius statements of the Second law – Refrigerator and Heat pump – Equivalence of Kelvin-Planck and Clausius statements – Reversibility and Irreversibility – Carnot cycle – Reversed Heat engine – Carnot's Theorem – Entropy – the Inequality of Clausius – Entropy generation in closed and open systems – Entropy and disorder – Concept of absolute entropy – Exergy – Exergy of closed and Steady flow systems – Irreversibility – Exergy balance – Second law efficiency.

UNIT III PROPERTIES OF PURE SUBSTANCE AND VAPOUR POWER CYCLES (9 Hrs)

Phase change processes – Property diagrams – p-v-T surface – Quality or Dryness fraction – Steam tables – Charts of thermodynamic properties – Measurement of Steam Quality – Simple steam power cycles – Actual vapour cycle processes – Comparison of Rankine and Carnot cycles – Mean temperature of Heat addition – Reheat cycle – Regenerative – Ideal regenerative cycle – Reheat-Regenerative cycle – Feed water heaters – Binary vapour cycles – Efficiencies of steam power plant.

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS (9 Hrs)

Equation of state for a perfect – p-v-T surface of an Ideal gas – Internal energy and Enthalpy of a perfect gas – Real gases – Van der Waals' equation – Virial equation of state – Beattie-Bridgeman of equation – Reduced properties – Law of Corresponding states – Compressibility Chart – Maxwell's equations – Tds Equations – Difference and ratio of heat capacities – Energy equation – Joule-Kelvin effect – Clausius Clapeyron equation – Gibbs phase rule – Types of equilibrium.

UNIT V PSYCHROMETRY AND REFRIGERATION CYCLES (9 Hrs)

Properties of Atmospheric air – Psychrometric chart – Psychrometric process: Sensible heating or cooling, Cooling and dehumidification, Heating and humidification, Adiabatic mixing of two steams, Chemical dehumidification, Adiabatic evaporative cooling – Refrigeration by non-cyclic processes – Reversed heat engine cycle – Vapour Compression cycle – Refrigerants – Absorption Refrigeration cycle – Heat pump system – Gas cycle refrigeration – Liquefaction of gases – Production of solid ice.

Text Books

1. Nag.P.K., “Engineering Thermodynamics”, 6th Edition, McGraw-Hill, New Delh, 2017.
2. Cengel.Y and M.Boles, "Thermodynamics - An Engineering Approach", 9th Edition, McGraw Hill, 2019

Reference Books

1. C.Borgnakke, R.E. Sonntag, “Fundamentals of Thermodynamics, 10th Edition, John Wiley & Sons, Inc., 2019.
2. M.J.Moran, H.N.Shapiro, D.D.Boettner and M.B. Bailey., “Fundamentals of Engineering Thermodynamics, 9th Edition, John Wiley & Sons, Inc., 2018.
3. Arora C.P, “Thermodynamics”, 25th Reprint, McGraw-Hill, New Delhi, 2013.
4. Rajput.R.K, “Thermal Engineering, Laxmi Publications (P) Ltd, 9th Edition, 2013.
5. Rathakrishnan.E., "Fundamentals of Engineering Thermodynamics", 2nd Edition, 10th Reprint, Prentice-Hall of India Pvt. Ltd, 2013.

Web References

1. https://nptel.ac.in/courses/112105266/
2. https://nptel.ac.in/courses/112108148/
3. https://nptel.ac.in/courses/112/103/112103275/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO2	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO3	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO4	2	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO5	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2

U20ESP202 **PROGRAMMING IN C LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course objectives

- To practice the fundamental programming methodologies in the C programming language.
- To apply logical skills for problem solving using control structures and arrays.
- To design, implement, test and debug programs that use different data types, variables, strings, arrays, pointers and structures.
- To design modular programming and provide recursive solution to problems.
- To understand the miscellaneous aspects of C and comprehension of file operations.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Apply and practice logical formulations to solve simple problems leading to specific applications.
CO2 - Develop C programs for simple applications making use of basic constructs, arrays and strings.
CO3 - Develop C programs involving functions, recursion, pointers, and structures.
CO4 - Design applications using sequential and random access file processing
CO5 - Build solutions for online coding challenges.

List of Experiments

1. Simple programming exercises to familiarize the basic C language constructs.
2. Develop programs using identifiers and operators.
3. Develop programs using decision-making and looping constructs.
4. Develop programs using functions as mathematical functions.
5. Develop programs with user defined functions – includes parameter passing.
6. Develop program for one dimensional and two dimensional arrays.
7. Develop program for sorting and searching elements.
8. Develop program to illustrate pointers.
9. Develop program with arrays and pointers.
10. Develop program for dynamic memory allocation.
11. Develop programs for file operations.

Text Books

1. Yashwant Kanetkar, “Let us C”, BPB Publications, 16th Edition, 2017.
2. Archana Kumar, “Computer Basics with Office Automation”, Dreamtech Press – Wiley Publisher, 2019.
3. Reema Thareja, “Fundamentals of Computing & C Programming” Oxford University Press, 2012

Reference Books

1. Zed A Shaw,” Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)”, Addison Wesley, 2016.
2. Anita Goel and Ajay Mittal, ”Computer Fundamentals and programming in C”,First edition, Pearson Education ,2011
3. Yashwanth Kanethkar, “Let us C”, 13th Edition, BPB Publications, 2008.
4. Maureen Sprankle,Jim Hubbard,” Problem Solving and Programming Concepts,” 9th Edition, Pearson,2011
5. B.W. Kernighan and D.M. Ritchie, “The C Programming language”, 2nd Edition, Pearson Education, 2006.

Web References

1. https://alison.com/course/introduction-to-c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	2	-	2	1	2	2	3	1	3	2
CO2	2	3	3	3	2	1	1	3	-	2	-	2	3	3	3
CO3	3	2	2	2	2	1	2	-	3	3	2	-	3	3	3
CO4	3	3	3	3	2	1	2	3	-	3	-	2	3	3	3
CO5	3	3	3	3	2	1	2	3	3	3	3	3	3	3	3

U20ESP212	ENGINEERING GRAPHICS USING AUTO CAD	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To develop graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to standardized technical drawings
- To Familiarize on orthographic projections
- To get exposed on development of solids and surfaces
- To extend the skill to use software for creating 2D and 3D models

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Familiarize with the fundamentals and standards of engineering graphics
CO2 - Perform freehand sketching of basic geometrical constructions and multiple views of objects.
CO3 - Plan orthographic projections of lines and plane surfaces.
CO4 - Draw projections, solids and development of surfaces.
CO5 - Visualize the project isometric and perspective sections of simple solids and to familiar on software packages for drafting and modelling.

List of Experiments

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-Dmodel.

Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

Reference Books

1. James D. Bethune, Engineering Graphics with AutoCAD A Spectrum book 1st Edition, Macromedia Press, Pearson, 2020
2. NS Parthasarathy and Vela Murali, Engineering Drawing, Oxford university press, 2015.
3. M.B Shah, Engineering Graphics, ITL Education Solutions Limited, Pearson Education Publication, 2011
4. Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2017.
5. Jeyapoovan T, Engineering Drawing and Graphics Using AutoCAD, 7th Edition, Vikas Publishing House Pvt Ltd., New Delhi, 2016
6. C M Agrawal, Basant Agrawal, Engineering Graphics, McGraw Hill, 2012
7. Dhananjay A. Jolhe, Engineering Drawing: With An Introduction To CAD McGraw Hill, 2016
8. James Leach, AutoCAD 2017 Instructor, SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO2	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO3	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO4	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO5	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-

U20MEP201 **MANUFACTURING PROCESSES LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To study and practice the various operations that can be performed in shaper machine and Grinding machine
- To study about foundry tools and preparation of sand mold
- To practice various welding joints in metal arc welding and sheet metal operations

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Acquire knowledge about manufacturing process.

