RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

Department of Mechanical Engineering

RSET VISION

To evolve into a premier technological and research institution, moulding eminent professionals with creative minds, innovative ideas and sound practical skill, and to shape a future where technology works for the enrichment of mankind.

RSET MISSION

To impart state-of-the-art knowledge to individuals in various technological disciplines and to inculcate in them a high degree of social consciousness and human values, thereby enabling them to face the challenges of life with courage and conviction.

DEPARTMENT VISION

To evolve into a centre of excellence by imparting professional education in mechanical engineering with a unique academic and research ambience that fosters innovation, creativity and excellence.

DEPARTMENT MISSION

- *To have state-of-the-art infrastructure facilities.*
- *To have highly qualified and experienced faculty from academics, research organizations and industry.*
- *To develop students as socially committed professionals with sound engineering knowledge, creative minds, leadership qualities and practical skills.*

PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Demonstrate the ability to analyse, formulate and solve/design engineering/real life problems based on his/her solid foundation in mathematics, science and engineering.

PEO 2: Showcase the ability to apply their knowledge and skills for a successful career in diverse domains viz., industry/technical, research and higher education/academia with creativity, commitment and social consciousness.

PEO 3: Exhibit professionalism, ethical attitude, communication skill, team work, multidisciplinary approach, professional development through continued education and an ability to relate engineering issues to broader social context.

PROGRAMME OUTCOMES

1) **Engineering Knowledge:** Apply the knowledge of Mathematics, Science, Engineering fundamentals, and Mechanical Engineering to the solution of complex engineering problems.
2) **Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.
3) **Design/development of solutions:** Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4) **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
6) **The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional Engineering practice.
7) **Environment and sustainability:** Understand the impact of the professional Engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments.
8) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the Engineering practice.
9) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10) **Communication:** Communicate effectively on complex Engineering activities with the Engineering Community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11) **Project management and finance:** Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
12) **Life -long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES

Mechanical Engineering Programme Students will be able to:

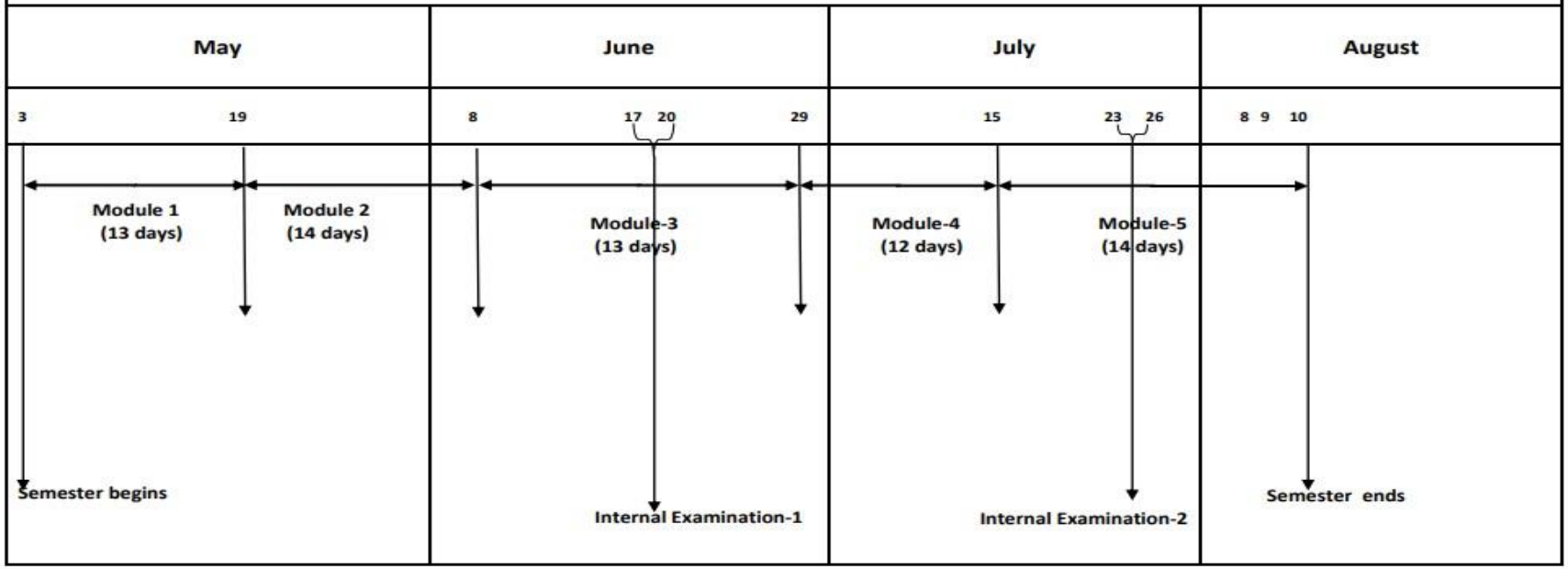
1) Apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.
2) Successfully apply the principles of design, analysis and implementation of mechanical systems/processes which have been learned as a part of the curriculum.
3) Develop and implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices.

SEMESTER PLAN

RSET
RAJAGIRI SCHOOL OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)

SEMESTER PLAN (S2/S4)

MAY 2022 – AUGUST 2022



May: 21 **June: 23** **July: 21** **August: 7**

Total no of working days: 72

Total no of instructional days: 66

ASSIGNMENT SCHEDULE	
Week 4	**VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS**
Week 5	**ENGINEERING CHEMISTRY**
Week 5	**Engineering Graphics**
Week 6	**Basics of Civil & Mechanical Engineering**
Week 7	**PROFESSIONAL COMMUNICATION**
Week 8	**PROGRAMMING IN C**
Week 8	**VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS**
Week 9	**ENGINEERING CHEMISTRY**
Week 9	**Engineering Graphics**
Week 12	**Basics of Civil & Mechanical Engineering**
Week 12	**PROFESSIONAL COMMUNICATION**
Week 13	**PROGRAMMING IN C**

SCHEME

Code	Subject	Hours/week			Credits
		L	T	P/D	
101908/MA200A	VECTOR CALCULUS, DIFFERENTIAL EQUATIONS AND TRANSFORMS	3	1	-	4
101908/CH900B	ENGINEERING CHEMISTRY	3	1	-	4
101908/ME900C	Engineering Graphics	2	-	2	3
101908/CO900D	Basics of Civil & Mechanical Engineering	4	-	-	4
101908/EN200E	PROFESSIONAL COMMUNICATION	2	-	2	
101905/CO200G	PROGRAMMING IN C	2	1	2	4
101908/CH922S	ENGINEERING CHEMISTRY LAB	-	-	2	1
101908/CO922T	Basics of Civil & Mechanical Engineering Workshop	-	-	2	1
	Total	**16**	**3**	**10**	**21**

4. 101908/C0900D BASICS OF CIVIL AND MECHANICAL ENGINEERING

4.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
PROGRAMME: MECHANICAL ENGINEERING	DEGREE: **B.TECH** UNIVERSITY**: AUTONOMOUS**
COURSE: BASICS OF CIVIL AND MECHANICAL ENGINEERING	SEMESTER**: II** CREDITS: **4**
COURSE CODE: 101908/C0900D ***REGULATION: UG***	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: BASIC SCIENCE	CONTACT HOURS: **4+1 hours/Week.**

SYLLABUS:

UNIT	***DETAILS***	***HOURS***
I	Relevance of Civil Engineering in the overall infrastructural development of the country Responsibility of an engineer in ensuring the safety of built environment. Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering Types of constructed facilities: Residential and commercial buildings, roads, bridges canals, hydraulic structures, earth retaining structures, offshore/coastal structures, industrial facilities, water/sewage treatment plants. Selection of site for buildings, building rules and regulations: Relevance of NBC, KBR (Interior and exterior open spaces & Site plan), CRZ norms (brief discussion only).Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR (Numerical Examples)	6
II	Types/classifications, properties and uses of stones, soil, timber, bricks, bitumen, cement and other binders, gypsum, aggregates, water, steel, aluminum, glass, ceramics, plastics, thermal and acoustic insulating materials, construction chemicals(grouts, paints, adhesives other coating materials etc.) and composite materials.	8
III	Surveying: Importance, objectives and principles, Classification of surveying, Introduction to GIS Concepts of Building Construction: Earth work and equipment, Types of foundations, brick masonry and random rubble masonry, load bearing and framed structures, types of roofs and floors, MEP, HVAC, elevators, escalators and ramps, fire safety for buildings	12

	Concepts of sustainable construction: Green buildings ratings: materials, energy systems, water management and environment for green buildings. Components of roads and highways, components of bridges	
IV	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle-Derivation of efficiency of these cycles, Problems to calculate heat added, heat rejected, net-work and efficiency IC Engines: CI, SI, 2-Stroke, 4-Stroke engines. Listing the parts of different types of IC Engines, efficiencies IC Engines(Description only) Air, Fuel, cooling and lubricating systems in SI and CI Engines, CRDI, MPFI. Concept of hybrid engines	8
V	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, Vapour compression cycle (only description and no problems) Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners Description about working with sketches: Reciprocating pump, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency, Problems on calculation of input and output power of pumps and turbines Description about working with sketches of: Belt and Chain drives, Gear and Gear trains, Single plate clutches	9
VI	Manufacturing Process: Basic description of the manufacturing processes – Sand Casting, Forging, Rolling, Extrusion and their applications. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications. Basic Machining operations: Turning, Drilling, Milling and Grinding Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine Principle of CAD/CAM, Rapid and Additive manufacturing	7
TOTAL HOURS		**50**

TEXT/REFERENCE BOOKS:

T/R	***BOOK TITLE/AUTHORS/PUBLICATION***
T1	Dalal, K R, Essentials of Civil Engineering, Charotar Publishing House
T2	McKay, W. B. and McKay, J. K., Building Construction Volumes 1 to 4, Pearson India Education Services
T3	Benjamin J., Basic Mechanical Engineering, Pentex books, 9th Edition,2018
T4	Balachandran P., Basic Mechanical Engineering, Owl Books
R1	Chen W.F and Liew J Y R (Eds), The Civil Engineering Handbook. II Edition CRC Press (Taylor and Francis)
R2	Chudley, R and Greeno R, Building construction handbook, Addison Wesley, Longman group, England
R3	Chudley, R, Construction Technology, Vol. I to IV, Longman group, England Course Plan
R4	Kandya A A, Elements of Civil Engineering, Charotar Publishing house

R5	Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers
R6	Rangwala S C and Ketki B Dalal, Engineering Materials, Charotar Publishing house
R7	Rangwala S C and Ketki B Dalal, Building Construction, Charotar Publishing house
R8	Clifford, M., Simmons, K. and Shipway, P., An Introduction to Mechanical Engineering Part I - CRC Press
R9	Roy and Choudhary, Elements of Mechanical Engineering, Media Promoters &Publishers Pvt. Ltd., Mumbai.
R10	P.K.Nag, *Engineering Thermodynamics*, McGraw Hill
R11	P.L. Bellany, *Thermal Engineering*, Khanna Publishers
R12	Sawhney G. S., Fundamentals of Mechanical Engineering, PHI

COURSE PRE-REQUISITES:

C.CODE	*COURSE NAME*	*DESCRIPTION*	*SEM*

COURSE OBJECTIVES:

1	To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.
2	To provide the students an illustration of the significance of the Civil Engineering Profession in satisfying societal needs.
3	To introduce the students to the basic principles of mechanical engineering

COURSE OUTCOMES:

SNO	*DESCRIPTION*	*Bloom's Taxonomy Level*
C101908/C0900D.1	Students will be able to recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.	Understand (level 2)
C101908/C0900D.2	Students will be able to explain different types of buildings, building components, building materials and building construction	Remember (level 2)
C101908/C0900D.3	Students will be able to describe the importance, objectives and principles of surveying.	Understand (level 3)
C101908/C0900D.4	Students will be able to summarise the basic infrastructure services MEP, HVAC, elevators, escalators and ramps	Remember (level 2)
C101908/C0900D.5	Students will be able to discuss the Materials, energy	Remember

	systems, water management and environment for green buildings.	(level 3)
C101908/C0900D.6	Students will be able to understand the important concepts of thermodynamics and will be able to analyze thermodynamic cycles	Understand and Analyze (level 2, 3)
C101908/C0900D.7	Students will be able to illustrate the working and features of IC Engines and can identify the scope of electronics in IC engines	Understand (level 2)
C101908/C0900D.8	Students will be able to identify and differentiate the different components of a refrigerator and air-conditioning unit.	Understand (level 2)
C101908/C0900D.9	Students will be able to understand the working of hydraulic machines	Understand (level 2)
C101908/C0900D.10	Students will be able to understand the working of power transmission devices. And will be able to select appropriate transmission device for a specific requirement.	Apply (level 3)
C101908/C0900D.11	Students will be able to classify different manufacturing processes for various applications.	Understand (level 2)
C101908/C0900D.12	Students will be able to apply their knowledge in machine tools to extend their opportunities in CNC machine tools.	Understand (level 2)

CO-PO AND CO-PSO MAPPING

	PO1	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***	***PO11***	***PO12***	***PSO1***	***PSO2***	***PSO3***
C101908/C0900D.1	3					3	2	2							
C101908/C0900D.2	3	2		1	3			3							
C101908/C0900D.3	3	2			3				2						
C101908/C0900D.4	3	2			3				2						1
C101908/C0900D.5	3	2			3	2	3		2						1
C101908/C0900D.6	2	2								1					
C101908/C0900D.7	2					1				1					
C101908/C0900D.8	2	1								1					

C101908/C0 900D.9	2	1								1					
C101908/C0 900D.10	2	1								1					
C101908/C0 900D.11	2									1					
C101908/C0 900D.12	2				1	1				1					

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	***LOW/MEDIUM/ HIGH***	***JUSTIFICATION***
C101908/C0 900D.1-PO 1	H	Recalling the role of the oldest branch of engineering in the development of infrastructure and society is highly important engineering knowledge.
C101908/C0 900D.1-PO 6	H	Civil engineering has a direct role in development of the society
C101908/C0 900D.1-PO 7	M	Environmental Engineering is a branch of Civil engineering that gives importance to the environment and the concept of sustainability
C101908/C0 900D.1-PO8	M	Ethics is very important in the field of construction
C101908/C0 900D.2-PO 1	H	The knowledge of the different types of buildings and building materials is an important engineering knowledge.
C101908/C0 900D.2-PO 2	M	Helps to identify, formulate, review research literature, and analyse complex civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
C101908/C0 900D.2-PO 4	L	Helps use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
C101908/C0 900D.2-PO 5	H	Helps create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the

		limitations.
C101908/C0 900D.2-PO 8	H	Ethics comes into play in adhering to maintain the highest quality in construction by selecting the best quality materials
C101908/C0 900D.3-PO 1	H	Helps apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of surveying problems.
C101908/C0 900D.3-PO 2	M	Helps to identify, formulate, review research literature, and analyse complex civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
C101908/C0 900D.3-PO 5	H	Helps create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
C101908/C0 900D.3-PO 9	M	Helps function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
C101908/C0 900D.4-PO 1	H	Helps apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of surveying problems.
C101908/C0 900D.4-PO 2	M	Helps to identify, formulate, review research literature, and analyse complex civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
C101908/C0 900D.4-PO 5	H	Helps create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
C101908/C0 900D.4-PO 9	M	Helps function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
C101908/C0 900D.5-PO 1	H	Helps apply the knowledge of mathematics, science, engineering fundamentals, and an engineering

		specialization to the solution of surveying problems.
C101908/C0900D.5-PO 2	M	Helps to identify, formulate, review research literature, and analyse complex civil engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
C101908/C0900D.5-PO 5	H	Helps create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
C101908/C0900D.5-PO 6	M	Helps apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
C101908/C0900D.5-PO 7	H	Helps understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
C101908/C0900D.5-PO 9	M	Helps function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
C101908/C0900D.6-PO1	M	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of thermodynamics.
C101908/C0900D.6-PO2	M	Problem analysis and obtaining the efficiencies of different thermodynamic cycles using the using the first principles of mathematics and thermodynamic process.
C101908/C0900D.6-PO10	L	Effectively communicate about the various terminologies used in thermodynamics.
C101908/C0900D.7-PO1	M	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of various energy conversion devices.
C101908/C0900D.7-PO6	L	Apply the knowledge in different energy conversion devices for the betterment of societal and safety issues of the society.
C101908/C0	L	Effectively communicate about the working of various

900D.7-PO10		energy conversion devices.
C101908/C0900D.8-PO1	M	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of refrigerator and air-conditioning unit.
C101908/C0900D.8-PO6	L	Apply the knowledge in different energy conversion devices for the betterment of societal and safety issues of the society.
C101908/C0900D.8-PO10	L	Effectively communicate about the working of various energy conversion devices.
C101908/C0900D.9-PO1	M	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of refrigerator and air-conditioning unit.
C101908/C0900D.9-PO10	L	Effectively communicate about the working of refrigerator and air-conditioning unit.
C101908/C0900D.9-PO2	L	Understanding the fundamental terms/parameters involved in RAC
C101908/C0900D.9-PO1	M	While understanding the principles of hydraulic machines students may apply knowledge in science and engineering
C101908/C0900D.9PO2	L	Basic calculations of efficiency of hydraulic machines
C101908/C0900D.9-PO10	L	Effectively communicate about hydraulic machinery
C101908/C0900D.10-PO1	M	Apply the knowledge of mathematics, science and engineering fundamentals to understand the concepts of power transmission devices.
C101908/C0900D.10-PO2	L	Basic understanding of calculations involved in power transmission devices
C101908/C0900D.10-PO10	L	Effectively communicate about the working of Power transmission devices.
C101908/C0900D.11-PO1	M	Apply the knowledge of mathematics, science and engineering fundamentals to understand the different engineering materials and manufacturing process.

C101908/C0900D.11-PO10	L	Effectively communicate about different manufacturing process.
C101908/C0900D.12-PO10	M	Apply the knowledge of mathematics, science and engineering fundamentals to understand the working of machine tools.
C101908/C0900D.12-PO10	L	Students will be able to gain the knowledge regarding modern machine tools
C101908/C0900D.12-PO10	L	Effective utilization of machine tools can reduce material and energy wastage.
C101908/C0900D.12-PO10	L	Effectively communicate about working of machine tools.