CO2 - Conduct experiments to understand the mechanism of chip formation

CO3 - Review various cutting parameters for different materials in machining operations.

List Of Experiments

MACHINES

1. Study of shaping machine
2. Square Head Shaping
3. Hexagonal Head Shaping
4. Study of grinding machine
5. Plain Surface grinding
6. Cylindrical grinding

FOUNDRY

7. Preparation of a sand mold using split pattern
8. Preparation of a sand mold using solid pattern

WELDING AND SHEET METAL

9. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding
10. Gas welding practice - Demonstration
11. Forming & Bending by sheet metal
12. Model making – Trays and funnels and different type of joints in sheet metal

Reference Books

1. P.N. Rao, “Manufacturing Technology – Metal Cutting and Machine Tools”,Tata Mc Graw Hill Publishing Company Ltd, NewDelhi,2008
2. Raghavan.V, “Physical Metallurgy–Principles and Practice”, Prentice Hall India Pvt. Ltd., NewDelhi, 2006.
3. Kalpakjain S, Schimd S, “Manufacturing Engineering and Technology”, Pearson Education, 7th edition, New Delhi, 2018

Web References

1. http://gssl.iitk.ac.in/pssl/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	2	2	2	2	2	1	-	2	1	2	3
CO2	3	2	1	1	2	2	2	2	2	1	-	2	2	2	3
CO3	3	1	2	2	2	2	2	2	2	1	-	3	2	3	3

SEMESTER III

U20BST320	COMPLEX ANALYSIS AND APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C	Hrs
		2	2	0	3	60

Course Objectives

- To understand the analytic functions of complex variables.
- To apply the analytic function techniques to transform irregular geometry into regular geometry.
- Expose to the concept of complex integration.
- To understand the nature of wave equations.
- To know the solutions of one dimensional and two dimensional heat flow equations.

Course Outcomes

On successful completion of this course, the students will be able to

CO1 - Understand the concepts of function of a complex variable.
CO2 - Transform complex functions from one plane to another plane.
CO3 - Evaluate complex integration over contour.
CO4 - Understand the concept of initial and boundary value and able to find the solutions of wave equations.
CO5 - Solve the one and two dimensional heat equation using Fourier series.

UNIT I FUNCTION OF A COMPLEX VARIABLE (12 Hrs)

Continuity, derivative and analytic functions – Necessary conditions – Cauchy-Riemann equations and sufficient conditions – Harmonic and orthogonal properties of analytic function – Construction of analytic function

UNIT II CONFORMAL MAPPINGS (12 Hrs)

Conformal mapping – Simple and standard transformations like $w = z+c$, cz, z^2, e^z, sin z, cosh z and $z+1/z$ – Bilinear transformation and cross ratio property - Taylor's and Laurent's theorem – Series expansion of complex valued functions – classification of singularities.

UNIT III COMPLEX INTEGRATION (12 Hrs)

Cauchy's integral theorem and its application – Cauchy's integral formula and problems – Residues and evaluation of residues – Cauchy's residue theorem – Contour integration: Cauchy's and Jordan's Lemma – Application of residue theorem to evaluate real integrals – unit circle and semicircular contour.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (12 Hrs)

Solution of partial differential equation by the method of separation of variables – Boundary value problems – Fourier series solutions of one dimensional wave equation – Transverse vibration of an elastic string.

UNIT V ONE AND TWO DIMENSIONAL HEAT EQUATIONS (12 Hrs)

Fourier series solutions of one dimensional heat flow equation – Fourier series solutions of two dimensional heat flow equation under steady state conditions.

Text Books

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2020.
2. Bali N.P. and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
3. P. Sivaramakrishna Das and C. Vijayakumar, "Engineering Mathematics", Pearsons, New Delhi, 2017.

Reference Books

1. Gupta C.B., Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2015.
2. Dass H.K. & Dr. Rama Verma, "Introduction to Engineering Mathematics", S. Chand & Co, New Delhi, 2019.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. Ravish R. Singh and Mukul Bhatt, "Engineering Mathematics", Tata McGraw Hill, 1st Edition, New Delhi, 2016.
5. Ramana B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill, New Delhi 2018.

Web References

1. https://nptel.ac.in/courses/122107036/
2. https://swayam.gov.in/nd1_noc20_ma17/preview
3. https://nptel.ac.in/courses/111107119/
4. https://youtu.be/W3HXK1Xe4nc

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

U20EST359 **DATA STRUCTURES**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To impart the basic concepts of data structures and its terminologies.
- To understand concepts about stack and queue operations.
- To understand basic concepts about linked list and its various operations.
- To understand concepts about Tree and its applications.
- To understand basic concepts about Sorting, Hashing and Graph.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Analyze Fundamentals of data structures and complexity analysis
CO2 - Demonstrate stack, queue and its operation.
CO3 - Apply and analyze linked list operation.
CO4 - Construct the tree and its various applications.
CO5 - Summarize sorting, hashing and graph techniques.

UNIT I BASIC TERMINOLOGIES OF DATA STRUCTURES (9 Hrs)

Introduction: Basic Terminologies: Elementary Data Organizations. Data Structure Operations: insertion, deletion, traversal. Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Array and its operations. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

UNIT II STACK AND QUEUE OPERATIONS (9 Hrs)

Stacks and Queues: ADT Stack and its operations, Applications of Stacks: Expression Conversion and evaluation. ADT Queue: Types of Queue: Simple Queue, Circular Queue, Priority Queue. Operations on each type of Queues.

UNIT III LINKED LIST OPERATIONS (9 Hrs)

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion, Deletion in linked list; Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.

UNIT IV TREES (9 Hrs)

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, Binary Tree Traversals, AVL Tree. Introduction to B-Tree and B+ Tree.

UNIT V SORTING, HASHING AND GRAPHS (9 Hrs)

Sorting: Bubble Sort, Selection Sort, Insertion Sort, Heap Sort, Shell Sort and Radix Sort. Performance and Comparison among the sorting methods. Hashing: Hash Table, Hash Function and its characteristics. Graph: Basic Terminologies and Representations, Graph traversal algorithms.

Text Books

1. Ellis Horowitz, Sartaj Sahni,"Fundamentals of Data Structures", Illustrated Edition, Computer Science Press, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 4th Edition, 2009

Reference Books

1. Mark Allen Weiss," Algorithms, Data Structures and Problem Solving with C++", Illustrated Edition, Addison-Wesley Publishing Company, 1995.
2. D.Samanta, "Classic Data Structures", Second Edition, Prentice-Hall of India, Pvt. Ltd., India 2012.
3. Robert Kruse, C.L. Tondo and Bruce Leung, "Data Structures and Program Design in C",Prentice-Hall of India, PVt. Ltd., Second edition, 2007.
4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second edition, 2006.
5. Balagurusamy, "Data Structures", Tata McGraw-Hill Education, 2019

Web References

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	1	2	2	1	1	2	2	3	2
CO2	3	2	3	3	2	2	1	2	2	1	3	-	3	3	3
CO3	3	3	3	3	2	2	2	2	-	1	-	2	3	2	3
CO4	3	2	3	3	3	2	2	2	2	1	3	-	3	3	3
CO5	3	3	3	3	2	2	2	2	2	1	3	3	3	3	3

U20EST345 **ELECTRONIC DEVICES AND CIRCUITS**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Understand the structure of basic electronic devices.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and applications of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Explain the structure and working operation of basic electronic devices.
CO2 - Describe the working principle of BJT, FET, UJT and Thyristors.
CO3 - Analyze the behavior of Bipolar Junction Transistors and Field Effect Transistors at different frequency Conditions.
CO4 - Design multistage amplifiers using Bipolar Junction Transistors.
CO5 - Employ the acquired knowledge in design and analysis of oscillators

UNIT I PN JUNCTION DEVICES (9 Hrs)

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode characteristics- Zener Reverse characteristics – Zener as a Voltage regulator

UNIT II TRANSISTORS AND THYRISTORS (9 Hrs)

BJT, JFET, MOSFET- structure, operation, Biasing and characteristics. UJT - Characteristics and equivalent circuit – intrinsic standoff ratio –UJT relaxation oscillator, Thyristors- SCR - Two transistor model, DIAC and TRIAC - Operation, Characteristics and their applications.

UNIT III AMPLIFIERS (9 Hrs)

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response. Small signal model of JFET and MOSFET – Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS (9 Hrs)

RC-coupled amplifier, Operation and Frequency response, Power amplifier – Series fed and transformer coupled Class A amplifiers, Class B amplifier, Circuit and Operation, conversion efficiency, amplifier distortion, Class C and D amplifiers.

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS (9 Hrs)

Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

Text Books

1. David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits",7th Ed., Oxford University Press

Reference Books

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, "Electronic devices and circuit theory", 2002.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation" CRC Press, 2004.

Web References

1. https://nptel.ac.in/courses/108/104/108104140/
2. https://nptel.ac.in/courses/108/107/108107128/
3. https://nptel.ac.in/courses/117/103/117103063/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	1	-	2	2	2	-	-	1	2	3	-	-
CO2	2	2	2	-	-	2	2	1	-	-	1	1	3	-	-
CO3	3	2	2	1	-	2	2	-	1	-	1	1	3	-	-
CO4	3	2	2	2	-	1	2	1	-	-	1	1	3	-	-
CO5	2	2	2	1	-	2	1	2	-	-	2	2	3	-	-

U20MET301 **MECHANICS OF SOLIDS**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the fundamental concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To compute slopes and deflections in determinate beams by various methods.
- To understand the effect of torsion on shafts and springs
- To learn about the buckling failure in columns and calculate the stresses, deformations induced in thin and thick shells.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Compute the concepts of stress and strain in simple and compound bars and understand the importance of principal stresses and principal planes.

CO2 - Comprehend the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.

CO3 - Calculate the slope and deflection in beams using different methods.

CO4 - Estimate the effect of torsion in shafts and helical spring

CO5 - Calculate the stresses and strains associated with thin and thick cylinder

UNIT I STRESSES AND STRAINS (9 Hrs)

Stress and Strain: Basic of stress & strain, Elastic constant, Stress-strain diagram - Hook's law- Factor of safety- stresses and strain in uniformly varying sections- stresses in composite bar- Relation between three modulus and Poisson's ratio – Thermal stresses.

Biaxial state of stress – Stress at a point – stresses on inclined planes – Principal stresses and Principal strains and Mohr's circle of stress.

UNIT II BEAMS AND SIMPLE BENDING (9 Hrs)

Beams: Cantilever, Simply supported: Shear Force and Bending Moment Diagrams. Theory of simple bending – Bending stress and shear stress in beams.

UNIT III DEFLECTION OF BEAMS (9 Hrs)

Deflection of beams: Cantilever and simply supported beam by Double integration method – Macaulay's method – Area moment theorems for computation of slopes and deflections in beams.

UNIT IV TORSION & SPRING (9 Hrs)

Torsion: Introduction - Derivation of torsion equation - stresses and deformations in circular and hollow shafts - Shafts in Series and parallel - Combined bending and torsion- Strain energy due to axial force – Resilience.

Spring: Open and closed coil helical springs, Leaf Springs, Application of Torsion springs.

UNIT V COLUMNS AND CYLINDERS (9 Hrs)

Theory of columns – Long column and short column - Euler's formula – Rankine's formula.

Thin cylinders and shells – Deformation of thin cylinders and shells; Thick Cylinders, Compound Cylinder.

Text Books

1. R.K. Bansal, "Strength of Materials", Laxmi Publications, 6th edition 2019.
2. D.S. Bedi, "Strength of Materials", Khanna Publishing, 6th edition 2019.
3. R.K. Rajput, "Strength of Materials", S. Chand Publications, 7th edition 2018.

Reference Books

1. Punmia, Jain and Jain, "Mechanics of Materials" , Laxmi Publications .2019
2. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, 9th Edition, 2018
3. Egor. P.Popov "Mechanics of Materials" Pearson Education, 2nd Edition, 2016.
4. S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 3rd Edition, 2016
5. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., 2nd edition New Delhi, 2018.

Web References

1. https://nptel.ac.in/courses/112107146/#

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
CO3	2	1	1	1	-	-	-	-	-	-	-	-	2	1	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-
CO5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	-

U20MET302 **COMPUTER AIDED DESIGN**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To understand the basics of CAD and its applications.
- To gain exposure over the algorithms and transformation techniques used in CAD.
- To learn about the geometric and surface modelling concepts of CAD
- To understand the rendering of models used in various software.
- To understand the standards and database in CAD

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Understand the importance of CAD and its hardware's.
CO2 - Perform transformation techniques and apply algorithm for modifying various CAD drawings
CO3 - Develop various model using geometric and surface modelling techniques
CO4 - Illustrate the working of rendering of CAD models
CO5 - Apply various standards and database models to exchange CAD data models.

UNIT I INTRODUCTION TO CAD AND DISPLAY DEVICES (9 Hrs)

Introduction: Fundamentals of CAD, Design process, Applications of computer for design, Benefits of CAD, Computer peripherals for CAD work station, Graphic terminal, CAD software, CAD database and structure.
Display Devices: Video display devices–Raster scan display, CRT , DVST, Inherent memory display devices, Random Scan Display, Raster scan systems – Video controller, Random scan systems – Graphic monitors and work station, Input devices.

UNIT II TRANSFORMATIONS (9 Hrs)

Bresenham's line and circle algorithms. Transformation in Graphics: co-ordinate system used in Graphics and windowing and view port transformations, Clipping , hidden line elimination, 2D transformations – rotation, scaling, translation, mirror, reflection and shear – homogeneous transformations – concatenation, 3D Transformation – orthographic and Perspective Projections.

UNIT III GEOMETRIC AND SURFACE MODELLING (9 Hrs)

Geometric Modelling: 2D wire frame modelling, 3D Wire frame modelling, Wireframe models, Entities and their definitions. Concept of Parametric and nonparametric representation of curve, Curve fitting techniques, Definitions of cubic splines.
Surface Modelling: Surface modelling and entities, Algebraic and geometric form, Parametric space of Surface, Blending functions, parameterization of surface patch, Subdividing cylindrical surface, Ruled surface, Surface of revolution, Spherical surface, Composite surface.

UNIT IV RENDERING IN CAD (9 Hrs)

Hidden line-surface-solid removal algorithm-shading - colouring-animation Parametric and variational modeling, Feature based modeling, An overview of modeling software like PRO-E, CATIA, IDEAS, SOLID EDGE and other advanced Software's.