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*
C101908/C0900D.4-PSO 3	L	Graduates will be able to collaborate with engineers from other disciplines to develop products for the betterment of the society.
C101908/C0900D.5-PSO 3	L	Graduates will be able to collaborate with engineers from other disciplines to develop products for the betterment of the society.
C101908/C0900D.6-PSO 2	M	Knowledge in various thermodynamic cycles and have fundamental knowledge on Internal Combustion Engines
C101908/C0900D.7-PSO 2	M	Have basic understanding on various thermodynamic processes and components of IC engines
C101908/C0900D.8-PSO 2	M	Knowledge on hydraulic machines and power transmission devices
C101908/C0900D.9-PSO 2	M	Graduates will be able to know the various manufacturing processes to be used for various applications

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO\PSO*	*PROPOSED ACTIONS*
1	Cement Mortar, Processes in concreting, Grades of concrete.	PO1	Classroom lectures
2	Significance of water cement ratio in concreting	PO1	Classroom lectures
3	Gas Laws, Ideal Gas Equation	PO1	Classroom lectures
4	Psychrometric Chart	PO1	Classroom lectures

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SINO:	**TOPIC**	**RELEVENCE TO PO\PSO**
1	Building finishes (Plastering, Painting etc.)	PO1, PO2, PO3
2	Introduction to construction equipment's	PO1, PO2, PO3
3	Lab visit to show the different parts of an automobile	PO1
4	Gas Laws, Ideal Gas Equation	PO1

WEB SOURCE REFERENCES:

1	Introduction to Civil Engineering Profession – Nptel - https://nptel.ac.in/courses/105/106/105106201/
2	Civil Engineering - Building materials and Construction - Nptel https://nptel.ac.in/courses/105/102/105102088/
3	https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8
4	https://www.youtube.com/watch?v=2iYqZ8tIP1I&list=PLT7nZHsCM2mxVhbXn7BeHTXg4w7btBf5I
5	https://www.youtube.com/watch?v=RR-3Uq--4Oo&list=PLE2DA184A2E479885&index=11
6	https://nptel.ac.in/content/storage2/courses/112105125/pdf/mod13les2.pdf
7	https://nptel.ac.in/courses/112/104/112104117/
8	https://nptel.ac.in/courses/112/107/112107219/

9	https://nptel.ac.in/content/storage2/courses/108105063/pdf/L-23(SM)%20(IA&C)%20((EE)NPTEL).pdf

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☑ LCD/SMART BOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

4.2 COURSE PLAN

DAY	*MODULE*	*TOPIC PLANNED*
1	*1*	*General Introduction to Civil Engineering, Relevance of Civil Engineering in the overall infrastructural development of the country.*
2	*1*	*Responsibility of an engineer in ensuring the safety of built environment.*
3	*1*	*Brief introduction to major disciplines of Civil Engineering like Transportation Engineering, Structural Engineering, Geo-technical Engineering, Water Resources Engineering and Environmental Engineering.*
4	*1*	*Introduction to buildings: Types of buildings*
5	*1*	*selection of site for buildings*
6	*1*	*Types of constructed facilities: Residential and commercial buildings, roads, bridges canals, hydraulic structures, earth retaining structures,*

		offshore/coastal structures, industrial facilities, water/sewage treatment plants.
7	*1*	*Building rules and regulations: Relevance of NBC, KBR*
8	*1*	*Building rules and regulations: Relevance of CRZ norms*
9	*1*	*Building area: Plinth area, built up area, floor area, carpet area and floor area ratio for a building as per KBR.*
10	*2*	*Surveying: Importance, objectives and principles , Steel: Steel sections and steel reinforcements, types and uses*
11	*2*	*Construction materials, Conventional construction materials: types, properties and uses of building materials: bricks, cement*
12	*2*	*Construction materials, Conventional construction materials: types, properties and uses of building materials: stones,*
13	*2*	*Construction materials, Conventional construction materials: types, properties and uses of building materials: cement*
14	*2*	*Construction materials, Conventional construction materials: types, properties and uses of building materials: timber and sand*
15	*2*	*Construction materials, Conventional construction materials: types, properties and uses of building materials: sand*
16	*2*	*Cement concrete: Constituent materials, properties and types.*
17	*2*	*Steel: Steel sections and steel reinforcements, types and uses.*
18	*2*	*Modern construction materials:- Architectural glass, ceramics,*
19	*2*	*Modern construction materials:- Plastics, composite materials, thermal and acoustic insulating materials*
20	*2*	*Modern construction materials:- decorative panels, waterproofing materials. Modern uses of gypsum, pre-fabricated building components*
22	*3*	*Building Construction: Foundations: Bearing capacity of soil (definition only), functions of foundations*
23	*3*	*Building Construction: Foundations:types – shallow and deep*
24	*3*	*Load bearing and framed structures*
25	*3*	*Brick masonry: - Header and stretcher bond, English bond & Flemish bond*
26	*3*	*Random rubble masonry*
27	*3*	*Roofs and floors: - Functions, types; flooring materials*
28	*3*	*Basic infrastructure services: MEP, HVAC, elevators, escalators and ramps, fire safety for buildings.*
29	*3*	*Green buildings:- Materials, energy systems, water management and environment for green buildings.*
30	*3*	*Revision*
31	4	Analysis of thermodynamic cycles: Carnot, Otto, and Diesel cycle-
32	4	Derivation of efficiency of these cycles,
33	4	Problems to calculate heat added,
34	4	heat rejected, net-work and efficiency.

35	4	IC Engines: CI, SI, 2-Stroke, 4-Stroke engines.
36	4	Listing the parts of different types of IC Engines, efficiencies IC Engines(Description only)
37	4	Air, Fuel, cooling and lubricating systems in SI and CI Engines,
38	4	CRDI, MPFI. Concept of hybrid engines
39	5	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, Vapour compression cycle (only description and no problems)
40	5	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Cooling and dehumidification, Layout of unit and central air conditioners.
41	5	Description about working with sketches: Reciprocating pump, Centrifugal pump,
42	5	Pelton turbine, Francis turbine and Kaplan turbine. Overall efficiency,
43	5	Problems on calculation of input and output power of pumps and turbines
44	5	Problems on calculation of input and output power of turbines
45	5	Description about working with sketches of: Belt and Chain drives,
46	5	Gear and Gear trains, Single plate clutches
47	6	Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing, and their applications.
48	6	Basic Machining operations: Turning, Drilling, Milling and Grinding
49	6	Description about working with block diagrams of: Lathe, Drilling machine, Milling machine, CNC Machine
50	6	Principle of CAD/CAM, Rapid and Additive manufacturing

4.3 MODULE WISE SAMPLE QUESTIONS

UNIT WISE QUSTION BANK

Module I

1) Explain the functional requirements of residential buildings.
2) Explain the role of civil engineer to the society.
3) Explain the general requirements of site and building for planning a residential building.
4) What are the factors to be considered in the selection of site for a residential building?
5) Explain in detail about the classification of buildings as per NBC.
6) Briefly discuss on KBR and CRZ
7) With neat sketch explain the essential components of a residential building.
8) List out the various building components of your house. (2 marks)
9) Give the functions of any three building components. (3 marks)

10) Classify the types of buildings as per National Building Code of India. (3 marks)
11) Explain the relevance of Civil Engineering in the overall infrastructural development of the country. (3 marks)
12) Explain the responsibility of an engineer in ensuring the safety of built environment. (3 marks)
13) List out the types of building as per occupancy. Explain any two, each in about five sentences. (6 marks)
14) Explain very briefly about the classification of buildings based on occupancy. (3 marks)
15) Write a short note on various components of a residential building and their functions. (6 marks)
16) Write a note on the importance of civil engineering on infrastructural development of India.(6 marks)
17) What is civil engineering? Explain the role of Civil engineer in society.
18) What measures should be taken during the site selection for building?
19) What are the various disciplines of civil engineering?
20) Explain the different fields of civil engineering.
21) What is the scope of civil engineering in the different field?
22) Discuss some recent remarkable infrastructure developments in India.
23) What are the different types of buildings according to NBC(National Building Code)?
24) Explain the kinds of buildings as per NBC and also write the comparison of load bearing and framed structure.
25) Explain different constructed facilities around you.
26) Explain coverage and FAR.
27) Explain plinth area and plot area.
28) Differentiate carpet area and floor area

Module II

1) Define surveying. What are the objectives of surveying
2) What is meant by Grade of cement? Give different grades of cement available in the market.
3) What are the chemical properties of cement?
4) Differentiate initial and final setting time of cement.
5) What are the properties of mild steel?
6) What is meant by tor steel? List out its advantages.
7) Explain the importance of steel in concrete.
8) Give the qualities of ideal brick.
9) List out the uses of brick.
10) Explain the manufacture of OPC.

11) Explain different types of cement
12) With neat sketches explain the different types of structural steel sections available in the market.
13) What are the different types of brick? Explain.
14) Differentiate cement mortar and cement concrete.
15) Differentiate between plain cement concrete and reinforced cement concrete.
16) What are the functions of water in concrete?
17) What are the objects of curing on concrete?
18) Describe the cement mortar preparation.
19) Give the advantages and disadvantages of concrete.
20) Explain the types of concrete.
21) What are the properties of concrete? Explain.
22) List out the grades of Ordinary Portland Cement (ICE,January,2016)
23) Sketch and explain any three structural steel sections (ICE,January,2016)
24) Which is the strongest bond in brick work? (ICE,January,2016)
25) What are the different flooring materials and factors affecting its selection?(ICE,January,2016)
26) Write any one relevant factor for selecting suitable flooring material.
27) List out the various types of tiles used in civil engineering (ICE,January,2016)
28) What are the uses of mild steel ?(ICE,January,2016)
29) What are the different types of roofing material? (ICE,January,2016)
30) Explain different types of steel with their properties (BCE,January,2016)
31) What are the constituents of cement and explain the functions of each? (BCE,January,2016)
32) What are the different kinds of cement available and what is their use?
33) Briefly discuss on Modern construction materials - Architectural glass, ceramics, Plastics, composite materials, thermal and acoustic insulating materials, decorative panels, waterproofing materials.

Module III

1) What are the objectives of foundations?
2) Define bearing capacity of soil.
3) Differentiate between ultimate bearing capacity and safe bearing capacity of soil
4) Give the difference between deep and shallow foundations.
5) Draw neat sketch of the following: a) Isolated Stepped Footing b) Cantilever Footing c) continuous Footing (BCE January 2016)
6) Define Stretcher and Header
7) Draw the elevation and plan of one brick thick wall with English Bond. (BCE January, 2016)

8) Draw the elevation and plan of one brick thick wall with Flemish Bond. (BCE January, 2016)
9) Compare and contrast English Bond and Flemish Bond with sketches.
10) What are the essential features of English Bond. (ICE January, 2016)
11) What are the essential features of Flemish Bond.
12) List the functions/requirements of roofs.
13) Explain different types of roofs. (Please note roofs and roofing materials are different)
14) What are the various roofing materials available? (BCE January, 2016)
15) List out seven advantages and disadvantages of flat roof. (ICE January, 2016)
16) List the functions/requirements of floors.
17) Explain different types of floors.
18) List the various types of flooring materials.
19) Write short note on lifts/elevators.
20) Explain the various design considerations for provision of lifts/elevators in a building.
21) Write short note on escalators.
22) Difference between elevators and escalators. (BCE, January 2016)
23) Write short note on ramps.
24) Explain the concept of air conditioning.
25) What are the purposes of air conditioning in a building? (BCE, January 2016)
26) Explain the different types of air conditioning systems. (BCE, January 2016)
27) What are the major sound proofing materials? Explain briefly. (BCE, January 2016)
28) Write short note on fire safety for buildings
29) Write a short on intelligent buildings.
30) What is meant by intelligent buildings? What are the various conditions to be satisfied by intelligent buildings? (BCE, January 2016)
31) Write a short note on Green Buildings.

Module IV

1. What is compression ratio of an IC engine?
2. Why there is NO engine which works based on Carnot cycle?
3. Explain the need of cooling systems in IC engines.
4. Name any SIX parts of an IC engine.
5. Explain the various processes of a Carnot cycle with the help of P-V diagram.
6. During a Carnot cycle the working fluid receives heat at a temperature of 317ºC and rejects heat at a temperature of 22ºC. Find the theoretical efficiency of the cycle.
7. With the help of a schematic diagram explain the working of a 4 stroke SI engine.
8. Draw the P-V diagram of Diesel Cycle and derive its efficiency.
9. Compare SI engines and CI engines.

10. In an Otto Cycle, condition of air is 27ºC and 1 bar at the start of compression. If the clearance volume is 20% of the swept volume, estimate (i) Temperature at the end of compression and (ii) Air standard efficiency of the cycle.
11. Explain the air system of SI & CI engines.
12. Briefly describe CRDI system with a neat sketch
13. Give details of a MPFI system with the help of a neat labelled diagram
14. Briefly explain the various types of WET sump lubrication systems.
15. Explain the working of a TWO stroke petrol engine

Module V

1) With neat sketch explain the working of Kaplan turbine.
2) Differentiate between open belt drive and cross belt drive. Mention its field of applications. ·
3) Explain why reciprocating pump runs at low speeds.
4) Explain with neat sketch the working of Francis turbine. What is the significance of draft tube in a Francis turbine?
5) Explain with neat sketch the working of Kaplan turbine?
6) What is the function of a scroll casing in a Francis turbine?
7) With a suitable sketch explain the working of a reciprocating pump.
8) Explain different types of gear trains with neat sketches
9) Explain the working of a single plate clutch with neat sketch.
10) Explain the split air conditioner and its working.
11) With the help of a neat sketch explain the working of a reciprocating pump.
12) Describe any four desirable properties of refrigerants.
13) What is relative humidity, Dew point temperature, specific humidity? Mention their units
14) Define DBT and WBT? What is the condition for saturated air?
15) Draw and explain a psychrometric chart
16) Explain various psychrometric processes and represent them on a schematic psychrometric chart.
17) Expalin various types of unitary AC systems.
18) Differentiate between impulse and reaction turbine.
19) Differentiate between positive displacement pumps and roto-dynamic pumps.
20) With neat schematic explain the working of centrifugal pump.
21) Draw neat schematics of Francis Turbine, Kaplan turbine, and Pelton turbine. Name the parts of each turbine.

Module VI

1. Compare the specialties of welding, brazing and soldering operations in metal joining. Discuss the fields of application.
2. Draw labelled schematic sketches of: a. Lathe b. Horizontal Milling Machine c. Radial Drilling Machine
3. Discuss the procedure for sand casting.
4. Explain arc welding and gas welding with neat schematics.

5. Compare conventional machine tools and CNC machines.
6. Describe the working of a cluster rolling mill giving a sketch.

7. Explain the rolling process. With neat sketches explain different types of rolling mills.
8. Explain the extrusion process. Compare direct and indirect extrusion process.
9. Explain important mechanical properties of materials.
10. With a neat diagram explain the main parts of a drilling machine. Explain any four operations performed on a drilling machine.
11. Compare up milling and down milling processes with neat diagrams.
12. With a neat sketch explain an arc welding process.
13. With a neat diagram explain the main parts a shaping machine.
14. Explain any five casting defects.
15. Bring out any 5 points of distinction between hot and cold rolling.
16. Why is casting the process of choice for manufacturing machine tool bases and beds of lathe? Explain casting process using a simple sketch.
17. Explain the basic steps involved in additive manufacturing.
18. With the help of a neat labelled sketch, explain the use of 2 high and 4 high rolling mills in rolling.
19. With the help of a neat sketch, explain the parts and working of a Drilling Machine.
20. Explain the parts and working of a horizontal milling machine using a neat labelled figure.
21. Explain the parts of a lathe using a neat labelled figure.
22. Using neat figures, explain the following milling processes: a. Plain milling b. Face milling
23. Explain the properties of moulding sand.
24. Explain the difference between soldering and brazing.

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5. 101908/CO922T MECHANICAL ENGINEERING WORKSHOP

5.1 COURSE INFORMATION SHEET

PROGRAMME: Common to All Branches	***DEGREE:*** BTECH
COURSE: MECHANICAL ENGINEERING WORKSHOP	**SEMESTER:** II **CREDITS:** 1
COURSE CODE: 101908/C0922T ***REGULATION:*** 2021	**COURSE TYPE:** CORE LAB
COURSE AREA/DOMAIN: BASIC SCIENCE	**CONTACT HOURS:** 2(Practical) Hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	**LAB COURSE NAME:** NA

SYLLABUS:

SL.NO.	*NAME OF SHOP FLOOR*	*DETAILS*	*HOURS*
1	**General**	Studies of mechanical tools, components and their applications: (a) Tools; Screw drivers, Spanners, Allen keys, Cutting pliers etc. And accessories (b) Components: Bearings, Seals, O-rings, Circlips, Keys etc.	1
2	**Carpentry**	Any one model from the following; 1. T-Lap joint 2. Cross lap joint 3. Dovetail joint 4. Mortise joint	2
3	**Smithy**	(a) Demonstrating the forgability of different materials (MS, Al, Alloy steel and Cast steel) in cold and hot states. (b) Observing the qualitative differences in the hardness of these materials. (c) Determining the shape and dimensional variations of Al test specimen due to forging under different states by visual inspection and measurements	2
4	**Foundry**	Any one exercise from the following 1. Bench moulding 2. Floor moulding 3.	2

		Core making	
5	**Sheet metal**	Any one exercise from the following Making 1. Cylindrical 2. Conical 3. Prismatic shaped jobs from sheet metal	2
6	**Welding**	Any one exercise from the following Making joints using Electric arc welding. Bead formation in horizontal, vertical and overhead positions.	2
7	**Fitting and Assembly**	Filing exercise and any one of the following exercises Disassembling and reassembling of 1. Cylinder piston assembly 2. Tail stock assembly 3. Time piece/clock 4. Bicycle or any machine.	2
8	**Machines**	Demonstration and applications of Drilling machine,Grinding machine, Shaping machine, Milling machine and lathe	2
	TOTAL		**15**

TEXT/REFERENCE BOOKS:

T/R	*BOOK TITLE/AUTHORS/PUBLICATION*
R1	Bawa H S, "Workshop Technology", 2nd edition, 2017
R2	Chapman W A J, "Workshop Technology", 5th edition, 2001.
R3	John K C, "Mechanical Workshop and Laboratory Manual", 2nd edition, 2010.
R4	RSET Workshop manual hand out

COURSE PRE-REQUISITES:

C.CODE	*COURSE NAME*	*DESCRIPTION*	*SEM*
-	-	Basic knowledge about use of measuring instruments	-

COURSE OBJECTIVES:

1	Introduction to basic manufacturing process like welding, moulding, fitting, assembling, smithy, carpentry works etc.
2	Familiarization of basic manufacturing hand tools and equipment's like files, hacksaw, spanner chisel hammers, etc.
3	Familiarization of various measuring devises like Vernier height gauge, Vernier calliper, steel rule etc.
4	Study of various machine tools like lathe, drilling machine, milling machine etc.
5	Familiarizing the disassembling and assembling of machine parts.