UNIT V STANDARDS AND DATABASE IN CAD (9 Hrs)

Standards for computer graphics (GKS) and Data exchange standards – IGES, STEP. Standard for exchange images (open GL) Data structures for Entity storage – Data structures for interactive modelling- Relational databases

Text Books

1. Radhakrishnan, P. Subramanyan, S. Raju, V. "CAD/CAM/CIM", New Age International, 4th Edition, 2020.
2. P.N. Rao, "CAD/CAM: Principles and Applications", Tata McGraw Hill, 3rd Edition, 2010.

Reference Books

1. Mikell P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, 5th Edition 2019
2. James A. Rehg, Henry W. Kraebber, "Computer Integrated Manufacturing", Pearson Education. 2007
3. Donald Hearn and M.Pauline Baker "Computer Graphics" with OpenGL Prentice Hall, International, 2011

4. Chris McMahon, Jimmie Browne CADCAM: Principles, Practice and Manufacturing Management, 2nd Edition, Pearson publications 1992.
5. Ibrahim Zeid and R. Sivasubramaniam, CAD/CAM : Theory and Practice, 2nd Edition, Tata McGraw Hill, 2009

Web References

1. https://nptel.ac.in/courses/112/102/112102101/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	-	2	-	-	-	-	-	-	-	3	2	-
CO3	3	3	2	-	2	-	-	-	-	-	-	-	3	2	-
CO4	3	3	2	-	2	-	-	-	-	-	-	-	3	2	-
CO5	3	3	2	-	2	-	-	-	-	-	-	-	3	2	-

U20MET303 **FLUID MECHANICS AND MACHINERY**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the properties of the fluid and flow characteristics.
- To emphasize the concept of dimensional analysis.
- To understand the concept of flow through circular pipes and boundary layer flows.
- To provide knowledge on the working principle and performance curves of hydraulic turbines.
- To educate the working principles and performance analysis of fluid pumps.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Understand the basic fluid property and its application.
CO2 - To apply the concepts of dimensional analysis on the fluid structure.
CO3 - To calculate the rate of flow and energy losses in flow through pipes.
CO4 - To evaluate the operating characteristics of hydraulic turbines
CO5 - Understand the working principles of hydraulic pumps and performances

UNIT I FLUID PROPERTIES AND FLUID STATICS (9 Hrs)

Units and dimensions - Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity, fluid statics, manometers, Hydrostatic Forces, buoyancy, forces on submerged bodies, stability of floating bodies

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS (9 Hrs)

Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation. Bernoulli's equation, applications - Venturi meter, Orifice meter, Pitot tube - dimensional analysis -Buckingham's π theorem applications - similarity laws and models.

UNIT III INCOMPRESSIBLE FLUIDS & FLOW THROUGH PIPES (9 Hrs)

Viscous flow - laminar flow between parallel plates, - Laminar and Turbulent flow, Reynold's experiment flow through Circular pipes - Darcy - Weisbach equation - friction factor minor losses – flow through pipes in series and in parallel - power transmission - boundary layer flows, boundary layer thickness, boundary layer separation.

UNIT IV HYDRAULIC MACHINE & TURBINES (9 Hrs)

Principles of Turbo Machinery: Fluid Machines – Classification – Introduction to Impact of jet Stationary plates, Moving Plates and Vanes - Construction of Velocity Vector Diagram– Unit and Specific Quantities. Turbine - Classification – Impulse Turbine – Pelton Wheel – Reaction Turbines – Francis and Kaplan Turbines – Draft Tube Theory – Velocity Triangle – Estimation of force, Power and efficiency – General Characteristics of Turbine – Similarity Study – Governing of Turbine – Cavitation in Turbine.

UNIT V HYDRAULIC PUMPS (9 Hrs)

Classification - Centrifugal Pump – Velocity Triangle – Estimation of Power Required and efficiency – General characteristics - Similarity study – Cavitation in Pump – Reciprocating Pump – Air Vessels – Ideal and Actual Indicator Diagram – Estimation of Power Required, percentage Slip and Efficiency – Cavitation - special purpose pumps.

Text Books

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi publications (P) Ltd., New Delhi, 10th Edition, 2018
2. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw-Hill, 9thEdition, 2010.
3. Kumar, K.L., "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi, 8thEdition, 2009.

Reference Books

1. S.S.Rattan - Fluid Mechanics and Hydraulic Machines- Khanna Publishers, 2019
2. S.M. Yahya, Turbine, Fans and Compressors, Tata McGraw-Hill- 4th Edition 2017.
3. Yunus Çengel, John M. Cimbala - Fluid Mechanics Fundamentals and Applications-Mc Graw Hill, 4th Edition, 2017
4. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, New Delhi, 8th Edition, 2016.
5. Modi P.N, & Seth S.M, "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 20th Edition, 2015.

Web References

1. https://nptel.ac.in/courses/112104118/
2. https://nptel.ac.in/courses/112104118/
3. http://fm-nitk.vlabs.ac.in
4. https://www.coursera.org/courses?query=fluid%20mechanics
5. https://apm.iitm.ac.in/fluid_mechanics.html

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	1	1	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	1	-	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	1	-	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	1	-	-	-	-	-	-	-	-	2	2	2

U20ESP360	DATA STRUCTURES LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To learn the basic concepts of Data Structures.
- To learn about the concepts of Searching and Sorting.
- To study about the linear and non-linear Data Structures

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Analyze the algorithm's / program's efficiency in terms of time and space complexity.
CO2 - Solve the given problem by identifying the appropriate Data Structure.
CO3 - Solve problems in linear and non-linear Data Structures.

List of Experiments

1. Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
3. Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list. b) Delete an element from list c) Search for a key element in list d) count number of nodes in list.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
6. Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
8. Write a C program that use recursive functions to traverse the given binary tree in
   a) Preorder
   b) Inorder and
   c) Postorder.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.

Text Book

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd edition, 2019
2. Gav.Pai,"Data Structures and Algorithms", McGraw-Hill India,1st edition, 2013.
3. Manjunath Aradhya M and Srinivas Subramiam,"C Programming and Data Structures", Cengage India 1st edition, 2017.

Reference Books

1. Ellis Horowitz, Sartaj Sahni,"Fundamentals of Data Structures", Illustrated Edition, Computer Science Press, 2018.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second edition, 2006.
3. Scymour Lipschutz,"Data structures", 1st edition, McGraw –Hill India,2017.
4. Reema Thareja,"Data structures using C", 2nd edition, Oxford University, 2014.
5. Tenebaum Aaron M,"Data Structures using C", Pearson Publisher, 1st edition, 2019.

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	1	2	1	2	-	1	1	2	2	3	2
CO2	3	2	-	2	2	2	1	2	2	1	3	2	3	3	3
CO3	2	3	2	-	-	-	2	-	-	1	3	2	3	2	3

U20MEP301	MATERIAL TESTING AND METALLURGY LAB	L	T	P	C	Hrs
		0	0	2	1	45

Course Objectives

- To understand mechanical behavior of various engineering materials by conducting standard tests.
- To perform the characterization of materials like microstructures.
- To learn the concepts of improving the mechanical properties of materials by different methods like heat treatment process.

Course Outcomes

On successful completion of this course, the student will be able to

CO1 - Acquire experimentation skills in the field of material testing and develop theoretical understanding of the mechanical properties of materials by performing experiments.