COURSE OUTCOMES:

S.NO.	*DESCRIPTION*	*Bloom's Taxonomy Level*
CO6	Students will be able to understand the various manufacturing processes in the basic mechanical engineering workshop trades.	Level 2 Understand
CO7	Students will be able to use various tools used in the basic mechanical engineering workshop trades.	Level 3 Apply
CO8	Students will be able to select appropriate measuring instruments according to the work.	Level 2 Understand
CO9	Students will be able to understand the operations of various machine tools and advanced manufacturing techniques.	Level 2 Understand
CO10	Students will be able to identify the different components of mechanical devices by assembling & disassembling models.	Level 2 Understand
CO11	Construct models by using various basic mechanical workshop operations	Level6 Create
CO12	Apply appropriate safety measures with respect to the mechanical workshop trades.	Level 3 Apply

CO-PO AND CO-PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO6	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO7	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO8	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO9	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO10	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO11	1	1	1	-	-	-	-	1	1	-	-	-	-	-	-
CO12	2	-	-	-	-	2	-	-	-	-	-	-	-	-	-

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO6-PO1	M	While identifying the mechanical workshop operation students are applying their knowledge in the Basic engineering science.
CO6-PO3	L	While understanding the mechanical workshop operation students can apply their knowledge to design solution and develop models
CO7-PO1	L	Applying the tools and instruments with respect to trade students are applying their fundamental knowledge on that specific trade.
CO7-PO2	L	While Applying the tools and instruments with respect to trade students are analysing a particular manufacturing process
CO7-PO3	L	While using the tools and instruments students apply their knowledge to design solutions and develop models
CO8-PO1	L	For selecting appropriate measuring instruments, students apply their fundamental knowledge of engineering science.
CO8-PO2	L	Proper analysis of the work is required for the selection of appropriate measuring instrument.
CO9-PO1	L	Understanding the operations carried out on machine tools and advanced manufacturing techniques will improve their knowledge in machine tools.
CO10-PO1	L	Identifying the different components of mechanical devices by assembling & disassembling models is an

		application of their knowledge in mechanical engineering.
CO10-PO9	M	As this is a group activity, it will improve their skills to work as a team
CO11-PO1	L	To construct models for their project they can apply their knowledge in the various mechanical workshop operations
CO11-PO2	L	While constructing models for their project they need to analyse the various manufacturing process.
CO11-PO3	L	They can use this experience to design solution considering societal and environmental impact.
CO11-PO8	L	Constructing models ethical principles are to be considered
CO11-PO9	L	As this is a group activity, it will improve their skills to work as a team
CO12-PO1	L	For selecting appropriate safety measures for a particular job they apply their knowledge on different aspects of various operations performed in that trade.
CO12-PO6	L	While practicing safe manufacturing operations they can ensure societal, health and safety issues.

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONALREQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO\PSO*	*PROPOSED ACTIONS*
-	-	-	-

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SNO	TOPIC	RELEVENCE TO PO\PSO
1	Demonstration of Aluminium Casting	PO3
2	Demonstration of Advanced welding process MIG&TIG	PO3
3	Demonstration of CNC Lathe	PO3

WEB SOURCE REFERENCES:

1	http://www.youtube.com/watch?v=HkjdMdp9KVU
2	http://www.youtube.com/watch?v=WaDsmeB5ywM
3	http://www.youtube.com/watch?v=JEF0_yTTL7w
4	http://www.youtube.com/watch?v=Rn31IEOKgQ8
5	http://www.youtube.com/watch?v=J63dZsw7Ia4
6	http://www.youtube.com/watch?v=dj64QvvbGXM
7	http://www.youtube.com/watch?v=iKizLfzz7GM
8	http://www.youtube.com/watch?v=qOGNnGZqjV4

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓CHALK & TALK	☐ STUD. ASSIGNMENT	✓ WEB RESOURCES	☐LCD/SMART BOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☐ ASSIGNMENTS	☐ STUD. SEMINARS	✓ TESTS/MODEL EXAMS	☐ UNIV. EXAMINATION
✓STUD. LAB PRACTICES	✓ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

5.2 COURSE PLAN & LAB CYCLE

Expt. No.	Topic	Schedule
1	**INTRODUCTION**	Day 1
1.1	Workshop practice, shop floor precautions, ethics and First Aid knowledge.	
	Studies of mechanical tools, components and their applications:	

	(a) Tools: screw drivers, spanners, Allen keys, cutting pliers etc and accessories (b) bearings, seals, O-rings, circlips, keys etc	
2	**ASSEMBLY**	Day 2
2.1	Demonstration of assembly and dissembling of multiple parts components	
3	**CARPENTRY**	Day 3
3.1	Understanding of carpentry tools and making minimum one model	
4	**FOUNDRY**	Day 4
4.1	Understanding of foundry tools and making minimum one model	
5	**SHEET METAL**	Day 5
5.1	Understanding of sheet metal working tools and making minimum one model	
6	**FITTING**	Day 6
6.1	Understanding of fitting tools and making minimum one model	
7	**SMITHY**	Day 7
7.1	Understanding of smithy tools and making minimum one model	
8	**WELDING**	Day 8
8.1	Understanding of welding equipments and making minimum one model	
9	**PLUMBING**	Day 9
9.1	Understanding of pipe joints and plumbing tools and making minimum one model	
10	**MACHINES**	Day 10
10.1	Demonstration of various machines	
11	**MODERN MANUFACTURING METHODS**	Day 11
11.1	Demonstrations of: power tools, CNC Machine tools, 3D printing, Glass cutting	
	Viva exam	Day 12

6. 101908/CO922T CIVIL ENGINEERING WORKSHOP

6.1 COURSE INFORMATION SHEET

PROGRAMME: CE	**DEGREE:** B. TECH
COURSE: Civil Engineering Workshop	**SEMESTER:** S2 ME **CREDITS:** 1
COURSE CODE: 101908/CO922T **REGULATION:** 2021	**COURSE TYPE:** REGULAR
COURSE AREA/DOMAIN: CIVIL ENGINEERING	**CONTACT HOURS:** 2 hr/Week

SYLLABUS:

UNIT	DETAILS	HOURS
I	Calculate the area of a built-up space and a small parcel of land- Use standard measuring tape and digital distance measuring devices	2
II	(a) Transfer the level from one point to another using a water level. (b) Set out a one room building with a given plan and measuring tape	2
III	Find the level difference between any two points using dumpy level	2
IV	(a) Construct a One and a half thick brick wall of 50 cm height and 60 cm length using English bond. Use spirit level to assess the tilt of walls. (b) Estimate the number of different types of building blocks/bricks to construct this wall.	2
V	(a) Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves, fixtures and sanitary fittings. (b) Install a small rainwater harvesting installation in the campus	2

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
T1	Khanna P.N, "Indian Practical Civil Engineering Handbook", Engineers Publishers.
T2	Bhavikatti. S, "Surveying and Levelling (Volume 1)", I.K. International Publishing House
T3	Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications
T4	Satheesh Gopi, Basic Civil Engineering, Pearson Publishers
T5	Rangwala, Essentials of Civil Engineering, Charotar Publishing House
T6	Anurag A. Kandya, Elements of Civil Engineering, Charotar Publishing house
T7	Rangwala S C and Ketki B Dalal, Engineering Materials, Charotar Publishing house
T8	Rangwala S C and Ketki B Dalal, Building Construction, Charotar Publishing house

COURSE PRE-REQUISITES:

C.CODE	COURSE NAME	DESCRIPTION	SEM
	Mathematics	Fundamental knowledge of trigonometry	Secondary School Level
	Physics	Basic knowledge about dimensions and units	Plus-Two

COURSE OBJECTIVES:

1	To enable students to identify and manage the tools, measuring devices, materials and methods required to execute an engineering project.
2	To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering.

COURSE OUTCOMES:

Sl No.	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	Name different devices and tools used for civil engineering measurements														
	1				1	1			2	2					
2	Explain the use of various tools and devices for various field measurements														
	1				1	1			2	2					
3	Demonstrate the steps involved in basic civil engineering activities like plot measurement, setting out operation, evaluating the natural profile of land, plumbing and undertaking simple construction work.														
	1				1	1		2	2	2	1				
4	Choose materials and methods required for basic civil engineering activities like field measurements, masonry work and plumbing.														
	1				1	1		2	2	2	1	1			
5	Compare different techniques and devices used in civil engineering measurements														
	1				1	1			2	2		1			

JUSTIFICATION FOR CO-PO MAPPING:

CO	PO	MAPPING	JUSTIFICATION
CO1	PO1	LOW	Knowledge of civil engineering tools can be applied to engineering problems
	PO5	LOW	Civil Engineering tools like digital distance measuring device gives exposure to modern tool usage
	PO6	LOW	Knowledge of civil engineering tools can help in the development of society
	PO9	MEDIUM	Study of civil engineering tools is conducted in group which helps in team working capability
	PO10	MEDIUM	Viva voce on civil engineering tools helps in improving their overall communication skills
CO2	PO1	LOW	Tools used in field measurement can be used to solve engineering problems
	PO5	LOW	Knowledge of field measurement tools can provide exposure to modern tool usage
	PO6	LOW	Knowledge of field measurement tools can help in development of society
	PO9	MEDIUM	Experiments conducted with field measurement tools are conducted in teams and thus develops team work abilities
	PO10	MEDIUM	Viva voce and record writing on experiments conducted on field measurement tools required for basic civil engineering can help in improving their overall communication skills
CO3	PO1	LOW	Knowledge of setting out operation and evaluating natural profile of land can be used to solve engineering problems
	PO5	LOW	Plumbing tools, levelling instrument can provide exposure to modern tool usage
	PO6	LOW	Knowledge of setting out operation and evaluating natural profile of land can help in development of society
	PO8	MEDIUM	Knowledge of simple construction works develops the responsibilities of engineering practice
	PO9	MEDIUM	Plot measurement and evaluating natural profile of land are conducted in teams and thus develops team work abilities
	PO10	MEDIUM	Viva voce and record writing on experiments conducted on Plumbing tools, levelling instrument required for basic civil engineering can help in improving their overall communication skills
	PO11	LOW	Experiments with Plumbing tools, levelling instrument

CO	PO	MAPPING	JUSTIFICATION
			project management skills
CO4	PO1	LOW	Knowledge of plumbing work, area measurement can be applied to engineering problems
	PO5	LOW	Knowledge of plumbing tools, area measurement devices can provide exposure to modern tool usage
	PO6	LOW	Experiments conducted on materials and methods required for basic civil engineering can help in development of society
	PO8	MEDIUM	Material and methods required for basic civil engineering enhances responsibility of engineering practice
	PO9	MEDIUM	Experiments conducted on materials and methods are conducted in teams and thus develops team work abilities
	PO10	MEDIUM	Viva voce and record writing on experiments conducted on materials and methods required for basic civil engineering can help in improving their overall communication skills
	PO11	LOW	Experiments conducted on field measurement and masonry work develops project management skills
	PO12	LOW	Experiments conducted on materials and methods required for basic civil engineering enhances learning
CO5	PO1	LOW	The techniques learnt in civil workshop can be applied to engineering problems
	PO5	LOW	Provides exposure to modern tool usage
	PO6	LOW	Helps in development of society
	PO9	MEDIUM	Working in groups for different exercise develops capability of working in team
	PO10	MEDIUM	Viva voce and record writing improves their overall communication skills
	PO12	LOW	Comparison of different tools enhances life long learning

WEB SOURCE REFERENCES:

1	https://www.youtube.com/watch?v=chhuq_t40rY
2	https://www.youtube.com/watch?v=p6ruuib1qsY

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☐ **CHALK & TALK**	☐ **STUD.**	☐ WEB RESOURCES	

√	**ASSIGNMENT √**		
□ LCD/SMART BOARDS	□ STUD. SEMINARS	□ ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

□ ASSIGNMENTS √	□ STUD. SEMINARS	**□ TESTS/MODEL EXAMS √**	**□ UNIV. EXAMINATION √**
□ STUD. LAB PRACTICES √	**□ STUD. VIVA √**	□ MINI/MAJOR PROJECTS	□ CERTIFICATIONS
□ ADD-ON COURSES	□ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

□ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE) √	**□ STUDENT FEEDBACK ON FACULTY √**
□ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	□ OTHERS

Prepared by **Approved by**

Dr Indu Geevar **Dr Rajeev Kumar P.**

6.2 COURSE PLAN

HOUR	TOPIC
HOUR 1	Introduction
HOUR 2	To set out one room building with given plan and measuring tape.
HOUR 3	To determine the area of a built up space and a small parcel of land using standard measuring tape and digital distance measuring devices.
HOUR 4	To transfer the level from one point to another point using a water level.
HOUR 5	Introduction to brick masonary. To construct a 1 1/2 thick brick wall of 50 cm height and 60 cm length using English Bond. Use spirit level to assess the tilt of walls.
HOUR 6	To estimate the number of different types of building blocks/bricks to construct a wall.
HOUR 7	Introduction to levelling. To conduct levelling and to find out the reduced level of the given points and level difference between first and last point.
HOUR 8	To introduce the plumbing instruments
HOUR 9	Final viva
HOUR 10	Lab exam

6.3 SAMPLE QUESTIONS

1. What are the different types of surveying based on instrument?
2. Enumerate the two principles of surveying?
3. Explain the different steps of setting out the building?
4. Define field book, formats used in different types of survey?
5. Give the standard size of bricks and nominal size of bricks
6. Write the procedure of determining the number of bricks for a given room?
7. Enumerate the rules of bond in brick work? Draw the elevation and plan of English bond one and half brick wall?
8. Differentiate between carpet area, plinth area and coverage?
9. What is a benchmark? Explain the different types of benchmarks.
10. What is meant by inverse levelling? When is it carried out?

ADVANCED QUESTIONS

1. Write the different steps involved in the completion of a building project?
2. Explain KMBR Rules and its significance?
3. What is the significance of mass moment of inertia and second moment of area?
4. Define compressive strength?
5. List out the modern survey equipment and its applications?
6. What is the importance of calculating coverage percentage?
7. Define cross staff surveying?
8. What are the different types of foundations?
9. Explain why English bonds are stronger than Flemish bonds in brick masonry.

7. 101908/ME900C ENGINEERING GRAPHICS

7.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
PROGRAMME: MECHANICAL ENGINEERING	DEGREE: **B.TECH** UNIVERSITY**: A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
COURSE: ENGINEERING GRAPHICS ***COURSE CODE: 101908/ME900C*** ***REGULATION: UG***	SEMESTER**: II** CREDITS: **3** COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: BASIC ENGINEERING	CONTACT HOURS: **2+0+2 (L+T+P) hours/week.**

SYLLABUS:

UNIT	*DETAILS*	*HOURS*
	Section A	
I	Introduction: Relevance of technical drawing in the engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. **Orthographic projection of Points and Lines**: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes. True length of line inclined to both the reference planes.	12
II	**Orthographic projection of Solids**: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.	10
III	**Sections of Solids**: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given. **Development of Surfaces**: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.	10
IV	**Isometric Projection**: Isometric View and Projections of Prisms, Pyramids, Cone , Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.	10
V	**Perspective Projection**: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane. **Conversion of Pictorial Views**: Conversion of pictorial views into orthographic views.	10

	Section B (To be conducted in CAD Lab)	
VI	Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. (Minimum 2 exercises mandatory) Introduction to Solid Modelling: Creating 3D models of various components using suitable modeling software. (Minimum 2 exercises mandatory)	8
	TOTAL HOURS	**60**

TEXT/REFERENCE BOOKS:

T/R	*BOOK TITLE/AUTHORS/PUBLICATION*
T1	**Anilkumar, K. N.**, Engineering Graphics, Adhyuth Narayan Publishers
T2	**Varghese, P. I.**, Engineering Graphics, V I P Publishers
R1	John, K. C., Engineering Graphics, Prentice Hall India Publishers
R2	Bhatt, N. D. Engineering Drawing, Charotar Publishing House Pvt Ltd.
R3	Agrawal, B. and Agrawal, C. M., Engineering Drawing, Tata McGraw Hill Publishers
R4	Benjamin, J., Engineering Graphics, Pentex Publishers
R5	Duff, J. M. and Ross, W. A., Engineering Design and Visualization, Cengage Learning, 2009
R6	Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K., Engineering Graphics with AutoCAD, PHI 2009
R7	Luzadder, W. J. and Duff, J. M., Fundamentals of Engineering Drawing, PHI 1993
R8	Venugopal, K., Engineering Drawing & Graphics, New Age International Publishers

COURSE PRE-REQUISITES:

Nil

COURSE OBJECTIVES:

1	To enable the student to effectively perform technical communication through graphical representation as per global standards.

COURSE OUTCOMES:

SNO	*DESCRIPTION*	*Bloom's Taxonomy Level*
CME900C.1	Draw the projection of points and lines located in different quadrants	Apply Level 3
CME900C.2	Prepare multi-view orthographic projections of objects by visualizing them in different positions	Apply Level 3

CME900C.3	Draw sectional views and develop surfaces of a given object	Apply Level 3
CME900C.4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three dimensions.	Apply Level 3
CME900C.5	Convert 3D views to orthographic views	Apply Level 3
CME900C.6	Obtain multi-view projections and solid models of objects using CAD tools.	Apply Level 3

CO-PO AND CO-PSO MAPPING

	PO 1	***PO 2***	***PO 3***	***P 0 4***	***P 0 5***	***P 0 6***	***P 0 7***	***P 0 8***	***P 0 9***	***P 0 10***	***P 0 11***	***P 0 12***	***PS 0 1***	***PS 0 2***	***PS 0 3***
CME900C.1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CME900C.2	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CME900C.3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CME900C.4	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CME900C.5	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CME900C.6	3	-	-	-	3	-	-	-	-	3	-	-	-	-	3

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	***LOW/MEDIUM/ HIGH***	***JUSTIFICATION***
CME900C.1-PO1	H	Ability to draw projections of points and lines located in different quadrants helps students to identify suitable methods to solve various engineering problems.
CME900C.2-PO1	H	Ability to prepare multi-view orthographic projections of objects by visualizing them in different quadrants is the basis for understanding the exact shape of an object and hence will be useful for the students to solve engineering problems.
CME900C.3-PO1	H	Ability to draw sectional views and develop surfaces of a given object will be highly useful for the students to solve engineering problems.
CME900C.3-	L	Ability to draw sectional views of a given object will be

PO2		useful for the students to analyse internal parts of the object.
CME900C.4-PO1	H	Ability to prepare pictorial drawings using the principles of isometric and perspective projections helps the students to visualize objects in three dimensions which is useful in solving engineering problems.
CME900C.4-PO10	L	Ability to prepare pictorial drawings using the principles of isometric and perspective projections helps the students to communicate effectively on complex engineering activities.
CME900C.5-PO1	H	Ability to convert 3D views to orthographic views will be useful for the students to solve engineering problems.
CME900C.5-PO10	M	Ability to convert 3D views to orthographic views helps the students to communicate effectively on complex engineering activities.
CME900C.6-PO1	H	Ability to obtain multi-view projections and solid models of objects using CAD tools helps students to use these modern engineering and IT tools for solving engineering problems.
CME900C.6-PO5	H	Ability to obtain multi-view projections and solid models of objects using CAD tools helps students to use these modern engineering and IT tools for the modeling and prediction of complex engineering problems.
CME900C.6-PO10	H	Ability to obtain multi-view projections and solid models of objects using CAD tools helps students for accurately preparing engineering drawings of various structures to effectively communicate with in an industry.