CO2 - Analysis the procedure of microstructure studies of various materials

CO3 - Execute the various heat treatment processes for different stages

List of Experiments

Materials Testing Laboratory

1. Tension test
2. Torsion test
3. Compression test
4. Impact test on a metallic specimen- Izod test
5. Impact test on a metallic specimen- Charpy test
6. Hardness test on metallic specimen (Brinell, Rockwell)
7. Ductility test: Sheet metals (Al, GI and MS)

Metallurgy Laboratory

8. Identification of the Metals using optical microscope
9. Jominy end quenching test

References Books

1. Material Testing Laboratory, by Ravichawla , C. Kukreja, Kishore K, standard publishers, 2016
2. Engineering Materials and Metallurgy, R K Rajput, S. Chand Publishing,2006
3. ASM Handbook Volume 8: Mechanical Testing and Evaluation, Published by ASM International

Web References

1. https://virtlabs.tech/strength-of-materials/
2. http://sm-nitk.vlabs.ac.in/index.html

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	1	-	-	-	1	1	2	-	3	1	1
CO2	3	2	1	1	1	-	-	-	1	1	2	-	3	1	1
CO3	3	3	1	1	1	-	-	-	1	1	2	-	3	1	1

U20MEP302	FLUID MECHANICS AND MACHINERY LAB	L	T	P	C	Hrs
		0	0	3	1	45

Course Objectives

- To understand the properties of the fluid.
- To impart training to use various flow measuring devices.
- To understand the conservation of laws to flow through pipes.
- To understand the principles and working of hydraulics machines and its applications.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Analyse and Interpret fluid flow parameters by conducting experiments on venture and orifice experimental setups.

CO2 - Analyse and Interpret the performance characteristic of various types of pumps

CO3 - Analyse and Interpret the performance characteristic of various types of turbine

List of Experiments

1. Determination of the coefficient of discharge of given Orifice meter.
2. Determination of the coefficient of discharge of given Venturi meter.
3. Visualizing the flow structures through various models.
4. Conducting experiments and drawing the characteristics curves of centrifugal pump.
5. Conducting experiments and drawing the characteristics curves of submersible pump.
6. Conducting experiments and drawing the characteristics curves of jet pump.
7. Conducting experiments and drawing the characteristics curves of pump in series and parallel.
8. Conducting experiments and drawing the characteristics curves of reciprocating pump.
9. Conducting experiments and drawing the characteristics curves of Gear pump.
10. Conducting experiments and drawing the characteristics curves of Turbine pump
11. Conducting experiments and drawing the characteristics curves of Pelton wheel.
12. Conducting experiments and drawing the characteristics curves of Francis turbine.

Reference Books

1. CWR, Hydraulics Laboratory Manual,2004
2. N. Kumarasamy, Fluid Mechanics and Machinery laboratory manual, Charotar Publishing House Pvt. Ltd. 2008.
3. S C Gupta, Fluid Mechanics and Hydraulic Machines, Pearson Education India, 2006.

Web References

1. http://fmc-nitk.vlabs.ac.in.

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	1	-	-	-	-	-	2	-	3	1	1
CO2	3	3	1	1	1	-	-	-	-	-	2	-	3	1	1
CO3	3	3	1	1	1	-	-	-	-	-	2	-	3	1	1

U20HSP301 **GENERAL PROFICIENCY - I**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To build a strong sight of vocabulary and decoding skills.
- To improve the communication and leadership skills in an innovative way
- To identify the information and understand the underlying meaning of the given concept
- To build the written communication skills to meet organizational goals
- To extend knowledge on verbal aptitude and prepare for interviews

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Gain strategies to build literal and inferred meaning through comprehension analysis
CO2 - Develop interpersonal communication skills professionally
CO3 - Recognize the information not directly stated and progress in employability skills
CO4 - Select compile and synthesize information for written mode of communication
CO5 - Learn to solve verbal aptitude for competitive exams

UNIT I COMPREHENSION ANALYSIS (9 Hrs)

Listening: Listening Comprehension (IELTS based) – Speaking: Break the iceberg - Reading: Reading technical passage (IELTS based) - Writing: Writing Task: 1 (IELTS: Graph / Process /Chart Description) Vocabulary: Synonyms (IELTS)

UNIT II PERSONALITY DEVELOPMENT (9 Hrs)

Listening: Interview Videos- Speaking: Extempore& Presentation (Soft Skills) - Reading: British & American Vocabulary, Read and review (Books, Magazines) - Writing: SWOT Analysis Vocabulary: Idioms (IELTS)

UNIT III INFERENTIAL LEARNING (9 Hrs)

Listening: Listening Speech sounds to overcome Mother Tongue Influence, Anecdotes– Speaking: Interpersonal Interaction & Situational attribution–Reading: Distinguish between facts & opinions - Writing: Writing Conversation to different context Vocabulary: Phrasal Verbs (IELTS)

UNIT IV INTERPRETATION AND FUNCTIONAL WRITING (9 Hrs)

Listening: Group Discussion videos - Speaking: Group Discussion Practice - Reading: Interpretation of data - Graph, table, chart, diagram (IELTS based) -Writing: Writing Task: 2 (IELTS) Vocabulary: Collocations (IELTS)

UNIT V APTITUDE (9 Hrs)

Language Enhancement: Articles, Preposition, Tenses.
Verbal Ability Enhancement: Blood Relation, Completing Statements- Cloze test, Spotting Errors –Sentence Improvement, One Word Substitution, Word Analogy, Word Groups(GATE)

Reference Books

1. Jeff Butterfield, —Soft Skills for Everyonell, Cengage Learning, New Delhi, 2013.
2. Grant Tayler, English conversation practice, English, 1998
3. Bailey, Stephen. Academic Writing: A practical guide for students. New York: Rutledge, 2011.
4. Marc Roche “IELTS Vocabulary Masterclass 8.5. Master Phrasal Verbs, Essay Vocabulary, Graph Vocabulary & Speaking Vocabulary"
5. A Modern Approach to Verbal & Non –Verbal Reasoning, Dr.R.S.Agarwal
6. High School English Grammar and Composition, Wren & Martin, Revised by Dr.N.D.V.Prasada Rao, Jan 2017

Web References

1. https://www.ielts-exam.net/grammar/
2. www.espressoenglish.net › free-English-grammar-e-book

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
CO2	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
CO3	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
CO4	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
CO5	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-

SEMESTER - IV

U20BST431 **PROBABILITY AND QUEUEING THEORY**

L	T	P	C	Hrs
2	2	0	3	60

Course Objectives

- Apply fundamental knowledge of the basic probability concepts.
- To introduce knowledge of standard discrete distributions.
- To acquire knowledge on Probability Distributions.
- To understand strengths and weaknesses of Queuing model.
- To gain strong knowledge in principles of Queuing theory.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Understand the fundamental knowledge of the probability concepts.
CO2 - Apply the basic rules of discrete random variables
CO3 - Apply the fundamentals of probability theory and random processes.
CO4 - Understand and extend Queuing models to analyze real world systems
CO5 - Apply the knowledge of Queuing theory in computer field.

UNIT I PROBABILITY AND RANDOM VARIABLE (12 Hrs)

Axioms of probability - Conditional probability - Total probability – Baye's theorem – Moments –Moment generating functions and their properties

UNIT II DISCRETE RANDOM VARIABLES (12 Hrs)

Random Variables and their event spaces, Random variable – Probability mass function – Probability density function - Distribution functions, Binomial, Geometric, Negative Binomial, Poisson.

UNIT III CONTINUOUS RANDOM VARIABLES (12 Hrs)

Some important distributions: Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties – Functions of a random variable.