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*
CME900C2-PSO1	L	Ability to visualize the exact shape of an object and hence will be useful for the students to solve engineering problems.
CME900C.6-PSO3	H	The ability to obtain a basic idea about CAD tools helps students to use these modern engineering and IT tools for solving engineering problems

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVANCE TO PO\PSO*	*PROPOSED ACTIONS*
1	Nil		

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SINO:	**TOPIC**	**RELEVANCE TO PO\PSO**
1	Nil	

WEB SOURCE REFERENCES:

1	http://nptel.ac.in/courses/112103019/
2	https://www.youtube.com/watch?v=9PMvYc7wPbs
3	https://www.youtube.com/watch?v=tztXIaLV2-k
4	https://www.youtube.com/watch?v=YAHhjNkT-lw
5	https://www.youtube.com/watch?v=3xCDfxltu5M
6	https://www.youtube.com/watch?v=_rir4KhIcWw
7	https://www.youtube.com/watch?v=0s6Qnmyp02w
8	https://www.youtube.com/watch?v=lr1dL615WVk

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☑ LCD/SMARTBOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☑ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

7.2 COURSE PLAN

No	*Topic*	*No. of Lectures*
	Module 1 (12 hours)	
1	Introduction to graphics, types of lines, Dimensioning	1
2	Concept of principle planes of projection, different quadrants, locating points on different quadrants	2
3	Projection of lines, inclined to one plane. Lines inclined to both planes.	2
4	Line rotation method of solving, problems on line rotation method	4
5	Trapezoidal method of solving problems on lines, Problems on lines using trapezoidal method	3
	Module 2 (10 hours)	
1	Introduction of different solids, Simple position plan and elevation of solids	2
2	Problems on views of solids inclined to one plane	2
3	Problems on views of solids inclined to both planes	2
4	Practice problems on solids inclined to both planes	4
	Module 3 (10 hours)	
1	Introduction to section planes. AIP and AVP. Principle of locating cutting points and finding true shape	1
2	Problems on sections of different solids	3
3	Problems when the true shape is given	2
4	Principle of development of solids & sectioned solids and its problems	4
	Module 4 (10 hours)	
1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2

2	Isometric problems on Frustum of solids, Sphere and Hemisphere	4
3	Problems on combination of different solids	4
	Module 5 (6 hours)	
1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
2	Perspective problems on prisms	2
3	Practice on conversion of pictorial views into orthographic views	2
	SECTION B *(To be conducted in CAD lab)*	
1	Introduction to CAD and software. Familiarizing features of 2D software. Practice on making 2D drawings	2
2	Practice session on 2D drafting	2
3	Introduction to solid modelling and software	2
4	Practice session on 3D modelling	2

7.3 MODULE WISE SAMPLE QUESTIONS

MODULE I

1. A line AB, 70 mm long has one of its extremities 20 mm in front of VP and the other 50 mm above HP. The line is inclined 40^0 to HP and 25^0 to VP. Draw its projections. Also show its traces. Find the apparent angles.
2. A line AB of length 130mm has its end A, 52mm in front of VP. The HT of the line is 44mm in front of VP and its VT is 50mm above HP. If the distance between HT and VT when measured parallel to the line of intersection of HP and VP is 110mm, draw the projections and find its inclinations with HP and VP.
3. A line RS, 70mm long, has its midpoint at a distance of 40mm and 30mm from H.P and V.P. Its top view makes 30^0 and front view makes 45^0 with XY line. Draw its projections and locate its traces. Find the true inclinations with HP and VP.
4. A line PQ 100mm long has its end P in the first quadrant and end Q in the 3rd quadrant. Its midpoint is in VP and 20mm above HP. The line is inclined 30^0 to HP and 45^0 to VP. Draw the projections of the line. Locate its traces and find the apparent angles.
5. The line RS 100mm long has its end R 20mm above HP and 30mm in front of VP. Its FV measures 90mm and TV measures 75mm. Draw its projections and find its inclinations with HP and VP. Also locate the traces

MODULE II

1. A Hexagonal prism20 mm sides of base and 50 mm axis length rests on HP on one of its base edges. Draw the projection of the pyramid when the axis is inclined 40° to HP and appears to be inclined to VP at 45°.
2. A square pyramid, base edge 35 mm and height 70 mm is resting on a corner in VP such that the above corner is at a height of 30 mm above HP and apex on HP. Draw the projections if the apex is at a distance of 25 mm away from VP.
3. Draw the projections of a cube of 40mm edge resting on one of its corners with a solid diagonal vertical.
4. A square pyramid, base 40mm side and axis 90mm long has a triangular face on the ground and the vertical plane containing the axis makes an angle of 45^0 with the VP. Draw its projections.
5. A triangular pyramid side of base 30mm and height of 50mm lies on HP on a triangular face. Draw its projection when its axis makes 70^0 with VP.

MODULE III

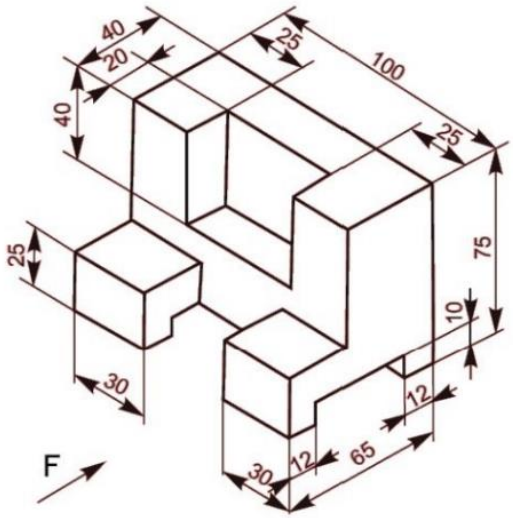
1. A tetrahedron of 70 mm edge is lying on HP on one of its faces with an edge perpendicular to VP. It is cut by a section plane perpendicular to VP so that the true shape of the section is an isosceles triangle of base 56 mm long and altitude 44 mm. Draw the sectional front view, top view and true shape of the section.
2. A cube of 65mm long edges has its vertical faces equally inclined to the VP. It is cut by a section plane perpendicular to VP, so that the true shape of section is a regular hexagon. Draw the projections of the sectioned cube and find the inclination of the section plane with HP.
3. A circular cone, base circle diameter 50 mm and height 70 mm is resting on its base. A semicircular hole, diameter 26 mm is drilled such that the axis of the hole is perpendicular to VP and intersects with the axis of the cone at a height of 20 mm above HP. Develop the lateral surface of the cone if the top surface of the hole is flat?
4. A vertical hexagonal prism of 30 mm side and axis 65 mm long has one of its rectangular faces parallel to VP and nearer to it. A circular hole of 20 mm diameter is drilled through the prism completely such that the axis of the hole bisects the axis of the prism at right angles and is perpendicular to VP. Draw the development of the prism showing the shape of the hole on it.?
5. A frustum of a square pyramid has its base 50mm side, top 25mm side and height 75mm. Draw the development of its lateral surface ?

MODULE IV

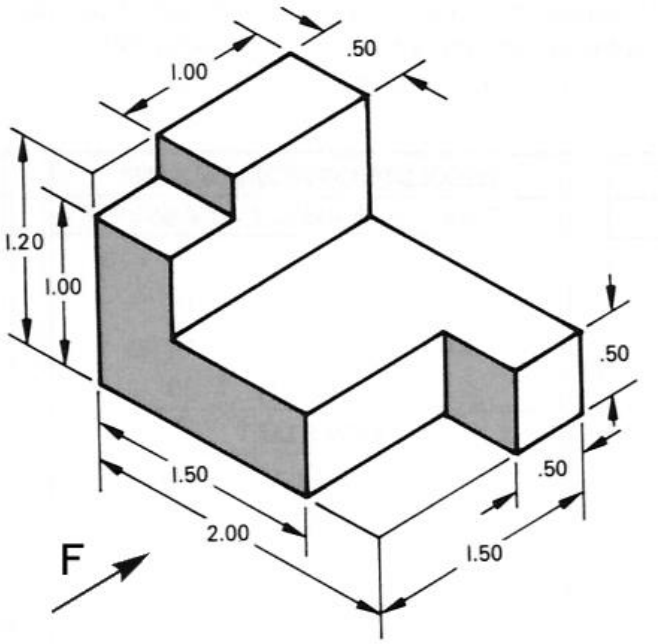
1. A solid in the form of a truncated hexagonal pyramid base 30 mm side, axis 60mm long and an edge of the base parallel to the VP is resting on its base on the horizontal plane. The truncated surface of the pyramid is contained in a plane which is inclined 30° to HP. The plane passes through a point on the axis of the pyramid and the point is 30 mm above the base. Draw the isometric view of the solid?
2. A cylindrical slab 80 mm diameter and 16 mm thick is surmounted by a cube of 40mm side'. On the top of the cube, rests a square pyramid of altitude 40 mm and side of base 32 mm. The axes of the solids are in the same straight line. Draw the isometric projection of the solid?
3. A cylindrical block of base 60mm diameter and height 90mm,standing on the HP with its axis perpendicular to the HP. Draw its isometric projection?
4. A tetrahedron of sides 40mm is resting centrally on the largest face of a rectangular block of size 60mm x 80mm x 40mm. Draw the isometric projection of the combination using isometric scale?
5. A right regular hexagonal prism edge of base 20mm and height 50mm has a co-axial hole of 20mm diameter. Draw its isometric projection?

MODULE V

1. A triangular prism of base edge 30 mm and 50 mm long is resting on one of its rectangular faces on the ground with its base edge making an angle of 40^0 with the picture plane. The nearest corner of the rectangular face on the ground is 10 mm behind the PP. The station point is 70 mm from the PP and 10mm to the left of the corner nearest to PP. The horizon plane is 60 mm above the ground. Draw the perspective view of the object?
2. A cube of side 40mm is resting on the ground such that one of its faces is parallel to and the mid of the solid is on the PP. The central plane is located 20mm to the left of the nearest corner of the cube. The station point is 60mm in front of the picture plane and 70mm above the GP. Draw the perspective view of the solid?
3. A regular hexagonal pyramid of base 30mm and height 50mm rests its base on the GP with one of its base edge in the PP. The station point is 60mm above the GP and 50mm in front of PP. The central plane is 25mm to the left of the axis. Draw the perspective view of the solid?
4. Draw the front, top and right side views with dimensions of the object shown in figure below.



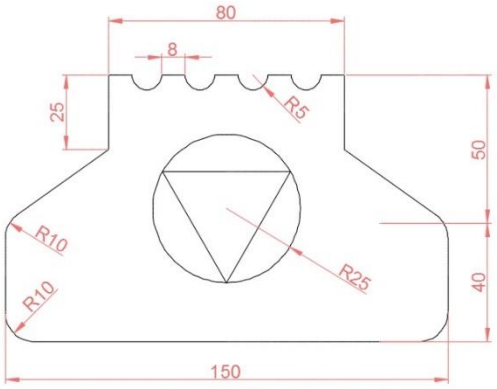
5. Draw FV,TV and RSV (orthographic views)of the object shown in figure below (All dimensions are in m)



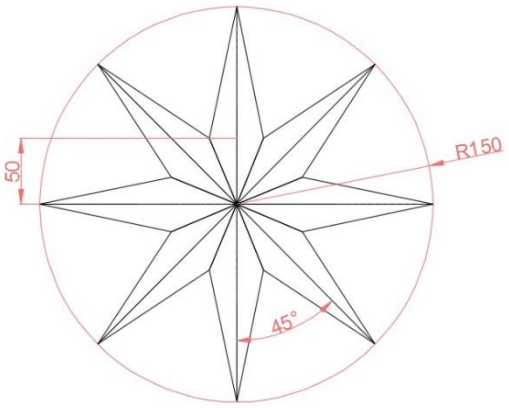
SECTION B

1. Sketch the diagram (1) given below as per the dimensions and annotate the dimensions.

2. Using polar array sketch the diagram (2) given below as per the dimensions and annotate the dimensions.

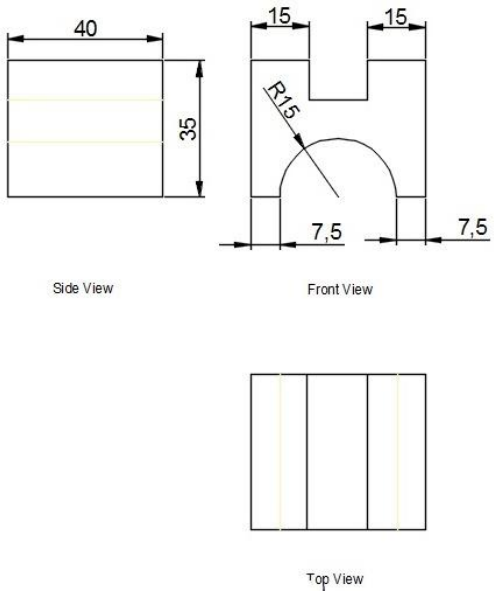


(1)

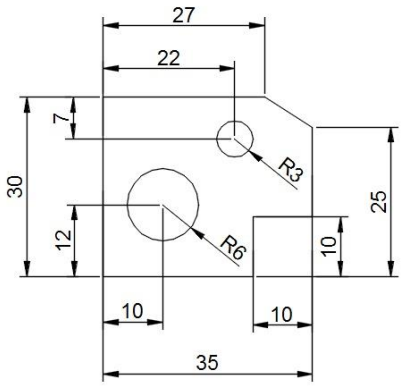


(2)

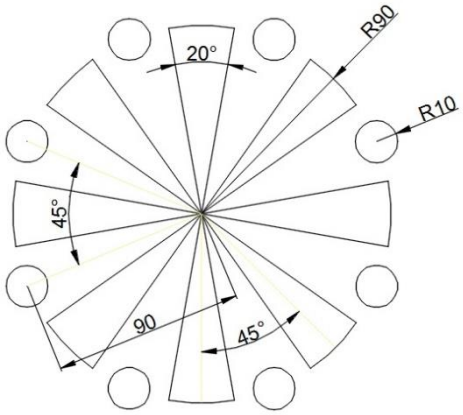
3. The orthographic views of a solid object are given below. Sketch the extruded isometric view (SW) of the object as per the dimensions.



4. Sketch the diagram given below as per the given dimensions and annotate the dimensions.



5. Sketch the diagram (2) given below as per the given dimensions and annotate the dimensions.



Prepared by
Mr. John Paul C D
(Faculty)

Approved by
Dr.Manoj G Tharian
(HOD)

8. 101908/CH900B ENGINEERING CHEMISTRY

8.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
PROGRAMME: MECHANICAL ENGINEERING	DEGREE: **B.TECH** UNIVERSITY**: A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
COURSE: ENGINEERING CHEMISTRY	SEMESTER**: II** CREDITS: **4**
COURSE CODE: 101908/CH900B ***REGULATION: UG***	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: SCIENCE	CONTACT HOURS: **3+1 (Tutorial) hours/Week**

SYLLABUS:

UNIT	*DETAILS*	*HOURS*
I	Electrochemical cell, Single electrode potential, Helmholtz electrical double layer, cell representation. Free energy and EMF-Nernst Equation-Derivation-single electrode and cell (Numerical) – Applications- Different types of electrodes (brief) - Reference electrodes - Calomel electrode - Construction and Working. Determination of E^o using calomel electrode. Glass Electrode-Determination of pH using glass electrode. Potentiometric titration - Introduction -Redox titration only. Energy storage devices- lithium batteries for electric vehicles - Lithium-ion battery, Lithium ion/Polymer battery, Lithium-sulphur battery - Super capacitors- Classifications based on mechanism with example - EDLC & Pseudo capacitors. Corrosion - Electrochemical corrosion – mechanism. Galvanic series-electroless plating –Copper and Nickel plating.	9
II	Introduction- Types of spectrum - electromagnetic spectrum - molecular energy levels - Beer Lambert's law (Numerical). UV-Visible Spectroscopy – Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications.IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and - Determination of force constant of diatomic molecule (Numerical) – Applications. 1H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).	9
III	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications –TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation (block diagram) and applications-DTA of $CaC_2O_4.H_2O$.	9

	Chromatographic methods - Basic principles and applications of column and TLC- Retention factor. GC and HPLC-Principle, instrumentation (block diagram) - retention time and applications. Surface characterization Technique - SEM – Principle and instrumentation (block diagram).	
IV	Classification of polymers - Nomenclature of polymers, Degree of polymerization, Functionality, Tacticity-Types of polymerization - Addition polymerization - Mechanism -Free radical and Ionic -Condensation polymerization - Polymerization techniques - Bulk, solution, suspension, emulsion - Molecular weight of polymers – Number average molecular weight - Weight average molecular weight - Viscosity average molecular weight (numerical). Structure - property relationship of polymers – Strength - Effect of heat on polymers (T_g)– Plastics- compounding of plastics - Plasticizers, fillers, accelerators, stabilizers, coloring agents (only function and examples)-Moulding Techniques - Injection, transfer, extrusion, blow (onlybrief procedure)- Engineering polymers - Polyurethane, Epoxy resin (DGEBA), PF resin,ABS, Kevlar, Silicones (Structure, properties & applications)- Conducting polymers-Classification-Doping (Conducting mechanism) - Chemical synthesis of Polyaniline and Polypyrrole – Applications – OLED -Construction and working – Advantages. Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nonmaterial.	9
V	Water characteristics -Hardness- Types of hardness- Temporary and Permanent-Disadvantages of hard water -Units of hardness- ppm and mg/L -Degree of hardness (Numericals) – Estimation of hardness-EDTA method (Numerical). Water softening methods -Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. Municipal water treatment (brief) - Disinfection methods - chlorination, ozone and UV irradiation. Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD- definition, estimation (only brief procedure) and significance (Numericals). Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process.	9
TOTAL HOURS		**45**

TEXT/REFERENCE BOOKS:

T/R	*BOOK TITLE/AUTHORS/PUBLICATION*
T1	B. L. Tembe, Kamaluddin, M. S. Krishnan, Engineering Chemistry (NPTEL Web-book), 2018.
T2	P. W. Atkins, Physical Chemistry, Oxford University Press, 10th Edition, 2014.
T3	C. N. Banwell, Fundamentals of Molecular Spectroscopy, McGraw-Hill, 4thEdition, 1995.
T4	C. N. Banwell, Fundamentals of Molecular Spectroscopy, McGraw-Hill, 4thEdition, 1995.

T5	Donald L. Pavia, Introduction to Spectroscopy, Cengage Learning India Pvt. Ltd., 5th Edition, 2015.
T6	B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 47thEdition, 2017.
T7	H. H. Willard &L. L. Merritt, Instrumental Methods of Analysis, CBS Publishers, 7thEdition, 2005.
T8	Raymond B. Seymour & Charles E. Carraher, Polymer Chemistry: An Introduction, Marcel Dekker Inc; 4thRevised Edition, 1996.
T9	Jain and Jain, Engineering Chemistry, DhanpatRai Publishers, 17th Edition, 2018.
T10	K. Ahluwalia & Anuradha Mishra, Polymer science: A text book, CRC Press, 2008.
T11	V. R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, Polymer Science, 4th Edition, New Age International Publishers, 2021.
R1	Muhammed Arif, Annette Fernandez, Kavitha P. Nair, Engineering Chemistry, Owl Books, 2019.
R2	Ahad J., Engineering Chemistry, Jai Publication, 2019.
R3	Roy K. Varghese, Engineering Chemistry, Crownplus Publishers, 2019.
R4	Soney C. George & Rino Laly Jose, Text Book of Engineering Chemistry, S. Chand & Company Pvt Ltd, 2019.
R5	Wiley India, Engineering Chemistry, ISBN 9788126543205.

COURSE PRE-REQUISITES:

C.CODE	*COURSE NAME*	*DESCRIPTION*	*SEM*
NA	Concepts of chemistry introduced at the plus two levels in schools	To develop basic ideas on electrochemistry, polymer chemistry, water technology etc	NA

COURSE OBJECTIVES:

1	To enable the students to acquire knowledge in the concepts of chemistry for engineering applications.
2	To familiarize the students with different application oriented topics like spectroscopy, electrochemistry, instrumental methods etc.
3	To familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, SEM, stereochemistry, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

COURSE OUTCOMES:

SNO	DESCRIPTION	Bloom's Taxonomy Level
CO 1	To design and sketch electrochemical cells, to compare working and mechanism of different electrochemical energy storage devices, to understand corrosion control by applying the fundamentals of electrochemistry and corrosion.	
CO 2	To elucidate the structure and chemical parameters of organic compounds using various spectroscopic techniques like UV-Visible, IR and NMR spectroscopy.	
CO 3	To demonstrate understanding of the instrumentation and working of analytical methods like TGA, DTA and various chromatographic techniques to characterize a compound or mixture.	
CO 4	To be aware of the preparation and applications of engineering materials like polymers and nanomaterials in the field of engineering and technology.	
CO 5	To analyse different water quality parameters and to learn the fundamentals of industrial, domestic and waste water treatment processes.	