UNIT IV QUEUING MODELS (12 Hrs)

Markovian queues – Birth and Death processes – Single and multiple server queuing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging. (M/M/I):(∞/FIFO), (M/M/I):(N/FIFO), (M/M/C):(∞/FIFO), (M/M/C):(N/FIFO)

UNIT V ADVANCED QUEUING MODELS (12 Hrs)

Finite source models – M/G/1 queue – PollaczekKhinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

Text Books

1. Bali N.P. and Dr. Manish Goyal, "Engineering Mathematics", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.
2. T. Veerarajan," Probability and Statistics, Random Process and Queuing Theory", McGraw Hill Education, 2018.
3. P. Sivaramakrishna Das, C. Vijayakumari , "Probability and Queuing Theory", Pearson Education, 6th Edition, 2019.
4. G. Balaji, "Probability and Queuing Theory", Balaji Publication, Revised Edition, 2017.

Reference Books

1. Gupta .C.B, Shree Ram Singh, M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2015
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi,10th Edition 2019
3. John F. Shortle, James M. Thomson, Donald Gross, "Fundamental of Queuing theory", 5th Edition, Wiley series May 2018
4. M.Bhatt and Ravish R Singh, "Probability and Statistics", McGraw Hill Education, 2017.
5. P.Kandasamy, Thilagavathi.K and Gunavathi.K, "Probability and Queuing Theory",S. Chand & Co. Pvt. Ltd, 2015

Web References

1. http://www.maths.qmul.ac.uk/~pjc/notes/prob.pdf
2. https://nptel.ac.in/courses/117/103/117103017/
3. https://youtu.be/COI0BUmNHT8
4. https://nptel.ac.in/courses/111107119/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	2	-	-	-	-

U20EST470 **PROGRAMMING IN JAVA**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- Gain and explore the knowledge of java programming
- To know the principles of inheritances, packages, interfaces
- To get familiarized to generic programming, multithreading concepts.
- Gain and explore the advanced concepts in Java.
- To explore database connectivity.

Course Outcomes

On successful completion of this course, the students will be able to

CO1 - Write a maintainable Java Program for a given algorithm and implement the same.
CO2 - Demonstrate the use of inheritance, interface and package in relevant applications.
CO3 - Create java applications using exception handling, thread and generic programming.
CO4 - Build java distributed applications using Collections and IO streams.
CO5 - Develop simple database programs.

UNIT I INTRODUCTION TO JAVA PROGRAMMING (9 Hrs)

The History and Evolution of Java - Byte code - Java buzzwords - Data types – Variables – Arrays – operators - Control statements -Type conversion and casting. Concepts of classes and objects: Basic Concepts of OOPs – Constructors -Static keyword -Final with data -Access control - This key word -Garbage collection - Nested classes and inner classes - String class.

UNIT II INHERITANCE, PACKAGES AND INTERFACES (9 Hrs)

Inheritance: Basic concepts - Forms of inheritance - Super key word – Method overriding -Abstract classes- Dynamic method dispatch - The Object class. Packages: Defining, Creating and Accessing - Importing packages. Interfaces: Defining – Implementing – Applying - Variables and extending interfaces

UNIT III EXCEPTION HANDLING, MULTITHREADING (9 Hrs)

Concepts of Exception handling - Types of exceptions - Creating own exception - Concepts of Multithreading - Creating multiple threads – Synchronization -Inter thread communication - Enumeration - Autoboxing - Generics.

UNIT IV COLLECTIONS, I/O STREAMS (9 Hrs)

Collections: List –Vector – Stack - Queue – Dequeue –Set - SortedSet. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT V EVENT DRIVEN PROGRAMMING AND JDBC (9 Hrs)

Events - Delegation event model -Event handling - Adapter classes. AWT: Concepts of components - Font class - Color class and Graphics - Introduction to Swing – Layout management - Swing Components - Java Database Connectivity - Develop real time applications.

Text Books

1. Herbert Schildt, Java: The Complete Reference 11th Edition, TMH Publishing Company Ltd, 2018.
2. Sagayaraj, Denis, Karthik, Gajalakshmi , “JAVA Programming for core and advanced learners” , Universities Press Private Limited, 2018
3. Herbert Schil dt, “The Complete Reference JAVA 2”, TMH, Seventh E dit ion, 2006.

Reference Books

1. Cay S. Horstmann, Gary cornell, Core Java Volume – I Fundamentals, 9th Edition, Prentice Hall, 2013.
2. H.M.Dietel and P.J.Dietel, Java How to Program, 11th Edition, Pearson Education/ PHI, 2017.
3. Cay.S.Horstmann and Gary Cornell, Core Java, Vol 2, Advanced Features, 8th Edition, Pearson Education, 2008.
4. Java for Programmers, P.J. Dietel and H.M Dietel,Pearson Education (OR) JAVA:
5. Programming in Java, S. Malhotra and S. Choudary, Oxford Univ. Press.

Web Resources

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM's tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. https://www.geeksforgeeks.org

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	1	2	2	2	2	2	3	3	3
CO2	2	2	2	3	2	1	1	3	-	3	3	-	2	2	2
CO3	3	2	3	2	-	2	1	2	2	2	-	2	3	3	3
CO4	2	2	2	2	2	1	1	2	-	2	2	-	2	2	3
CO5	3	2	1	2	2	2	1	3	3	3	3	3	2	3	2

U20MET401 **KINEMATICS OF MACHINERY**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To understand the basics components and layout of linkages in the assembly of a system and machine to visualize simple mechanisms and its applications
- To Illustrate students about Kinematic Analysis (Instantaneous center method and relative velocity method) of simple mechanisms
- To provide students an understanding of different types of mechanisms.
- To teach students about different types of specified contour and derived contour cams and its kinematic analyses.
- To explain about kinematic advantages, problems and explain about epicyclic gear train and its speed calculation.

Course Outcomes

On successful completion of this course, the students will be able to

CO1 - Demonstrate an understanding of the concepts of various mechanisms and pairs.
CO2 - Solve velocity and acceleration in simple mechanism by Graphical Method.
CO3 - Develop a simple mechanism such as Four Bar and slider crank Mechanism.
CO4 - Design a layout of cam for specified motion.
CO5 - Solve problem on gears and gear Train.

UNIT I BASICS OF MECHANISMS (9 Hrs)

Mechanisms and machines; Elements of kinematic chain, mobility and range of movements, Definition & Concept - inversion of single and double slider chain and four bar chain and its applications Mechanism with lower pairs -Pantograph, Straight line mechanism- exact and approximate Motion-Mini projects.

UNIT II KINEMATIC ANALYSIS OF MECHANISMS (9 Hrs)

Analysis of displacement, velocity & acceleration diagrams of simple planar mechanisms by graphical (Instantaneous center method and relative velocity method), analytical and computer aided methods (for four-bar and slider crank mechanism only.

UNIT III KINEMATIC SYNTHESIS OF MECHANISMS (9 Hrs)

Kinematic synthesis, graphical method using relative pole method, Inversion method and overlay 3 point synthesis problems - Motion, path & function generation, Chebyshev's spacing of accuracy points - Freudenstein Method of 3 point synthesis of four link mechanism and slider crank Mechanism- Coupler curves.

UNIT IV CAMS (9 Hrs)

Classification-Displacement diagrams-Uniform velocity, SHM, uniform acceleration and retardation and cycloidal motions-layout of profile of plate cams of the above types with reciprocating, oscillating, knife edge, roller and flat faced followers.

UNIT V GEARS AND GEAR TRAIN (9 Hrs)

Classification and terminology used Fundamental law of gearing – friction wheel, teeth for positive action and condition for constant velocity ratio. Conjugate profiles cycloidal and involute teeth profiles. Involute construction, properties and computation of path of contact and contact ratio. Interference and undercutting-Minimum number of teeth to avoid Interference, methods to avoid Interference. Introduction, classification, examples, gear ratio in simple and compound gear trains.

Text Books

1. J.J. Uicker, Jr., G.R. Pennock, and J.E. Shigley - Theory of Machines and Mechanisms, Oxford University Press, 5th Edition, 2016.
2. Khurmi,R.S.,Gupta,.J.K., "Theory of Machines",S.Chand&Company,2009
3. S S.Rattan - Theory of Machines, McGraw Hill, 5th Editon, 2020

Reference Books

1. J.S.Rao and R.V.Dukkipati - Mechanism and Machine Theory, New Age International, 2014.
2. Thomas Bevan - Theory of Machines, 3rd Edition, Pearson education, 2009,
3. P.L.Ballaney - Mechanics of Machines, Khanna Publishers, 2012.
4. Cho W. S. To , Introduction to Kinematics and Dynamics of Machinery, Morgan and Claypool publishers, 2018.
5. B. V. R. Gupta, Theory of Machines: Kinematics and Dynamics, I.K. Publishing house ltd.,2011

Web References

1. http://mm-nitk.vlabs.ac.in/

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	1	2	-	2	-	-	-	2	2	1
CO2	3	2	2	-	-	1	-	-	2	-	-	-	2	2	1
CO3	3	2	2	-	2	1	-	-	2	-	-	-	2	2	1
CO4	3	2	3	-	-	1	-	-	2	-	-	-	2	2	1
CO5	3	2	2	-	-	1	-	-	2	-	-	-	2	2	1

U20MET402 **HEAT AND MASS TRANSFER**

L	T	P	C	Hrs
2	2	0	3	45

Course Objectives

- To teach the students to understand the conduction type of heat transfer in steady and transient condition.
- To enable the students to expose the mechanisms of free and forced convection type of heat transfer.
- To develop the radiation shape factor for black and grey body radiations.
- To demonstrate the phase change heat transfer and calculate the performance of heat exchanging devices.
- To understand the phenomenon of diffusion and convective mass transfer.

Course Outcomes

On successful completion of this course, the students will be able to

CO1 - Understand the basic concepts of heat transfer and solve steady and unsteady conduction heat transfer problems.

CO2 - Determine the temperature variation and rate of heat flow in convection heat transfer problems.

CO3 - Explain basic laws for Radiation and Determine the radiative properties of a black and grey body radiation.

CO4 - To integrate the concepts of phase change heat transfer and compare the thermal performance of heat exchangers using LMTD and NTU approach

CO5 - Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications

UNIT I CONDUCTION (9 Hrs)

Introduction of heat transfer – conduction - convection and radiation – Laws – General equation of heat conduction – Derivation in Cartesian - cylindrical and spherical coordinates – One dimensional steady state heat conduction in simple geometries – plane wall - cylinder and sphere – Heat transfer composite walls - composite cylinders and composite spheres – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts.

UNIT II CONVECTION (9 Hrs)

Boundary layer theory – Hydrodynamic and Thermal Boundary Layer- Dimensional Analysis-Flow over a flat– Flow over cylinders -spheres - tube bank – Internal flow through pipes in forced heat transfer – Natural convection in vertical - inclined and horizontal surfaces – Mixed convection.

UNIT III RADIATION (9 Hrs)

Radiation heat transfer –Thermal radiation – Laws of radiation – Black body concept – Grey body radiation - Emissive power – Radiation shape factor-radiation heat exchange between surfaces – Electrical Analogy – Radiation Shields-Radiation through gases.

UNIT IV PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS (9 Hrs)

Condensation and Boiling – Film wise and drop wise condensation – Film condensation on a Vertical plate – Regimes of Boiling – Forced convection boiling. Heat Exchangers – Types and practical applications – Use of LMTD – Effectiveness – NTU method – Compact heat exchangers – Plate heat exchangers – Fouling factor.

UNIT V MASS TRANSFER (9 Hrs)

Introduction of Mass Transfer – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations-Evaporation of water into air.

Text Books

1. R. C. Sachdeva, Fundamentals of Heat and Mass Transfer, New Age International Publishers. 2017
2. C. P. Kothandaraman and S. Subramanyan, ,Fundamental of Heat and Mass Transfer, New Age International Publishers, 2012.
3. P. K. Nag, Heat and Mass Transfer, McGraw Hill Education India Pvt. Ltd. 2011.

References Books

1. C. P. Kothandaraman and S. Subramanyan, Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers, 2018.
2. Frank P. Incropera and David P. Dewitt, Incropera's principles of Heat and Mass Transfer, Wiley India Edition, 2018
3. Yunus A. Cengel, Heat and Mass Transfer: Fundamentals and Applications, McGraw Hill Education, 2016.
4. P. S. Ghoshdastidar, Heat Transfer, Oxford University Press. 2012
5. J. P. Holman, Heat Transfer, 10th Edition, McGraw-Hill Publishing Company Limited. 2011

Web References

1. https://nptel.ac.in/courses/112108149
2. https://nptel.ac.in/courses/112106170
3. https://nptel.ac.in/courses/112105248

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO2	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO3	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO5	3	2	2	1	1	-	-	-	-	-	-	-	2	2	2

U20ESP471 **PROGRAMMING IN JAVA LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To acquire programming skill in core java.
- To learn how to design java program and applications.
- To acquire object oriented skills in java.
- To develop the skill of designing applications.
- To explore database connectivity.

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Apply and practice logical formulations to solve simple problems leading to specific applications.
CO2 - Demonstrate the use of inheritance, interface and package in relevant applications.
CO3 - Create java applications using exception handling, multithread.
CO4 - Build java distributed applications using Collections and IO streams.
CO5 - Develop simple database programs.

List of Experiments

Implement the Following programs using JAVA

1. Develop simple programs using java technologies and testing tools.
2. Develop a java program that implements class and object.
3. Write a java program to demonstrate inheritance.
4. Develop a simple real life application program to illustrate the use of Multi Threads.
5. Implement simple applications using Collections.
6. Develop a simple application and use JDBC to connect to a back-end database.
7. Create a student application with Add, Edit, Delete, Show functions using JDBC.
8. Create a Bill Application to store sales details using JDBC.
9. Create java applications using Exception Handling for error handling.
10. Develop a java program that implements the Packages.

Text Books

1. E.Balagurusamy . “Programming with java”, TMH Publ, 2nd Edition, 2005.
2. JAVA How to programming by DIETEL&DIETEL.
3. Herbert Schil dt, “The Complete Reference JAVA 2”, TMH, Seventh E dit ion, 2006

Reference Books

1. Herbert Schildt, “Java: The Complete Reference”, TMH Publishing Company Ltd, New Delhi, ISBN: 9781260440249, 11th Edition, 2018.
2. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentalsll”, Prentice Hall, 9th Edition, 2013.
3. H.M.Dietel and P.J.Dietel,”Java How to Program”, Pearson Education/PHI, Sixth Edition, 2010.
4. Cay.S.Horstmann and Gary Cornell, “Core Java 2, Vol 2, Advanced Features”, Pearson Education, Seventh Edition, 2010.
5. Java for Programmers, P.J. Dietel and H.M Dietel,Pearson Education (OR) JAVA

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog
5. ttps://www.geeksforgeeks.org.