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1												
CO 2	1	1		1	2										
CO 3	1	1		1	2									1	
CO 4	2	1													
CO 5	1			1			3								

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO 1-PO 1	L	Knowledge on electrochemistry and corrosion can be used to find solution to various engineering problems like rusting, construction of batteries

		etc
CO 1-PO 2	M	Basic principles of electrochemistry and corrosion help to analyse the problems related to above fields in engineering
CO 1-PO 3	L	An awareness regarding corrosion theory and electrochemical system can be utilized in solving material corrosion tendencies and to design various energy storage systems
CO 2-PO 1	L	Knowledge on spectrochemical techniques helps in structure analysis of materials used for engineering applications
CO 2-PO 2	L	Study of the basic concepts of spectroscopic techniques can be used to analyse the structural aspects of the materials
CO 2- PO4	L	Analysis and interpretation of material structural features is possible by understanding modern analytical tools like spectroscopy
CO 2 –PO 5	M	Usage of modern analytical tools like IR, UV-Visible, NMR is possible by understanding the basic working principle of spectroscopy
CO 3- PO 1	L	An awareness of characterization techniques like TGA, SEM and chromatography can be utilized to find thermal stability of compounds and separation and purification of mixture of compounds
CO 3-PO 2	L	Appropriate choice of materials for various engineering activities can be done by utilizing the knowledge on various analytical techniques
CO 3-PO 4	L	Study of research based analytical techniques like TGA, SEM etc helps in analysis and interpretation of various experimental data
CO 3-PO 5	M	Usage of modern analytical tools like TGA, DTA is possible by understanding the basic working principle of thermal analytical techniques
CO 4- PO1	M	Knowledge of engineering materials like polymers and nanomaterials and their synthesis with specific properties
CO 4-PO 2	L	An awareness of polymeric materials can be utilized in the selection of materials ideal for engineering constructions and modelling
CO 5- PO 1	L	An awareness of various water treatment methods can be used to solve problems like hardness, salinity etc
CO 5- PO 4	L	Appropriate design of water treatment plants can be done by

		utilizing the principles of various water treatment methods
CO 5- PO 7	H	Knowledge on various water treatment methods can be utilized for the sustainable development based on societal and environmental context

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*
CO 3-PSO 2	M	Development and construction of various mechanical systems used in modern analytical instruments like TGA, DTA,SEM etc

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO\PSO*	*PROPOSED ACTIONS*
1	An introduction to microwave spectroscopy	CO 2 –PO 1, PO 2, PO 4, PO 5	Reading, Assignment, seminar, Group discussion
2	CNT, Fullerene	CO 4-PO 1, PO 2	Reading, Assignment, seminar, Group discussion

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SINO:	**TOPIC**	**RELEVENCE TO PO\PSO**
1	Differential Scanning Calorimetry	CO 3-PO 1, PO 2, PO 4, PO 5
2	Intelligent Polymers	CO 4-PO 1, PO 2

WEB SOURCE REFERENCES:

1	https://nptel.ac.in/courses/104/108/104108078/
2	https://nptel.ac.in/content/storage2/courses/103108100/module5/module5.pdf
3	https://www.iitk.ac.in/che/pdf/resources/TGA-DSC-reading-material.pdf

4	https://nptel.ac.in/content/storage2/courses/103108100/module7/module7.pdf
5	https://www.youtube.com/watch?v=teTkvUtW4SA
6	https://www.youtube.com/watch?v=dkARLSQWHH8
7	https://www.youtube.com/watch?v=OFh_Id8Ja4Y
8	https://www.youtube.com/watch?v=k81pmfpKwIE
9	https://www.youtube.com/watch?v=712pXGSJ8Pc
10	https://nptel.ac.in/courses/104/105/104105039/
11	https://nptel.ac.in/courses/104/105/104105124/
12	https://nptel.ac.in/courses/113/105/113105028/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☐LCD/SMART BOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

8.2 COURSE PLAN

DAY	*MODULE*	*TOPIC PLANNED*
1	1	Electrochemical cell, Single electrode potential, Helmholtz electrical double layer
2	1	Cell representation, Free energy and EMF-Nernst Equation- Derivation- single electrode

3	1	Cell (Numerical)– Applications
4	1	Different types of electrodes (brief)
5	1	Reference electrodes - Calomel electrode - Construction and Working. Determination of Eo using calomel electrode, Glass Electrode-Determination of pH using glass electrode
6	1	Potentiometric titration - Introduction -Redox titration only.
7	1	Energy storage devices- lithium batteries for electric vehicles - Lithium-ion battery, Lithium ion/Polymer battery, Lithium- sulphur battery - Supercapacitors- Classifications based on mechanism with example - EDLC & Pseudo capacitors.
8	1	Corrosion - Electrochemical corrosion – mechanism. Galvanic series-electroless plating –Copper and Nickel plating.
9	2	Introduction- Types of spectrum - electromagnetic spectrum – molecular energy levels
10	2	Beer Lambert's law (Numerical).
11	2	UV-Visible Spectroscopy –Principle - Types of electronic transitions - Energy level diagram of ethane, butadiene, benzene and hexatriene. Instrumentation of UV-Visible spectrometer and applications
12	2	IR-Spectroscopy – Principle - Number of vibrational modes - Vibrational energy states of a diatomic molecule and -Determination of force constant of diatomic molecule (Numerical) –Applications.
13	2	1H NMR spectroscopy – Principle - Relation between field strength and frequency - chemical shift - spin-spin splitting (spectral problems) - coupling constant (definition) - applications of NMR- including MRI (brief).
14	3	Thermal analysis –TGA- Principle, instrumentation (block diagram) and applications –TGA of CaC_2O_4. H_2O and polymers.
15	3	DTA-Principle, instrumentation (block diagram) and applications- DTA of $CaC_2O_4.H_2O$.
16	3	Chromatographic methods - Basic principles and applications of column and TLC- Retention factor. GC and HPLC- Principle, instrumentation (block diagram) - retention time and applications.
17	3	Surface characterization Technique - SEM – Principle and instrumentation (block diagram).
18	4	Classification of polymers - Nomenclature of polymers, Degree of polymerization, Functionality, Tacticity
19	4	Types of polymerization – Addition polymerization - Mechanism - Free radical and Ionic -Condensation polymerization
20	4	Polymerization techniques - Bulk, solution, suspension, emulsion
21	4	Molecular weight of polymers – Number average molecular weight - Weight average molecular weight - Viscosity average molecular weight (numerical).

22	4	Structure - property relationship of polymers – Strength - Effect of heat on polymers (T_g)
23	4	Plastics- compounding of plastics -Plasticizers, fillers, accelerators, stabilizers, coloring agents (only function and examples)
24	4	Moulding Techniques - Injection, transfer, extrusion, blow (only brief procedure)
25	4	Engineering polymers - Polyurethane, Epoxy resin (DGEBA), PF resin, ABS, Kevlar, Silicones (Structure, properties & applications)
26	4	Conducting polymers-Classification-Doping (Conducting mechanism) - Chemical synthesis of Polyaniline and Polypyrrole – Applications – OLED -Construction and working – Advantages.
27	4	Nanomaterials - Definition - Classification - Chemical methods of preparation - Hydrolysis and Reduction - Applications of nanomaterial.
28	5	Water characteristics -Hardness- Types of hardness- Temporary and Permanent-Disadvantages of hard water -Units of hardness- ppm and mg/L
29	5	Degree of hardness (Numericals)
30	5	Estimation of hardness-EDTA method (Numerical).
31	5	Water softening methods -Ion exchange process-Principle, procedure and advantages, Reverse osmosis – principle, process and advantages.
32	5	Municipal water treatment (brief)
33	5	Disinfection methods - chlorination, ozone and UV irradiation.
34	5	Dissolved oxygen (DO) -Estimation (only brief procedure-Winkler's method), BOD and COD- definition, estimation (only brief procedure) and significance (Numericals).
35	5	Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.
No. of lectures for each topic may be more than one		

8.3 MODULE WISE SAMPLE QUESTIONS

MODULE-1

1. What are the different types of electrodes?
2. What are the functions of salt bridge?
3. What is EMF of a cell? How is it related to free energy change of a cell?
4. Briefly describe a galvanic cell.
5. Write a short note on Helmoltz electrical double layer?
6. State and derive Nernst equation.
7. What are reference electrodes?
8. What is the principle of glass electrode?
9. Explain a)Calomel b)Glass electrode
10. Construction and working of Li-ion cell
11. Explain different types of lithium batteries for electric vehicles.
12. Explain the construction and working of calomel electrode.
13. What is potentiometric redox titration?
14. Define electrochemical corrosion? Describe its mechanism.
15. What is corrosion? Illustrate with three examples.
16. Explain electroless plating.
17. Write electrode reactions and cell reaction for the following cells.
    a. Pt, H_2 (g) | HCl soln |AgCl (s) | Ag

       ½ $H_2 \rightarrow H^+ + e$, $AgCl + e \rightarrow Ag + Cl^-$

    b. Pt | Fe^{2+} ; Fe^{3+} || KCl soln | Hg_2Cl_2 (s) | Hg

       $2Fe^{2+} \rightarrow 2Fe^{3+} + 2e$, $Hg_2Cl_2 + 2e \rightarrow 2Hg + 2Cl^-$

c. Ag | $AgNO_3$ (0.01 M) || $AgNO_3$ (0.02 M) | Ag

Ag → Ag^+ (0.01) + e, Ag^+ (0.02) + e → Ag

18. Copper and silver rods are placed in a solution of cupric nitrate and silver nitrate solutions of concentrations 0.02 M and 6.0 M respectively and connected through a salt bridge in the form of a cell. Represent the cell, write down the cell reaction and calculate its EMF at 30°C. The standard reduction potentials of copper and silver electrodes are +0.34 V and +0.80 V respectively.
19. Explain the classifications of super capacitors.

MODULE -2

1. What is Beer-Lamberts law?
2. Principle of a) UV visible b) IR c) NMR spectroscopy.
3. Write a note on types of molecular vibrations.
4. Differentiate auxochrome and chromophore. Give examples.
5. Define Hypsochromic, Bathochromic, Hyperchromic, Hypochromic shift
6. Explain the applications of UV Visible and IR spectroscopy.
7. Explain the instrumentation of UV visible spectroscopy.
8. Explain the principle of MRI.
9. What is the relation between field strength and frequency in NMR spectroscopy?
10. Which are the factors effecting chemical shifts?
11. Define chemical shift, shielding and de-shielding.
12. What is spin-spin splitting?
13. Sketch the low resolution and high resolution NMR spectrum of ethanol.
14. Differentiate UV and IR spectroscopy.

15. Why TMS is taken as the reference to determine chemical shift?
16. What interpretations are obtained from the chemical shifts in a molecule?
17. Draw the energy level diagram of ethane and benzene.
18. Find the energy of a $6.5A^{o}$ X-ray beam.
19. A solution of thickness 2cm transmits 20% of the incident light. Calculate the concentration of the solution if the molar extinction coefficient $\epsilon=3000dm^{3}mol^{-1}cm^{-1}$
20. Give the number of signals from the following compounds acetone, butanol, pentane, acetaldehyde, ethyl methyl ether.
21. Draw the energy level diagrams of butadiene and hexatriene

MODULE-3

1. What is thermal analysis? Explain the principle of TGA and DTA.
2. Differentiate TGA and DTA with examples.
3. What is the principle of chromatography?
4. Explain how Column chromatography works.
5. Explain with a neat diagram thin layer chromatography.
6. How is TLC used?
7. What are the applications of TGA and DTA?
8. Gas chromatography is the most efficient and convenient tool these days. Why?
9. How HPLC become a superior analytical tool?
10. Explain partition chromatography.
11. Make a comparison between GSC and GLC.
12. Discuss the term carrier gas, columns, stationary phase and detectors.
13. State the applications and advantages of gas chromatography.

14. Define retention factor and retention time.
15. What is elution? What are the requirements of a good adsorbent?
16. What is SEM? Explain the principle and instrumentation.

MODULE-4

1. What are co-polymers? Which are the different types of copolymers? Explain each with examples.
2. Describe the term a) polymer b)Functionality c)Tacticity
3. Give the preparation and properties of ABS and Kevlar.
4. Write a brief note on OLED.
5. What is conducting polymers?
6. Explain the preparation of a) polyaniline b) polypyrrole
7. Which kind of doping is possible (p or n) in polypyrrole why? Give two properties and applications.
8. Explain the classification of nanomaterials based on dimension.
9. Explain the classification of polymers.
10. Write the differences between addition and condensation polymerization.
11. Write a short note on different polymerization techniques.
12. Write the differences between number average, weight average and viscosity average molecular weights.
13. Define glass transition temperature.
14. What are the different components of compounding of plastics?
15. Explain the procedure for the extrusion and injection techniques.
16. Write the structure of epoxy resin and polyurethanes.

17. What are the main applications of silicones?
18. To improve processing properties, an equal weight of low molecular mass nylon 6 (degree of polymerization n = 100) is blended with a moulding grade of nylon 6 (n = 500). Assuming both materials are monodisperse, what will the weight-average molecular mass?

MODULE -5

1. Define hardness of water? Describe the different types of hardness?
2. Mention the units in which hardness of water is expressed?
3. What are boiler scale? How it is formed? Describe the harmful effects of boiler scale formation?
4. How is water purified by the ion exchange process?
5. What are different water softening method?
6. What are reverse osmosis? Where it is applied?
7. Explain degree of hardness and its determination by EDTA method?
8. What are the advantages & disadvantages of UV disinfection of water?
9. How BOD reflect the organic loading in waste water?
10. DO indicates purity of water. Comment.
11. Give any four points of difference between BOD & COD.
12. Describe the significance and determination of BOD.
13. Explain the methods for disinfection of water.
14. Explain different methods used for the desalination of brackish water.
15. What do you mean by UASB process? How is it useful in waste water treatment?
16. Discuss the steps involved in sewage water treatment.

17. Explain the working of trickling filter process with a neat labeled sketch.
18. Compare aerobic oxidation of sewage water.
19. 100ml sewage water is diluted to 1000ml with dilution water, the initial dissolved oxygen was 7.6 ppm, and dissolved oxygen level after five days of incubation was 3.2 ppm. Find the BOD of the sewage water.
20. 50ml of the standard hard water containing 1mg of CaCO3 per ml consumed 17ml of EDTA .50ml of a sample of hard water consumed 12 ml of EDTA .Calculate the total hardness in ppm.

Prepared by
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(Faculty)

Approved by
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(HOD)

10. 101908/CH922S ENGINEERING CHEMISTRY LAB

9.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
PROGRAMME: MECHANICAL ENGINEERING	DEGREE: **B.TECH** UNIVERSITY**: A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
COURSE: ENGINEERING CHEMISTRY LAB	SEMESTER**: II** CREDITS: **1**
COURSE CODE: 101908/CH922S ***REGULATION: UG***	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN: SCIENCE	CONTACT HOURS: **2 hours/Week.**

SYLLABUS:

UNIT	***DETAILS***	***HOURS***
1	Estimation of total hardness of water-EDTA method	2
2	Potentiometric titration	2
3	Determination of cell constant and conductance of solutions.	2
4	Calibration of pH meter and determination of pH of a solution	2
5	Estimation of chloride in water	2
6	Identification of drugs using TLC	2
7	Determination of wavelength of absorption maximum and colorimetric estimation of Fe3+ in solution	2
8	Determination of molar absorptivity of a compound (KMnO4 or any water soluble food colorant)	2
9	Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin	2
10	Estimation of iron in iron ore	2
11	Estimation of copper in brass	2
12	Estimation of dissolved oxygen by Winkler's method	2
13	(a) Analysis of IR spectra (minimum 3 spectra) (b) Analysis of 1H NMR spectra	2
14	Flame photometric estimation of Na+ to find out the salinity in sand	2
15	Determination of acid value of a vegetable oil	2

TEXT/REFERENCE BOOKS:

T/R	***BOOK TITLE/AUTHORS/PUBLICATION***
R	*G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.*
R	*R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.*
T	*Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers,2019.*
T	*Ahad J., "Engineering Chemistry Lab manual", Jai Publications, 2019.*

T	*Roy K Varghese, "Engineering Chemistry Laboratory Manual", Crownplus Publishers, 2019.*
R	*Soney C George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd, New Delhi, 2019.*

COURSE PRE-REQUISITES:

COURSE NAME	*DESCRIPTION*
Experiments in chemistry introduced at the plus two levels in schools	*To develop basic ideas on quantitative and qualitative chemical analysis*

COURSE OBJECTIVES:

To impart scientific approach and to familiarize with the experiments in chemistry relevant for research projects in higher semesters

COURSE OUTCOMES:

SNO	*DESCRIPTION*	*Bloom's Taxonomy Level*
CO1	*Understand and practice different techniques of qualitative and quantitative chemical analysis to generate experimental skills and apply these skills to various analyses*	
CO2	*Develop skills relevant to synthesize organic polymers and acquire the practical skill to use various chromatographic techniques like TLC for the identification of drugs and chemical compounds*	
CO3	*Develop the ability to understand and explain the use of modern spectroscopic techniques for analysing molecular chemical structure by interpreting IR and NMR spectra of organic compounds*	
CO4	*Acquire the ability to understand, explain and use instrumental techniques for chemical analysis*	
CO5	*Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments*	
CO6	*Function as a member of a team, communicate effectively and engage in further learning. Also understand how chemistry addresses social, economic and environmental problems and why it is an integral part of curriculum.*	
CO7	*An ability to analyze the quality of water by determining its chemical parameters*	

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O 10	P O 11	P O 12	PS O 1	PS O 2	PS O 3
CO1	3				2							3			
CO2	3				3							3			
CO3	3				3							3			
CO4	3				3							3		1	
CO5	3				1							3			
CO6	3				1							3			
CO7	3		1			1	1								

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO1-PO1	H	Knowledge and skills of various quantitative techniques like colorimetry, potentiometry etc can be used for various chemical analyses
CO1-PO5	M	Proper modeling of engineering activities can be done by utilizing knowledge of various analytical techniques
CO1-PO12	H	Basic knowledge of analytical techniques helps to engage in independent and lifelong learning of various technologies
CO2-PO1	H	The practical skills in the preparation of organic polymers and the usage of chromatographic techniques can be used to develop engineering materials
CO2-PO5	H	Development and modeling of engineering materials can be done by using the skills of material synthesis
CO2-PO12	H	Knowledge of material synthesis and analysis helps to understand the broadest context of material chemistry by a lifelong learning process
CO3-PO1	H	Knowledge of spectroscopic techniques like IR and NMR can be used to analyze and predict the structure of materials used in engineering activities
CO3-PO5	H	An ability to use modern techniques of structural analysis and its interpretation is inevitable in analyzing engineering

		materials
CO3-PO12	H	An awareness about the fundamental concepts of structural analytical techniques helps to apply the concept to solve complex molecular structures
CO4-PO1	H	Basic knowledge of various instrumental techniques is inevitable for measuring chemical parameters which is essential in finding solutions for many engineering problems
CO4-PO5	H	Appropriate modeling of various engineering activities can be done by using the knowledge of handling various instrumental techniques
CO4-PO12	H	An understanding and usage of instrumental techniques can be applied in the lifelong learning process of technological change
CO5-PO1	H	Accurate design, record and interpretation of experimental data are very essential to solve scientific problems
CO5-PO5	L	Solutions to complex problems always demand proper planning and conduct of experiments
CO5-PO12	H	Understanding of new technologies requires designing and modifications of scientific experiments
CO6-PO1	H	Knowledge of the basic principles of chemistry and proper team work helps to solve various social, economic and environmental problems
CO6-PO5	L	Proper team work is essential to design complex engineering activities
CO6-PO12	H	The continuous development of technological innovations always demand proper team work and modification of basic knowledge in various fields
CO7-PO1	H	Knowledge to conduct experiments to analyze quality of water helps to solve societal and environmental problems
CO7-PO3	L	Measurement of water quality parameters meet the specifications with consideration for the public health and safety
CO7-PO6	L	Solutions to societal, health and safety issues can be sorted out by analysing chemical parameters of water
CO7-PO7	L	Improving water quality by analysing chemical parameters is essential for sustainable development

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO4-PSO2	L	Knowledge to design various instruments used to measure chemical parameters like pH, Colrimeter, Chemical balance etc

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	DESCRIPTION	RELEVENCE TO PO\PSO	PROPOSED ACTIONS
1	Construction and working of Daniel cell	PO1,5,12	Assignment, Reading, Lab work
2	Determination of BOD and COD of water	PO1,3,5,6,7,12	Assignment, Reading, Lab work

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SNO	DESCRIPTION	RELEVENCE TO PO\PSO	PROPOSED ACTIONS
1	Testing of materials with Universal testing machine, testing of hardness and impact strength.	PO1,5,12	Assignment, Reading, Lab work
2	Determination of molecular weight of polymers	PO1,5,12	Assignment, Reading, Lab work

WEB SOURCE REFERENCES:

1	https://www.youtube.com/watch?v=Q70PgxkjH5E
2	https://www.youtube.com/watch?v=LxgZsMhuyNM
3	https://www.youtube.com/watch?v=gd1YQr-74sw

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☐ STUD. ASSIGNMENT	☑ WEB RESOURCES	☐LCD/SMART BOARDS
☐ STUD. SEMINARS	☐ ADD-ON COURSES	☑ HANDS ON EXPERIENCE	

ASSESSMENT METHODOLOGIES-DIRECT

☐ ASSIGNMENTS	☐ STUD. SEMINARS	☑ TESTS/MODEL EXAMS	☑ UNIV. EXAMINATION
☑ STUD. LAB	☑ STUD. VIVA	☐ MINI/MAJOR	☐ CERTIFICATIONS

PRACTICES	(DAILY)	PROJECTS	
☐ ADD-ON COURSES	☑ PRACTICAL RECORD EVALUATION (DAILY)	☐ OTHERS	

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (ONCE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

9.2 COURSE PLAN

DAY	*MODULE*	*EXPT NO.*	*CYCLE*	*EXPERIMENTS PLANNED*
1	4	1	1	Preparation of urea-formaldehyde resin
2	5	2	1	Estimation of total hardness water sample by EDTA method
3	1	3	1	Estimation of ferrous ion in a solution by potentiometric redox titration.
4	4	4	2	Preparation of phenol-formaldehyde resin
5	5	5	2	Estimation of chloride in a given water sample by argentometric method
6	2	6	2	Colorimetric estimation of Fe^{3+} ions in a solution
7	5	7	3	Estimation of dissolved oxygen by Winkler's method
8	2	8	3	Analysis of IR spectra of any three organic compounds
9	2	9	3	Analysis of NMR spectra of any three organic compounds

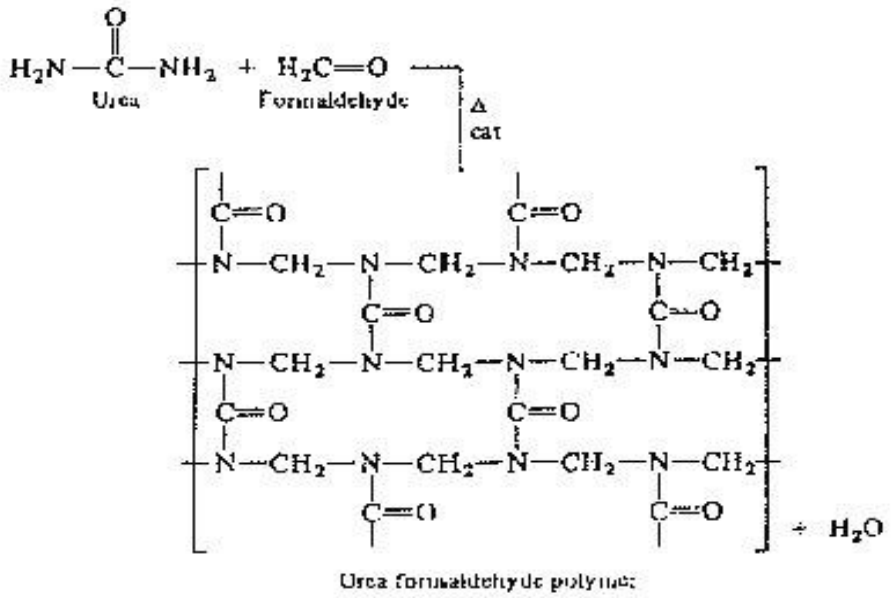
9.3 MODULE (EXPERIMENT) WISE SAMPLE QUESTIONS

VIVA QUESTIONS

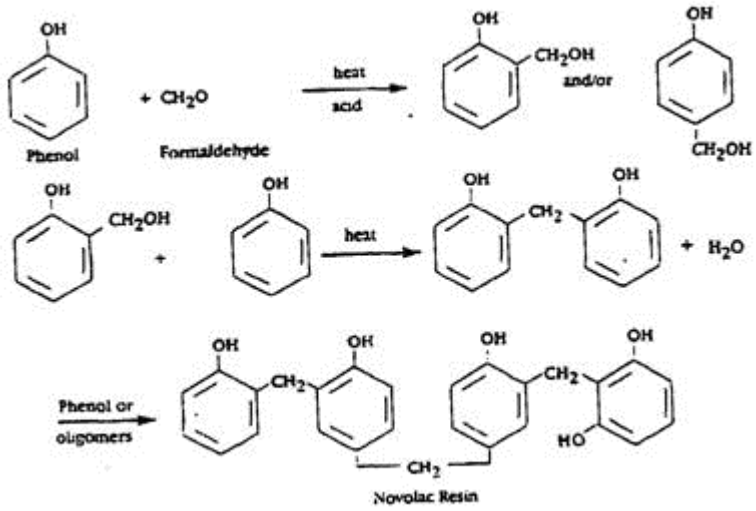
EXPT NO 1 & 4: PREPARATION OF UREA –FORMALDEHYDE AND PHENOL-FORMALDEHYDE RESIN

1. Another name of phenol formaldehyde?
   Bakelite
2. Give 3 examples of thermosetting polymers?
   Melamine formaldehyde, PF, UF

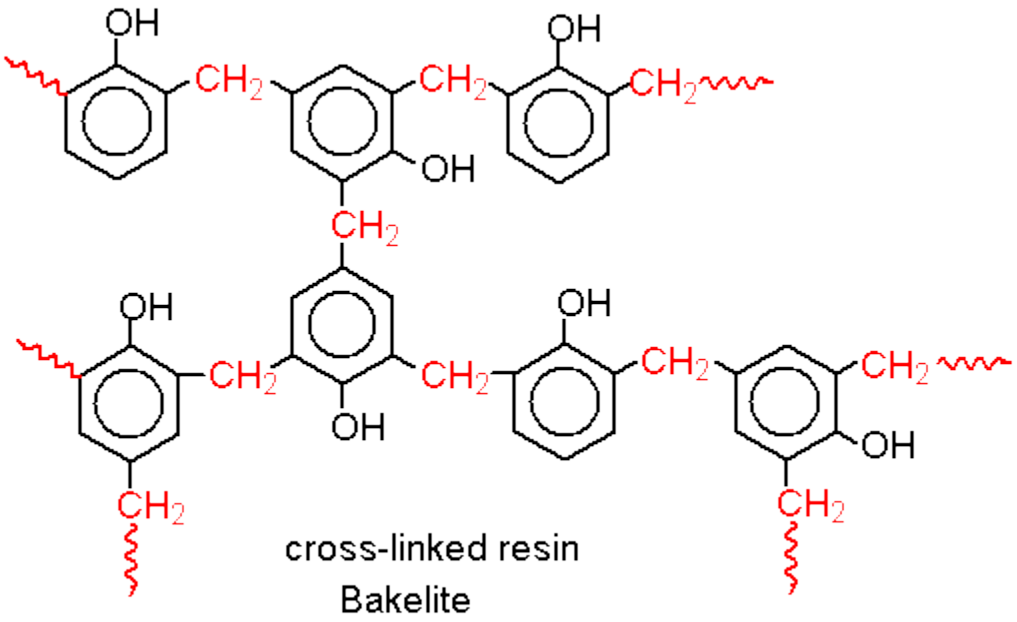
3. Uses of PF, UF?
   Button, Bottle caps, surgical items, household items
4. What is a polymer?
   Large molecule formed of monomers
5. Wha is functionality
   Number of reactive sites of a monomer
6. What is condensation polymerization
   Condensation polymers are any kind of**polymers** formed through a **condensation**reaction—where molecules join together—losing small molecules as by-products such as water or methanol, as opposed to addition**polymers** which involve the reaction of unsaturated monomers.
7. Chemical structure of UF and PF resin



Urea formaldehyde polymer



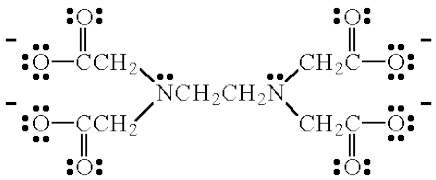
Novolac Resin



8. Colour of UF and PF resins?
   UF- White, PF- Pink

EXPT NO.2: ESTIMATION OF HARDNESS OF WATER

1. What is hardness?
   Soap consuming capacity of water
2. Cause for temporary and permanent hardness?
   Temperory- Bicarbonates, carbonates of Ca and Mg
   Permanent- Chlorides and sulphates of Ca and Mg
3. Methods to remove hardness of water?
   Temporary- Boiling
   Permanent- Lime soda process, zeolite, ion exchange
4. Use of buffer in EDTA titration?
   Maintain pH
5. Units of hardness?
   PPm, mg/l, ^oFr, ^oCl
6. What is EDTA? Write the structure of EDTA.
   Etyelene Diammine Tetra Acetic acid

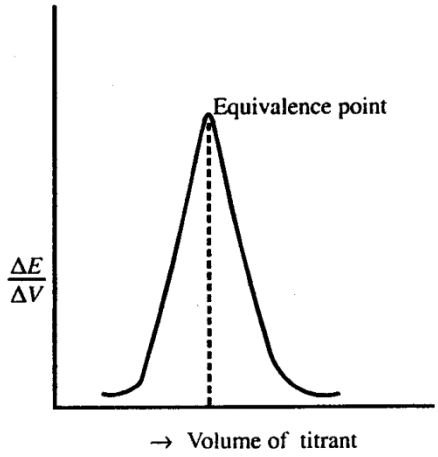


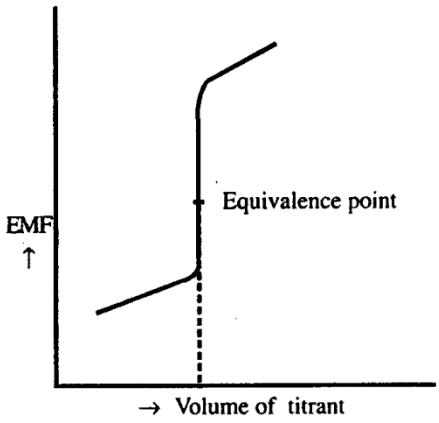
7. On what principle the colour changes from wine red to steel blue?
   Hard water + EBT Metal ion –indicator complex(wine red colour)
   Metal ion-indicator complex + EDTA Metal ion – EDTA complex + Indicator(steel blue)

8. Why CaCO3 is used as a standard for calculating hardness?
   Its molecular weight is 100 which is easier for calculation. It is most insoluable salt.

EXPT NO.3: POTENTIOMETRIC TITRATIONS: REDOX POTENTIOMETRIC TITRATION

1. What is potentiometric titration?
   The analyte can be determined by means of a titration, and the change in its concentration monitored by measurement of the solution potential. This is known as a potentiometric titration.
2. What are the features of potentiometric titration curve?





3. What is reference electrode ? Give examples.
   The potential of unknown electrode can be measured by coupling it with another electrode called reference electrode whose potential is already known
   Example: calomel electrode , standard hydrogen electrode.
4. What is calomel electrode ?
   It is a secondary reference electrode containing mercury, mercuruous chloride and a solution of KC
5. What is the the E0 Value of a Saturated calomel electrode
   0.2422

6. What is the standard solution used in the titration
Potassium dichromate
7. What is the name of the indicator electrode

Platinum electrode

8. What is the equivalent weight of Fe2+ ion

55.85

9. How will you calculate the amount of Fe2+

55.85 x N gm/l

EXPT NO.5: ESTIMATION OF CHLORIDE IN WATER

1. What is the name of the method used in this titration
   Mohr's method
2. What is the equivalent weight of chloride ion
   35.46
3. What is the indicator used in the titration
   Potassium Chromate
4. What is the colour change in the titration
   Yellow to reddish brown
5. What is the standard solution used in the standardization of AgNO3
   Distilled water

EXPT NO.6: COLORIMETRIC ESTIMATION OF Fe^{3+} IN SOLUTION

1. Define absorbance?
   A= log (1/T)
2. What is Beer law?
   $I_t = I_o e^{-kc}$
3. Give the chemical formula of the complex formed by the addition of thiocyanate and mention its colour?
   $[Fe(SCN)_6]3-$, blood red colour
4. What is ferric alum?
   Ferric ammonium thiocyanate
5. What is Lamberts law?
   $I_t = I_o e^{-kc}$

EXPT NO.7: ESTIMATION OF DISSOLVED OXYGEN IN WATER SAMPLE

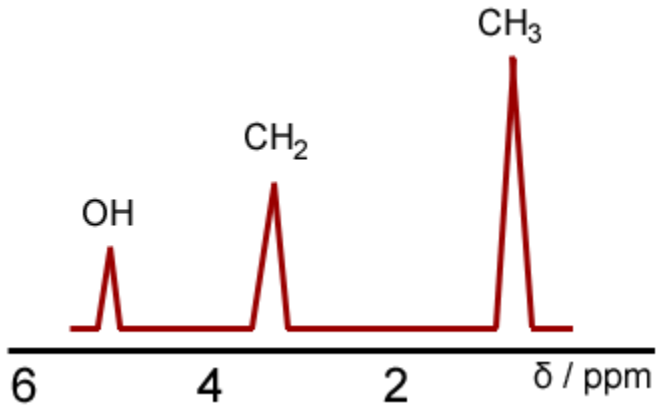
1. What is the name of the method used in this titration
   Winklers method.
2. What is the reagent used to standardize sodium thiosulphate solutiin
   Potassium dichromate
3. What is the equivalent weight of oxygen
   8
3. What is the indicator used in the titration
   Starch
4. What is the colour change in the titration
   Disappearance of blue colour.
5. What is the standard solution used in the estimation of liberated iodine
   Sodium thiosulphate

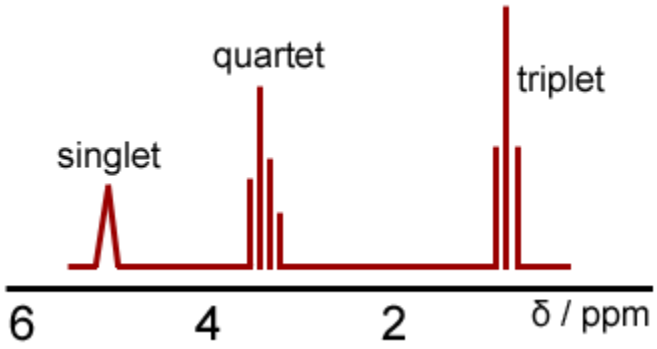
EXPT NO.8: ANALYSIS OF IR SPECTRA

1. What is the IR frequency region?
   650- 4000 cm-1
2. Which is fingerprint region and what is its speciality?
   650- 1500cm-1, each molecule
3. What is functional group region?
   1500- 4000cm-1
4. What is the principle of IR spectroscopy?
   By absorbing IR radiation, molecules get excited from one vibrational level to another
5. Number of modes of vibration of water molecule?-3

EXPT NO.9: ANALYSIS OF ^{1}H NMR SPECTRA

1. What is chemical shift?
   T= 10-ƨ
2. What is shielding and deshielding?
   Deshielding: The electrons around the proton create a magnetic field that opposes the applied field. This reduces the field experienced at the nucleus and therefore decreases the freqency required for the absorption
   Shielding: The electrons around the proton create a magnetic field that reinforces the applied field. This increases the field experienced at the nucleus and therefore increases the freqency required for the absorption
3. Which of the following attaching protons will have the highest electron density? a. H-O b. H-C c. H-F d. H-Br e. H-P
4. Give the high and low resolution spectrum of ethanol?