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	1	1	2	2	2	2	2	3	3	3
CO2	2	2	2	3	2	1	3	-	-	3	-	-	2	2	2
CO3	2	2	3	-	3	2	3	2	2	-	2	2	3	3	3
CO3	2	2	2	3	2	1	3	2	-	2	-	-	2	2	3
CO5	3	2	1	2	3	2	3	-	3	3	3	3	2	3	2

U20MEP401 **COMPUTER AIDED MACHINE DRAWING LAB**

L	T	P	C	Hrs
0	0	3	1	30

Course Objectives

- To expose the students to CAD /CAE software in the design and drawing of machine components
- Create 2-D Sketches
- To draw various permanent and temporary joints
- To be able to understand and find mistakes in the diagrams drawn by draughtsman
- To Create assembly models of simple machine

Course Outcomes

On successful completion of this course, the students will be able to

CO1 - Design and drawing of machine using suitable software
CO2 - Draw 2D Assembly models of simple machine
CO3 - Draw various joints using in machine assembly
CO4 - Apply the concept of GD &T in drawings
CO5 - Analyze the drawings using engineering skills

List of Experiments

1. Preparation of Drawings for Parts and Assembly of the following by using Drafting software.
2. Gear coupling, spring loaded safety valve, lever safety valve, blow-off cock, cast iron flange joint, hydraulic joint, feed check valve, foot step bearing, ball valve, stuffing box- minimum 5 exercises
3. Preparation of Production Drawings with tolerances limits and fits using Drafting software - Minimum one exercise
4. Introduction to Geometric Dimensioning & Tolerancing, Geometric Tolerances Symbols- Tolerance Zone, Run-out, Feature Control Frame & its components, Straightness, Flatness, Circularity & Cylindricity, Parallelism, Perpendicularity & Angularity, Material Conditions- MMC & LMC, Position Tolerance & Datums, Twelve Degrees of Freedoms & Datum Planes, Surface Symbols – Roughness- Applying Feature Control Frame usage in drawings

References/ Manuals/ Software

1. Ajeet Singh, Machine Drawing, Tata McGraw-Hill Publishing Company, New Delhi, 2nd Edition, 2012.
2. Bhatt.N.D. “Machine Drawing”, Charotar Publishing House, 50th Edition, 2016.
3. Narayana, K.L., Bheemanjaneyulu, S, "Engineering Drawing with AutoCAD 2016", New Age International, 1st Edition, 2018.
4. Venugopal, K., Prabhu Raja, V. "Engineering Drawing + AutoCAD", New Age International 5th Edition, 2011.
5. Goutam Pohit, Goutam Ghosh, Machine drawing with AutoCAD, Pearson Education, 1st Edition, 2007.
6. P.S. Gill, Geometric Dimensioning & Tolerancing, S. K. Kataria & Sons, 2009.

Web References

1. https://mech.iitm.ac.in/Production%20Drawing.pdf

Cos Mapping with POs and PSOs

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO3	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO4	3	2	2	1	1	-	-	-	-	-	-	1	2	2	-
CO5	3	3	3	2	1	-	-	-	-	-	-	1	2	2	-

U20MEP402 **HEAT TRANSFER LAB**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To apply conduction and convection heat transfer concepts to do experimentation on heat transfer equipment and improve practical knowledge of the systems.
- To apply radiation heat transfer concept to find Stefan Boltzmann constant and emissivity.
- To teach the principle of parallel flow, Counter flow and Plate type heat exchangers

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Analyse and Interpret heat transfer parameters by conducting experiments on conduction and convection experimental setups.

CO2 - Analyse and Interpret heat transfer parameters by conducting experiments on radiation experimental setups.

CO3 - Analyse and Interpret heat transfer parameters by conducting experiments on Heat exchanger experimental setups.

List of Experiments

1. Heat transfer on cylindrical surface by natural convection
2. Heat transfer on cylindrical surface by forced convection
3. Heat transfer from Pin fin by natural convection
4. Heat transfer from Pin fin by forced convection
5. Heat transfer on a composite wall
6. Determination of Stefan Boltzmann constant
7. Determination of emissivity of a specimen
8. Experiment on Parallel flow heat exchanger
9. Experiment on Counter flow heat exchanger
10. Experiment on plate type heat exchanger

Reference Books

1. C. P. Kothandaraman and S. Subramanyan, (2018), Heat and Mass Transfer Data Book, Fifth Edition, New Age International Publishers.
2. R. C. Sachdeva, (2017), Fundamentals of Heat and Mass Transfer, New Age International (P) Ltd.
3. J. P. Holman, (2011), Heat Transfer, 9th Edition, McGraw-Hill Publishing Company Limited.

Cos Mapping with POs and PSOs

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CO2	3	2	2	1	1	-	-	-	-	-	-	2	2	2	2
CO3	3	2	2	1	1	-	-	-	-	-	-	2	2	2	2

U20HSP402 **GENERAL PROFICIENCY - II**

L	T	P	C	Hrs
0	0	2	1	45

Course Objectives

- To examine various standardized test in English language
- To recognize the key features of various technical writing
- To integrate LSRW skills to endorse multifarious skill set in practical situation
- To understand the factors that influences the usage of grammar
- To assess the capability to understand, analyse and interpret written information

Course Outcomes

On successful completion of the course, students will be able to

CO1 - Derive ideas to attend international standardized test internationally by broadening receptive and productive skills

CO2 - Inculcate types of writing required in a variety of situation

CO3 - Develop language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation

CO4 - Adhere the rules of grammar in formal and informal communication

CO5 - Assimilate the correct patterns of the language and reproduce the sound units with correct Pronunciation

UNIT I CAREER SKILLS (9 Hrs)

Listening: Listening at specific contexts speaking: Mock interview (Personal & Telephonic)-Reading: Read and Review -Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) writing: Essay Writing (TOEFL) Vocabulary: Words at specified context (IELTS)

UNIT II CORPORATE SKILLS (9 Hrs)

Listening: Listening and replicating Speaking: Team Presentation (Work Place Etiquettes) Reading: Short texts (signs, emoticons, messages) Writing: E-mail writing- Hard skills -Resume' Writing, Job Application Letter, Formal Letter Vocabulary: Glossary (IELTS)

UNIT III FUNCTIONAL SKILLS (9 Hrs)

Listening: Listening TED Talks – Speaking: Brainstorming &Individual Presentation, Persuasive Communication –- Reading: Text Completion (GRE Based) Writing: Expansion of Compound Words Vocabulary: Expansion of vocabulary (IELTS)

UNIT IV TRANSFERABLE SKILLS (9 Hrs)

Listening: Listening Documentaries and making notes –Speaking: Conversation practice at formal & informal context Reading: Read and transform- report, memo, notice and advertisement, Writing: Euphemism, Redundancy, and Intensifiers Vocabulary: Refinement of vocabulary (IELTS)

UNIT V APTITUDE (9 Hrs)

Transformational Grammar: Phrases & Clauses, Concord, Conditional Clauses, Voice, Modals.

Verbal Ability Enhancement: Letter Series, Coding &Decoding, Sentence Completion (GATE), Critical Reasoning & Verbal Deduction (GATE), Syllogism

Reference Books

1. Barron's IELTS 3rdedition, Dr. Lin Lough heeds, New Age International Publishers
2. A Modern Approach to Verbal & Non –Verbal Reasoning, Dr.R.S.Agarwal
3. Bruce Tulgan,Bridging the Soft Skills Gap: How to Teach the Missing Basics to Today's Young Talent Kindle Edition
4. Cambridge practice tests for IELTS, TOEFL
5. Gopalasamy Ramesh, Mahadevan Raj, The Ace of Soft Skills Attitude Communication, 2010

Web References

1. www.indeed.co.in › career-advice › resumes-cover-letters › soft-skills
2. www.britishcouncil.in › exam › ielts › test-taker-portal

Cos Mapping with POs and PSOs

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CO2	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
CO3	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
CO4	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
CO5	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-