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10. 101908/EN200E PROFESSIONAL COMMUNICATION

10.1 COURSE INFORMATION SHEET

PROGRAMME: ALL PROGRAMMES	DEGREE: BTECH
PROGRAMME: ALL PROGRAMMES	DEGREE: B.TECH UNIVERSITY: A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY
COURSE: PROFESSIONAL COMMUNICATION	SEMESTER: II CREDITS: —
COURSE CODE: 101908/EN200E REGULATION: 2021	COURSE TYPE: MANDATORY NON-CREDIT
COURSE AREA/DOMAIN: HUMANITIES	CONTACT HOURS: 4 hours/Week - 2L + 2P

SYLLABUS:

UNIT	DETAILS	HOURS
I	Use of language in communication - Verbal and non-verbal communication - Technical communication: significance of technical communication Vocabulary development: technical vocabulary, vocabulary used in formal letters/emails and reports, sequence words, misspelt words, compound words, finding suitable synonyms, verbal analogies Language Development: subject-verb agreement, personal passive voice, numerical adjectives, embedded sentences, interrogative sentences, clauses, conditionals, reported speech, active/passive voice, parts of speech, transitive and intransitive verbs, prepositions and tenses Technology-based communication: effective email messages, slide presentations, editing skills using software - Modern-day research and study skills: search engines and how to get optimal results using language, repositories, forums such as Git Hub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora	9

II	Reading, comprehension and summarizing - Reading styles, speed, valuation, critical reading, reading and comprehending shorter and longer technical articles from journals, newspapers - Identifying the various transitions in a text - SQ3R method, PQRST method - Speed reading - Comprehension: techniques, understanding textbooks, marking and underlining - Note-taking: recognizing non-verbal cues - Paraphrasing	4
III	Oral Presentation: voice modulation, tone, describing a process - Presentation skills: oral presentation and public speaking skills, business presentations - Preparation: organizing the material, self-introduction, introducing the topic, answering questions, individual presentation practice, presenting visuals effectively - Online presentation Debate and group discussions: introduction to group discussion (GD), differences between GD and debate, participating in GD, understanding GD, brainstorming the topic, questioning and clarifying, GD strategies, activities to improve GD skills - Persuasion	5
IV	Listening: active and passive listening, listening for general content, to fill up information, intensive listening, for specific information, to answer, and to understand - Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks Interview skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (Skype) interviews, one-to-one interview and panel interview, FAQs related to job interviews	6
V	Formal writing - Technical writing: differences between technical and literary style - Letter writing (formal, informal and semi-formal), job applications, minute preparation, CV preparation (differences between Bio-Data, CV and Resume), and reports - Elements of style - Common errors in writing, describing a process, Statement of Purpose, instructions, checklists Analytical and issue-based essays - Report writing: basics of report writing, structure of a report, types of reports, references, bibliography -Referencing style (IEEE Format) - Plagiarism	4

LAB	Written: letter writing, CV writing, attending a meeting and minute preparation, vocabulary building	2
LAB	Spoken: phonetics, MMFS (Multimedia Feedback System), mirroring, elevator pitch, telephone etiquette, qualities of a good presentation with emphasis on body language and use of visual aids	2
LAB	Listening: exercises based on audio materials like radio and podcasts, listening to songs, practice and exercises	2
LAB	Reading: speed reading, reading with the help of audio-visual aids, reading comprehension skills	2
LAB	Mock interview and debate/group discussion: concepts, types, do's and don'ts- intensive practice	
TOTAL HOURS		36

TEXT/REFERENCE BOOKS:

T/R	BOOK TITLE/AUTHORS/PUBLICATION
R	Ellis Rod, *English for Engineers and Technologists (Combined edition, Vol. 1 and 2)*, Orient Blackswan, 2010.
R	Meenakshi Raman and Sangeetha Sharma, *Technical Communication: Principles and Practice*, 2nd Edition, Oxford University Press, 2011
R	Stephen E. Lucas, *The Art of Public Speaking*, 10th Edition; McGraw Hill Education, 2012.
R	Ashraf Rizvi, *Effective Technical Communication*, 2nd Edition, McGraw Hill Education, 2017.
R	William Strunk Jr. & E.B. White, *The Elements of Style*, 4th Edition, Pearson, 1999.
R	David F. Beer and David McMurrey, *Guide to Writing as an Engineer*, John Willey. New York, 2004.
R	Goodheart-Willcox, *Professional Communication*, First Edition, 2017.
R	Philip L. Hunsaker and Stephen P. Robbins, *Training in Interpersonal Skills: Tips for*

	Managing People at Work, Pearson Education, India, 6th edition, 2015.
R	Gopalaswamy Ramesh and Mahadevan Ramesh, *The Ace of Soft Skills: Attitude, Communication and Etiquette for Success*, Pearson Education; 1 edition, 2013.
R	Anand Ganguly, *Success in Interview*, RPH, 5th Edition, 2016.

COURSE PRE-REQUISITES:

1	A basic level of ability to read, write and speak in English.

COURSE OBJECTIVES:

1	Students should have their vocabulary augmented and be able to understand the basic rules of grammar.
2	Students should be able to employ reading strategies to effectively read, understand and critically analyse technical and non-technical texts.
3	Students should be able to take part in debates, group discussions, interviews and presentations, making use of effective communication and presentation techniques.
4	Students should be able to understand the different types of listening and speaking techniques and employ these in their day-to-day communication.
5	Students should be able to adopt effective writing strategies used for technical as well as non-technical communication.

COURSE OUTCOMES:

SNO	DESCRIPTION	Bloom's Taxonomy Level
CO1	Develop vocabulary and language skills relevant to engineering as a profession.	Remember, Understand, Apply (Levels 1,2 & 3)
CO2	Analyze, interpret and effectively summarize a variety of textual content.	Remember, Understand, Apply (Levels 1,2 & 3)
CO3	Create effective technical presentations.	Remember, Understand, Apply (Levels 1,2 & 3)
CO4	Discuss a given technical/non-technical topic in a group setting and arrive at generalizations/consensus.	Remember, Understand, Apply (Levels 1,2 & 3)
CO5	Identify drawbacks in listening patterns and apply listening techniques for specific needs.	Remember, Understand, Apply (Levels 1,2 & 3)
CO6	Create professional and technical documents that are clear and adhering to all the necessary conventions.	Remember, Understand, Apply (Levels 1,2 & 3)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3

CO1										3		2			1
CO2										1		3			1
CO3						1			1	3					1
CO4										3		1			1
CO5		1							2	3					1
CO6	1					1			1	3					1

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO1-PO10	H	A strong foundation in vocabulary and grammar will aid in effective communication skills relevant to the engineering profession.
CO1-PO12	M	Owing to the infinite nature of vocabulary and grammar rules, professional communication becomes a life-long learning process.
CO2-PO10	L	Abilities to absorb, comprehend, process and present information are inevitable for effective communication.
CO2-PO12	H	In the face of technological change, the ability to analyse, interpret and effectively summarise textual content would prove beneficial.
CO3-PO6	L	Creating relevant technical presentations would enhance one's awareness of societal and cultural issues, instilling moral and social responsibilities in them.

CO3-PO9	L	Engaging in team activities will help one appreciate the need for reaching a consensus through delegation, employing proper and contextual listening skills.
CO3-PO10	H	Understanding, creating, and delivering technical presentations are aided by effective communication skills.
CO4-PO10	H	Articulating with clarity and preciseness of thought shall assist in discussing both technical and non-technical topics and arriving at generalisations and consensus.
CO4-PO12	L	Participation in group discussions and interviews would equip one to overcome inhibitions and anxieties.
CO5-PO2	L	Problem solving requires understanding the context through active listening.
CO5-PO9	M	Understanding proper listening techniques aids in effective problem solving while working in a team.
CO5-PO10	H	Active listening is quintessential for effective communication.
CO6-PO1	L	Drafting technical papers and official documents require adequate writing skills.
CO6-PO6	L	The framing of technical documents necessitates the consideration of relevant social and cultural codes.
CO6-PO9	L	Team activities require standardised and sound writing skills to avoid ambiguity.
CO6-PO10	H	Effective communication skills aid in the creation of technical and non-technical content that follows industry standards.

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	LOW/MEDIUM/ HIGH	JUSTIFICATION
CO1- PSO 3	L	Developing vocabulary and language skills will help to bring out excellent results in professional fields.
CO2- PSO 3	L	Analysing, interpreting and summarizing textual contents will help in the implementation and development of new ideas.
CO3- PSO 3	L	Creating effective technical presentations will ensure best manufacturing practices.
CO4- PSO 3	L	Discussion of technical and non-technical topics will help in reaching group consensus thereby developing new ideas on product designs.
CO5- PSO 3	L	Development of listening skills will result in best manufacturing practices.
CO6- PSO 3	L	Preparation of technical documents will help develop and implement new ideas on product design

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	DESCRIPTION	RELEVANCE TO PO\PSO	PROPOSED ACTIONS
1	Nil		

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SINO:	TOPIC	RELEVANCE TO PO\PSO
1	Gender Sensitivity in Communication	PO6, PO8, PO9, PO10, PO12, PSO3

WEB SOURCE REFERENCES:

1	https://www.thoughtco.com/what-is-communication-168987
2	https://www.grammarbook.com/grammar/subjectVerbAgree.asp
3	https://grammar.yourdictionary.com/grammar-rules-and-tips/basic-english-grammar-rules.html
4	https://jerz.setonhill.edu/writing/e-text/email/amp/
5	https://www.toppr.com/guides/english/reading-comprehension/summarizing/
6	https://iedunote.com/reading-techniques
7	https://www.eapfoundation.com/writing/cohesion/transitions/
8	https://www.readnaturally.com/research/5-components-of-reading/comprehension

9	https://medium.goodnotes.com/the-best-note-taking-methods-for-college-students-451f412e264e
10	http://tutorials.istudy.psu.edu/oralpresentations/oralpresentations3.html
11	https://www.managementstudyguide.com/group-discussion-and-debate.htm
12	https://peptalkindia.com/9-important-tips-to-succeed-in-a-group-discussion/
13	https://virtualspeech.com/blog/guide-for-handling-questions-after-a-presentation
14	https://www.orchard.co.uk/blog/different-types-of-interviews-1536.aspx
15	https://www.job-interview-wisdom.com/interview-etiquette.html
16	https://socialmettle.com/what-is-difference-between-passive-active-listening
17	https://www.skillsyouneed.com/ips/ineffective-listening.html
18	https://www.skillsyouneed.com/write/report-writing.html
19	https://www.naukri.com/blog/how-to-write-a-job-application/amp/
20	https://www.wildapricot.com/articles/how-to-write-meeting-minutes
21	https://zety.com/blog/how-to-write-a-cv
22	https://www.getsetresumes.com/blog/143-difference-between-resume-cv-and-biodata/

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑ CHALK & TALK	☑ STUD. ASSIGNMENT	☑ WEB RESOURCES	☐ LCD/SMART BOARDS
☑ STUD. SEMINARS	☐ ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ ASSIGNMENTS	☑ STUD. SEMINARS	☑ TESTS/MODEL	☑ UNIV.

		EXAMS	EXAMINATION
☐ STUD. LAB PRACTICES	☐ STUD. VIVA	☐ MINI/MAJOR PROJECTS	☐ CERTIFICATIONS
☐ ADD-ON COURSES	☐ OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑ STUDENT FEEDBACK ON FACULTY (TWICE)
☐ ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐ OTHERS

10.2 COURSE PLAN

DAY	MODULE	TOPIC PLANNED
1	1	Introducing the students to the modules, the question paper and the assignments
2	5	Theory: CV/Resume/Bio-data
3	5	Lab: CV writing
4	5	Lab: Letter writing
5	5	Theory: Interview
7	1	Theory: Vocabulary Development: technical vocabulary, vocabulary used in formal letters/emails and reports, sequence words, misspelled words, compound words, finding suitable synonyms, paraphrasing, verbal analogies.
6	1	Lab: Vocabulary practice, Modern day research and study skills: search engines, repositories, forums such as Git Hub, Stack Exchange, OSS communities (MOOC, SWAYAM, NPTEL), and Quora

8	1	Theory: subject-verb agreement, personal passive voice, numerical adjectives, embedded sentences, clauses, conditionals, reported speech, active/passive voice
9	1	Theory: Reported speech, active/passive voice, plagiarism
10	1	Lab: Report writing
11	1	Lab: Grammar practice 1 (Subject-verb agreement, active/passive voice, reported speech)
12	1	Theory: Tenses, articles, common mistakes in grammar
13	1	Phonetics
14	1	Lab: Grammar practice 2 (Tenses, articles)
15	1	Lab: Vocabulary Quiz and phonetics practice
16	2	Theory: Reading Comprehension, and Summarizing: Reading styles, speed, valuation, critical reading
17	2	Theory: SQ3R method, PQRST method, speed reading, Reading and comprehending shorter and longer technical articles from journals, newspapers, identifying the various transitions in a text, Types of reading
18	2	Lab: Reading practice
19	2	Lab: Reading Comprehension
20	3	Theory: Voice modulation, tone, describing a process, Presentation Skills: Oral presentation and public speaking skills, business presentations
21	3	Theory: Debate and Group Discussions: introduction to Group Discussion (GD), differences between GD and debate; participating GD, understanding GD, brainstorming the topic, questioning and clarifying, GD strategies, activities to improve GD skills
22	3	Lab: Presentation skills

23	3	Lab: GD skills
24	4	Theory: Listening and Interview Skills Listening: Active and Passive listening, listening: for general content, to fill up information, intensive listening, for specific information, to answer, and to understand.
25	4	Theory: Developing effective listening skills, barriers to effective listening, listening to longer technical talks, listening to classroom lectures, talks on engineering /technology, listening to documentaries and making notes, TED talks.
26	4	Lab: Listening practice, listening to different sources of audio
27	4	Lab: Interview Skills: types of interviews, successful interviews, interview etiquette, dress code, body language, telephone/online (skype) interviews, one-to-one interview & panel interview, FAQs related to job interviews
28	5	Theory: Formal writing: Technical Writing: differences between technical and literary style. Job applications, Minute preparation.
29	5	Theory: Elements of style, Common Errors in Writing: describing a process, use of sequence words, Instructions, Checklists
30	5	Lab: Writing MOM
31	1	Assignments
32	1	Assignments
33	1	Revision
34	1	Revision
35	1	Revision
36	1	Revision

10.3 MODULE WISE SAMPLE QUESTIONS

MODULE 1

1. What are examples of language that should be avoided when writing a formal letter?
2. List the differences between an essay and a report.
3. What are the different types of compound words? Explain with examples.
4. Give any three rules for writing formal Emails.
5. Give ten points for making formal PPTs more professional.
6. What is the format of formal letters?

MODULE 2

1. What is the difference between paraphrasing and summarising?
2. Name and describe any three reading styles with suitable examples.
3. Define Speed Reading. Which are instances where speed reading is employed?
4. What is Critical reading? What are the steps to critical reading?
5. Explain the SQ3R method of reading.
6. Explain the PQRST method of reading.
7. Describe the Cornell Method of note-taking. How does it differ from the Outline method?
8. Mention any three note-taking methods and elaborate.

MODULE 3

1. What is the difference between group discussion and debate?
2. What are the different steps involved in the preparation of the presentation?
3. What is the importance of voice modulation during the presentation?

MODULE 4

1. Which are the types of interviews based on the count of people involved?
2. Differentiate between formal and informal interviews.
3. What is a stress interview?
4. Which are the important interview etiquette an applicant must follow?

5. What constitutes good self-introduction?
6. Differentiate between active and passive listening.
7. Which are the major barriers that hinder effective listening?
8. Explain the methods to develop effective listening skills
9. What is TED Talk? Explain its influence in the present age.

MODULE 5

1. What is the difference between the technical and literary styles of writing?
2. Give a real-life scenario where a reader uses the information (technical writing) for an intended purpose.
3. What type of writing style do the poets and writers employ for their craft, with examples?
4. What are the main features of a formal letter, and how is it different from informal letters?
5. What are semi-formal letters? Explain it with examples.
6. What exactly should you put in your job application letter, and what should you leave out?
7. How should you format your job-application letter?
8. Are meeting minutes important and why they should be accurate. How do we keep track of confidential information without disclosing it in our minutes?
9. Should you hide employment gaps in your CV?
10. How long should your CV be and how long should your CV be?
11. Can we include hobbies and interests in your CV?
12. What is the difference between CV, Biodata and Resume?
13. Write a Report for your school magazine describing a Cultural Fest held in your school in which various schools of your city took part.
14. What are the essential elements of report writing?
15. How are reports different from essays?
16. Elaborate on this famous sentence ‘A writer should make his every word tell’
17. What are the most common grammatical errors we all need to be aware of?
18. How can we rectify errors in our writings, name some practical tips that you can follow?
19. What is the importance of sequence words while writing and how does it make reading easy
20. When are ‘statement of purpose’ letters required in your career? What is its word limit and what all details should it encompass?

21. What is a checklist? How do you create a checklist? Give an example.
22. Difference between analytical and issue-based essays.
23. What is the IEEE style of referencing?

Prepared by

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Mr Vinay Menon

Approved by

Dr. Sonia Paul

(HOD, DBSH)

11. 101908/MA200A VECTOR CALCULUS DIFFERENTIAL EQUATIONS AND TRANSFORMS

11.1 COURSE INFORMATION SHEET

PROGRAMME: ME	***DEGREE:*** BTECH
PROGRAMME: MECHANICAL ENGINEERING	DEGREE: **B.TECH** UNIVERSITY**: A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY**
COURSE: VECTOR CALCULUS DIFFERENTIAL EQUATIONS AND TRANSFORMS	SEMESTER**: II** CREDITS: **4**
COURSE CODE: 101908/MA200A ***REGULATION: UG***	COURSE TYPE: **CORE**
COURSE AREA/DOMAIN ENGINEERING MATHEMATICS	CONTACT HOURS: **3+1 (Tutorial) hours/Week.**

SYLLABUS:

UNIT	*DETAILS*	*HOURS*
I	Module 1 (Calculus of vector functions) (Text 1: Relevant topics from sections 12.1, 12.2, 12.6, 13.6, 15.1, 15.2, 15.3) Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed, and acceleration. Concept of scalar and vector fields, Gradient and its properties, directional derivative, divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields, independence of path and potential function (results without proof).	9

II	**Module 2 (Vector integral theorems)** (Text 1: Relevant topics from sections 15.4, 15.5, 15.6, 15.7, 15.8) Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form $z = g(x,y), y = g(x,z)$ or $x = g(y,z)$, Flux integrals over surfaces of the form $z = g(x,y), y = g(x,z)$ or $x = g(y,z)$, divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done	9
	(For practice and submission as assignment only: Plots of partial sums of Fourier series and demonstrations of convergence using plotting software)	
III	**Module- 3 (Ordinary differential equations)** (Text 2: Relevant topics from sections 2.1, 2.2, 2.5, 2.6, 2.7, 2.10, 3.2) Homogenous linear differential equation of second order, Superposition principle, Initial value problems, Basis, General solution _ Find a basis if one solution is known, Second order homogenous linear ODEs with constant coefficients-general solution. Solution of homogeneous Euler-Cauchy equations (second order only). Existence and uniqueness (without proof)-Wronskian-Non homogenous linear ODE's-general solution, solution by the method of undetermined coefficients (for the right hand side of the form $x^n, e^{kx}, sinax, cosax, e^{kx}sinax, e^{kx}cosax$and their linear combinations), methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficient.	9
IV	**Module- 4 (Laplace transforms)** (Text 2: Relevant topics from sections 6.1,6.2,6.3,6.4,6.5)	10

	Laplace Transform and its inverse, , linearity, Laplace transform of basic functions, First shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Convolution theorem(without proof)and its application to finding inverse Laplace transform of products of functions.	
V	**Module-5 (Fourier Transforms)** (Text 2: Relevant topics from sections 11.7,11.8, 11.9) Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties**.** The Fourier transform of derivatives. Convolution theorem (without proof)	8
TOTAL HOURS		**45**

TEXT/REFERENCE BOOKS:

T/R	***BOOK TITLE/AUTHORS/PUBLICATION***
T1	H. Anton, I. Biven Davis, *"Calculus"*, Wiley, 10th edition, 2015
T2	Erwin Kreyszig, *"Advanced Engineering Mathematics",* Wiley, 10th edition, 2015.
R1	J. Stewart, *Essential Calculus*, Cengage, 2nd edition, 2017

R2	G.B. Thomas and R.L. Finney, *Calculus and Analytic geometry*, 9 th Edition, Pearson,Reprint,2002
R3	Peter O Neil, *Advanced Engineering Mathematics*, 7th Edition, Thomson, 2007.
R4	Louis C Barret, C Ray Wylie, *"Advanced Engineering Mathematics",* Tata McGraw Hill, 6th edition, 2003
R5	VeerarajanT."*Engineering Mathematics for first year",* Tata McGraw - Hill, 2008
R6	B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 36th edition , 2010
R7	Srimanta Pal, Subodh C. Bhunia, *"Engineering Mathematics", Oxford University Press,2015*
R8	Ronald N. Bracewell*, "The Fourier Transform and its Applications",* McGraw – Hill International Editions, 2000.

COURSE PRE-REQUISITES:

C.CODE	*COURSE NAME*	*DESCRIPTION*	*SEM*
101908/MA 100A	Calculus of single and multi-variable functions	To develop basic ideas on vector differentiation, vector integration, their applications, and differential equations.	I

COURSE OBJECTIVES:

1	To familiarize the concepts and applications of differentiation and integration of vector valued functions.
2	To understand the concept of ordinary differential equations which have many applications in engineering.
3	To apply the basic transforms such as Laplace and Fourier transform which are invaluable for any engineer's mathematical toolbox.

COURSE OUTCOMES:

SNO	*DESCRIPTION*	*Bloom's Taxonomy Level*
CO 1	**Apply** the concept of differentiation and integration of vector valued functions in various fields of Engineering.	Apply (Level 3)
CO 2	**Evaluate** the surface and volume integrals and learn their inter-relations and applications.	Evaluate (Level 5)
CO 3	**Remember** and solve homogeneous and non-homogeneous linear differential equation with constant coefficients.	Remember (Level 1)
CO 4	**Analyze the** Laplace transform and apply them to solve ODEs arising in engineering.	Analyse (Level 4)
CO 5	**Understand** the Fourier transforms of functions and apply them to solve problems arising engineering	Understand (Level 2)

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	1				2		2	2		
CO 2	3	3	3	3	2	1				2		2	2		
CO 3	3	3	3	3	2	1				2		2	2		
CO 4	3	3	3	3	2	1				2		2			1
CO 5	3	3	3	3	2	1				2		2	2		

JUSTIFICATIONS FOR CO-PO MAPPING

MAPPING	*LOW/MEDIUM/ HIGH*	*JUSTIFICATION*
CO 1-PO 1	3	Applying the concept of differentiation and integration of vector valued functions we can solve various types of engineering problems.
CO 1-PO 2	3	Vector calculus can be used to reduce complex engineering problems into a simpler one.
CO 1-PO 3	3	We can design solutions to engineering problems which involves vector valued functions
CO 1-PO 4	3	Using the concept of differentiation and integration of vector valued functions we can analyse and interpret functions of multiple variables in engineering.
CO 1-PO 5	2	With the help of vector calculus, we can apply appropriate techniques & resources in modern engineering.
CO 1-PO 6	1	Fundamental knowledge in vector calculus helps to assess various safety issues relevant to the professional engineering practice
CO 1-PO 10	2	The common knowledge of vector calculus makes it

		easier to communicate ideas effectively
CO 1-PO 12	2	Able to engage in independent and lifelong learning in the broadest context of technological change
CO 2-PO 1	3	Basic knowledge in vector integral calculus helps in solving engineering problems
CO 2-PO 2	3	Vector integration can be applied to analyze deterministic systems that have multiple degrees of freedom
CO 2-PO 3	3	Vector integration is used in many fields of natural and social science and engineering to model and study high-dimensional systems
CO 2-PO 4	3	Most of the natural phenomenon is non-linear and that can be best described by using vector calculus and partial differential equation
CO 2-PO 5	2	Vector calculus can be used to optimize functions of two or more variables
CO 2-PO 6	1	The concept of vector calculus helps to assess societal, health, safety legal and cultural issues.
CO 2-PO 10	2	Effective communication helps the engineering community to give and receive clear instructions.

CO 2-PO 12	2	Study, experience, and practice of the fundamentals of vector integration will allow for further learning in the context of technological change
CO 3-PO 1	3	Basic knowledge of differential equations is used to create mathematical models to arrive at an optimal solution
CO 3-PO 2	3	Differential equations help to analyse complex engineering problems to reach substantiated conclusions
CO 3-PO 3	3	Application of differential equations help in designing solutions for engineering problems
CO 3-PO 4	3	Modelling using differential equations can help in better design of research and experiments
CO 3-PO 5	2	Differential equations give the engineer new techniques and methods for prediction and modelling
CO 3-PO 6	1	Differential equations can be used to find the optimal solution, or the extrema for various problems
CO 3-PO 10	2	Effective presentations and clear instructions can be done using differential equations
CO 3-PO 12	2	In the new era of technology, application of differential equations is used in the creation of new knowledge and

		learning of new techniques
CO 4-PO 1	3	Laplace transforms make solving complex differential equations easier
CO 4-PO 2	3	Knowledge of Laplace transforms broaden the research literature and information available to the engineer
CO 4-PO 3	3	To meet the specified needs for the public health and safety, solutions of differential equations using Laplace transforms can be applied widely
CO 4-PO 4	3	Laplace transforms are used for interpreting and analyzing the data in engineering field
CO 4-PO 5	2	Laplace transforms can be used to create new programs for solving various models and making predictions from them
CO 4-PO 6	1	Modelling, using differential equations and Laplace transforms can be applied to assess societal, legal, and cultural issues.
CO 4-PO 10	2	Laplace transforms allow the engineer to communicate effectively on various complex engineering problems
CO 4-PO 12	2	Learning the fundamentals of Laplace transforms will increase learning skills, which will in turn foster lifelong independent learning

CO 5-PO 1	3	Knowledge of Fourier integrals and transforms provides different techniques in solving engineering problems
CO 5-PO 2	3	Identify and analyses the signals in electronics and communication using Fourier integrals and transforms
CO 5-PO 3	3	Fourier integrals can be used to design and develop solutions for problems with societal, cultural, and environmental implications
CO 5-PO 4	3	Fourier transforms can be used to analyses new research literature and help in solving new complex problems
CO 5-PO 5	2	Modern IT and engineering tools can be created to apply Fourier integrals and transforms for solution of engineering problems
CO 5-PO 6	1	Application of Fourier transforms and integrals in context to assess societal issues
CO 5-PO 10	2	The ability to determine Fourier transforms and use them to solve problems will allow for effective communication
CO 5-PO 12	2	Good learning skills will improve independent and life-long learning with help of Fourier transforms

JUSTIFICATIONS FOR CO-PSO MAPPING

MAPPING	*LOW/MEDIUM / HIGH*	*JUSTIFICATION*
CO1-PSO1	*MEDIUM*	**Using the concept of differentiation and integration of vector valued functions in various fields of Engineering students will be able apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences.**
CO2-PSO1	*MEDIUM*	**By evaluating the surface and volume integrals and learn their inter-relations and applications students can apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology**
CO3-PSO1	*MEDIUM*	**Solving homogeneous and non-homogeneous linear differential equation with constant coefficients students will become sound in solving complicated problems in the field of Mechanical Engineering.**
CO4-PSO3	*LOW*	**Analyzing the Laplace transform and apply them to solve ODEs arising in engineering students are able to implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices**
CO5-PSO1	*MEDIUM*	**By applying their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology students will acquire good technical skills in their fields**

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSIONAL REQUIREMENTS:

SNO	*DESCRIPTION*	*RELEVENCE TO PO*	*PROPOSED ACTIONS*	*RELEVANCE*
1	Basic notation and arithmetic of vectors	PO 1	Reading	1
2	Applications of vector calculus	PO2	Reading	1
3	Application of Fourier and Laplace transforms	PO2	Reading	1

PROPOSED ACTIONS: TOPICS BEYOND SYLLABUS/ASSIGNMENT/INDUSTRY VISIT/GUEST LECTURER/NPTEL ETC

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SINO:	**TOPIC**	**RELEVENCE TO PO**
1	Conservative fields in 3- space	1
2	Properties of curl and gradient	1

WEB SOURCE REFERENCES / ICT ENABLED TEACHING LEARNING RESOURCES:

1	http://www.math.com/
2	https://www.youtube.com/watch?v=Fh8m6ZdFaqU
3	https://www.youtube.com/watch?v=GmIcbqdvIgc
4	https://www.youtube.com/watch?v=2ZBcbFhrfOg
5	https://www.youtube.com/watch?v=o77UV7YrWvw
6	https://www.youtube.com/watch?v=Jd_t8jUJJfA
7	https://www.youtube.com/watch?v=2I4jKIGy238
8	https://www.youtube.com/watch?v=uliv9TzeD6o

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

☑CHALK & TALK	☑STUD. ASSIGNMENT	☑WEB RESOURCES	☑LCD/SMART BOARDS
☐STUD. SEMINARS	☐ADD-ON COURSES		

ASSESSMENT METHODOLOGIES-DIRECT

☑ASSIGNMENTS	☐STUD. SEMINARS	☑TESTS/MODEL EXAMS	☑UNIV. EXAMINATION
☐STUD. LAB PRACTICES	☐STUD. VIVA	☐MINI/MAJOR PROJECTS	☐CERTIFICATIONS
☐ADD-ON COURSES	☐OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

☑ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	☑STUDENT FEEDBACK ON FACULTY (TWICE)
☐ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	☐OTHERS

Prepared by **Approved by**

Ms.Bindu V.A **Dr. Ramkumar P.B**

(HoD)

12. 01905/CO200G PROGRAMMING IN C

12.1 COURSE INFORMATION SHEET

PROGRAMME: MECHANICAL ENGINEERING	DEGREE: BTECH
COURSE: PROGRAMMING IN C	SEMESTER: II CREDITS: 4
COURSE CODE: 101905/CO200G REGULATION: 2021	COURSE TYPE: CORE
COURSE AREA/DOMAIN: PROGRAMMING, DATA STRUCTURES AND ALGORITHMS	CONTACT HOURS: 2+1 (Tutorial) +2 (Lab) =5 hours/Week.
CORRESPONDING LAB COURSE CODE (IF ANY): NIL	LAB COURSE NAME: NIL

SYLLABUS:

UNIT	DETAILS	HOURS
I	Basics of Computer Architecture: processor, Memory, Input & Output devices - Application Software & System software: Compilers, interpreters, High level and low level languages Introduction to structured approach to programming, Flow chart Algorithms.	7
II	Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf. Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence. Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements. (Simple programs covering control flow).	10
III	Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional Array. String processing: In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets) Linear search program, bubble sort program, simple programs covering arrays and strings.	6
IV	Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Structure, union, Storage Classes, Scope and life time of variables, simple programs using functions.	6
V	Basics of Pointer: declaring pointers, accessing data though pointers, NULL pointer, pass by reference effect. File Operations: open, close, read, write, (Simple programs- read	6

	from a file, write to a file, copy from one file to another).	
	TOTAL HOURS	**35**

Text Books

1. Schaum Series, Gottfried B.S., Tata McGraw Hill, Programming with C
2. E. Balagurusamy, McGraw Hill, Programming in ANSI C
3. Asok N Kamthane, Pearson, Programming in C
4. Anita Goel, Pearson, Computer Fundamentals

Reference Books

1. Anita Goel and Ajay Mittal, Pearson, Computer fundamentals and Programming in C
2. Brian W. Kernighan and Dennis M. Ritchie, Pearson, C Programming Language
3. Rajaraman V, PHI, Computer Basics and Programming in C
4. Yashavant P, Kanetkar, BPB Publications, Let us C Course Contents and Lecture

COURSE OBJECTIVES:

1	The objective of the course is to prepare the Engineering Graduates capable of writing readable C programs to solve computational problems that they may have to solve in their professional life. The course content is decided to cover the essential programming fundamentals which can be taught within the given slots in the curriculum

COURSE OUTCOMES:

SNO	DESCRIPTION
101905/CO 200G.1	Analyze a computational problem and develop an algorithm/flowchart to find its solution
101905/CO 200G.2	Develop readable* C programs with branching and looping statements, which uses Arithmetic, Logical, Relational or Bitwise operators.
101905/CO 200G.3	Write readable C programs with arrays, structure or union for storing the data to be processed.
101905/CO 200G.4	Divide a given computational problem into a number of modules and develop a readable multi-function C program by using recursion if required, to find the solution to the computational problem.
101905/CO 200G.5	Develop readable C programs with files for reading input and storing output.

readable* - readability of a program means the following:

1. Logic used is easy to follow
2. Standards to be followed for indentation and formatting
3. Meaningful names are given to variables
4. Concise comments are provided wherever needed

CO-PO AND CO-PSO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	P O1 1	PO 12	PSO 1	PSO 2	PSO 3
101905/ CO200G.1	3	3	3	2	-	1	-	-	-	1	1	2	-	-	1
101905/ CO200G.2	2	2	2	1	1	-	-	-	-	1	-	2	-	-	1
101905/ CO200G.3	2	2	2	1	2	-	-	-	-	1	-	2	-	-	1
101905/ CO200G.4	3	3	3	2	3	-	-	-	-	1	1	2	-	-	2
101905/ CO200G.5	3	3	-	-	3	-	-	-	-	3	-	3	-	-	2
EST102 (overall level)	2.8 33	2.5	2.2 5	1.5	2.2	1	-	-	-	1.33	1	2.17	-	-	1.33

JUSTIFICATIONS FOR CO-PO MAPPING

Mapping	LOW/MEDIUM /HIGH	Justification
101905/CO20 0G.1-PO1	H	Students will study the fundamental of programming by analyzing a problem and develop an algorithm/ flowchart to find its solution.
101905/CO20 0G.1-PO2	H	The students will be able to analyze a given complex problem since they have to understand the problem in depth to write an algorithm/ flowchart
101905/CO20 0G.1-PO3	H	The students will be able to develop and design solution to complex problems and express the solution they have designed using flowchart/ algorithm/ pseudocode.
101905/CO20 0G.1-PO4	M	The students will be able to use the skills of algorithm design in design of experiments and interpretation of data
101905/CO20 0G.1-PO6	L	The students will be able to write algorithm / draw flowchart for a solution catering to the needs of the society.
101905/CO20 0G.1-PO10	L	The students will be able to communicate the idea of their solution effectively in a step by step manner using algorithm or pictorially by using a flowchart.
101905/CO20 0G.1-PO11	L	The students will be able to write algorithm / draw flowchart for a solution catering to the needs of the society.
101905/CO20	M	The students will be able to use their algorithm writing /

0G.1-PO12		flowchart drawing skills whenever they need to design solutions to complex real life problems.
101905/CO200G.1-PSO3	L	The skill of algorithm development is fundamental to research and industry.
101905/CO200G.2-PO1	M	The concepts of branching, looping and operators are fundamental to our engineering specialization of problem solving.
101905/CO200G.2-PO2	M	The concepts of branching, looping and operators are needed in analyzing complex engineering problems.
101905/CO200G.2-PO3	M	The concepts of branching, looping and operators are inevitable when designing solutions to complex problems.
101905/CO200G.2-PO4	L	The concepts of branching, looping and operators are used in the design of experiments and data interpretation.
101905/CO200G.2-PO5	L	The concepts of branching, looping and operators are useful in usage of different tools since every tool makes use of these fundamentals.
101905/CO200G.2-PO10	L	The concepts of branching, looping and operators are used in the design of solutions which is efficient for communicating the design to others.
101905/CO200G.2-PO12	M	The concepts of branching, looping and operators are used in all areas of research as well as industry.
101905/CO200G.2-PSO3	L	The concepts of branching, looping and operators are the fundamentals in programming and they are used in areas of research as well as developing new products/ ideas.
101905/CO200G.3-PO1	M	The concepts of arrays and structure for data storage are fundamental to our engineering specialization of problem solving.
101905/CO200G.3-PO2	M	The concepts of arrays and structure for data storage are needed in analyzing complex engineering problems.
101905/CO200G.3-PO3	M	The concepts of arrays and structure for data storage are inevitable when designing solutions to complex problems.
101905/CO200G.3-PO4	L	The concepts of arrays and structure for data storage are used in the design of experiments and data interpretation.
101905/CO200G.3-PO5	M	The concepts of arrays and structure for data storage are useful in usage of different tools since every tool makes use of these fundamentals.
101905/CO200G.3-PO10	L	The concepts of arrays and structure for data storage are used in the design of solutions which is efficient for communicating the design to others.
101905/CO200G.3-PO12	M	The concepts of arrays and structure for data storage are used in all areas of research as well as industry.

101905/CO200G.3-PSO3	L	The concepts of arrays and structure for data storage are the fundamentals in programming and they are used in areas of research as well as developing new products/ ideas.
101905/CO200G.4-PO1	H	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are fundamental to our engineering specialization of problem solving.
101905/CO200G.4-PO2	H	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are needed in analyzing complex engineering problems.
101905/CO200G.4-PO3	H	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are inevitable when designing solutions to complex problems.
101905/CO200G.4-PO4	M	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are used in the design of experiments and data interpretation.
101905/CO200G.4-PO5	H	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are useful in usage of different tools since every tool makes use of these fundamentals.
101905/CO200G.4-PO10	L	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are used in the design of solutions which is efficient for communicating the design to others.
101905/CO200G.4-PO11	L	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are fundamental to any application related to engineering.
101905/CO200G.4-PO12	M	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are used in all areas of research as well as industry.
101905/CO200G.4-PSO3	M	The concepts of dividing the complex problem into modules forming multi function programs and the concept of recursive functions are needed in analyzing complex engineering problems in all areas of research and industry.
E101905/CO200G.5-PO1	H	The concept of files for data input and output are fundamental to CS and are very helpful in manipulating large amount of data input and output of complex problems.

101905/CO200G.5-PO2	H	The concept of files for data input and output are helpful in analyzing problems and reviewing the output obtained after doing complex programs in C.
101905/CO200G.5-PO5	H	The concept of files for data input and output will be very useful when we use modern tools for data analysis and prediction
101905/CO200G.5-PO10	H	The concept of files for data input and output helps to store the results in an organized manner so that it can be effectively communicated to outside world
101905/CO200G.5-PO12	H	The concept of files for data input and output is an inevitable concept that can be used with almost every real life engineering problem and this helps to manipulate data effectively.
101905/CO200G.5-PSO3	M	The concept of files for data input and output helps to model and analyze complex problems effectively so that it helps develop programs that meets industry standards

GAPS IN THE SYLLABUS - TO MEET INDUSTRY/PROFESSION REQUIREMENTS:

SNO	DESCRIPTION	PROPOSED ACTIONS
1	NIL	

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN:

SL NO	DESCRIPTION	PROPOSED ACTIONS
1	Dynamic Memory Allocation	Lecture
2	Command Line Arguments	Reading assignment
3	Recursion, Array as function parameters, Array access using pointers	Programming exercise during tutorial hours

DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓ CHALK & TALK	✓ STUD. ASSIGNMENT	✓ WEB RESOURCES	
✓ LCD/SMART BOARDS	STUD SEMINARS	ADD-ON COURSES	

ASSESSMENT METHODOLOGIES-DIRECT

✓ ASSIGNMENTS	STUD. SEMINARS	✓ TESTS/MODEL EXAMS	✓ UNIV. EXAMINATION
✓ STUD. LAB PRACTICES	✓ STUD. VIVA	Micro/Mini/Main PROJECTS	CERTIFICATIONS

ADD-ON COURSES	OTHERS		

ASSESSMENT METHODOLOGIES-INDIRECT

✓ ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	✓ STUDENT FEEDBACK ON FACULTY (TWICE)
ASSESSMENT OF MINI/MAJOR PROJECTS BY EXT. EXPERTS	OTHERS

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