CET401	DESIGN OF STEEL STRUCTURES	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	0	0	3	2019

Preamble: Goal of this course is to expose the students to the fundamental concepts of DESIGN OF STEEL STRUCTURES. After this course, students will be able to design steel structures and to recognize practical problems in real-world situations and respond accordingly.

Prerequisite: CE302 STRUCTURAL ANALYSIS II

Course Outcomes: After the completion of the course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO 1	Explain the behavior and properties of structural steel members to resist various structural forces and actions and apply the relevant codes of practice	Understanding and analyzing
CO 2	Analyses the behavior of structural steel members and undertake design at both serviceability and ultimate limit states	Analysing and applying
CO 3	Explain the theoretical and practical aspects of Design of composite Steel Structure along with the planning and design aspects	Understanding and applying
CO 4	Apply a diverse knowledge of Design of Steel engineering practices applied to real life problems	Applying
CO5	Demonstrate experience in the implementation of design of structures on engineering concepts which are applied in field Structural Engineering	Applying

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	3	2	-	-	-	-	-	-	-	-	-
CO 3	2	3	2	-	-	-	-	-	-	-	-	-
CO 4	2	3	3	-	-	-	-	-	-	-	-	-
CO5	2	3	3	-	-	-	-	-	-	-	-	-

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Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination (Marks)
	Test 1 (Marks)	Test 2 (Marks)	
Remember			
Understand	25	10	20
Apply		40	50
Analyse	25		30
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation (CIE) Pattern :

Attendance : 10 Marks

Continuous Assessment Test (2 numbers) : 25 Marks

Assignment/Quiz/Course project : 15 Marks

End Semester Examination (ESE) Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

(*Questions may be framed based on the outline given under each course outcome*)

Course Outcome 1 (CO1): Explain the behavior and properties of structural steel members to resist various structural forces and actions and apply the relevant codes of practice

1. The fundamental concepts of basic structural behavior in steel structures
2. Basic theories of steel structural members and its analysis.

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Course Outcome 2 (CO2): Analyses the behavior of structural steel members and undertake design at both serviceability and ultimate limit states

1. The fundamental concepts of different structural members
2. Design of simple structural members

Course Outcome 3 (CO3): Explain the theoretical and practical aspects of Design of composite Steel Structure along with the planning and design aspects

Design of composite beams and columns

Course Outcome 4 (CO4): Apply a diverse knowledge of Design of Steel engineering practices applied to real life problems

Design of different structural elements considering application aspects

Course Outcome 5 (CO5): Demonstrate experience in the implementation of Design of Structures on engineering concepts which are applied in field Structural Engineering

1. Design engineering problems giving importance to field application

Syllabus

Module	Contents
1	Introduction to steel and steel structures, properties of steel, structural steel sections. Introduction to design: Design loads and load combinations, limit state design concepts. Connections bolted and welded (direct loads)
2	Tension members-Types of sections – net area- design of tension members- concept of shear lag-use of lug angle-connections in tension members
3	Compression members- design of struts- solid and built up columns for axial loads--design of lacings and battens-column bases- slab base – gusseted base
4	Design of beams- laterally restrained and unrestrained – simple and compound beams-plate girders subjected to uniformly distributed loads – design of stiffeners.
5	Design of roof trusses- types-design loads and load combinations- assessment of wind loads- design of purlins. Moment resistant/Eccentric connections (in plane and out of plane) Fire resistant design-criterion-fire resistance assessment-material property-design approach-passive protection for steel work-fire resistant steel-fire performance assessment

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Text Books:

1. Punmia B. C., Jain A. K. and Jain A. K., Design of Steel Structures, Laxmi Publications (P) Ltd, 2017

2. Ramchandra S and Virendra Gehlot, Design of Steel Structures Vol. II, Standard Book House, 2007

References:

1. N.Subramanian; Steel Structures, Oxford Publication
2. P. Dayaratnam., Design of Steel Structures ,Wheeler Publishing, 2003
3. Raghupathi, Steel Structures, Tata McGraw Hill, 2006
4. V L Shah & Veena Gore, Limit State Design of steel Structures , Structures Publications, 2009
5. William T Segui., Steel Design , Cenage Learning, 6e, 2017
6. IS 800 – 2007, Code of practice for Structural steel design, BIS
7. IS:875-Part 3-2015 Design loads for buildings Part 3: Wind loads , BIS

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Estd. 2014
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Model Question Paper

QP CODE:

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CET401

Course Name: DESIGN OF STEEL STRUCTURES

(Use of Codes IS 800, IS 875, IS 883 is permitted. Assume suitable data wherever necessary)

Max. Marks: 100 Duration: 3 hours

Part A

(***Answer all questions; each question carries 3 marks***)

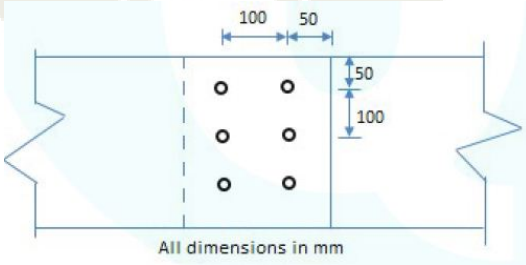
1. Explain the failures of bolted joints.
2. What do you mean by prying forces?
3. Under what circumstances do we use slot welds and plug welds?
4. With the help of suitable diagram, explain the concept of shear lag
5. What are the main purposes of lacings and battens?
6. Explain the failure modes of axially loaded columns
7. Distinguish between laterally restrained and unrestrained beams.
8. What is lateral torsional buckling of beams?
9. List the different fire resistance criterion.
10. List the various passive protection methods for steel structures against fire.

Part B

(Answer ANY ONE full question from each module, each question carries 14 marks)

Module – 1

11. Determine the strength and efficiency of a bolted lap joint shown I the figure. The bolts are of 20mm diameter, grade 4:6. The plates are of 12mm thick and grade F2410



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12. An ISMC 250 @ 298kg/m is used as a tie member to transmit a factored load of 800kN. The channel section is connected to a gusset plate of 10mm thickness Design a fillet weld if the lap length is limited to 300mm Provide slot welds if required.

Module – 2

13. Design a tension member to carry an axial factored load of 500kN Use a double angle rolled steel section connected (at site) to each side of a gusset plate of10mm thick using 20mm diameter bolts of grade 4.6.
14. A tie member consisting of an angle section ISA100x75x8 designed to transfer a factored axial load of 280kN, is to be welded to a gusset plate of 10mm thick using 6mm fillet weld. Design the weld if the weld is provided on three sides by overlapping the angle on the gusset plate at a shop. Also sketch the connection showing the weld lengths.

Module – 3

15. Determine the design compressive load capacity of a column. made of a rolled steel section ISMC 200 @217N/m if length of the column is 3m, with both ends fixed.
16. Design a column 10 m long to carry a factored axial load of 1100kN The column is restrained in position but not in direction at both ends. Design a batten system for the column Assume that the two channels are kept back to back

Module – 4

17. Design a simply supported beam of 10m effective span carrying a total factored load of 60kN/m. The depth of beam should not exceed 500mm. The compression flange of beam is laterally supported by floor construction. Assume stiff end bearing is 75mm
18. A conference hall 8mx12m is provided with a 120 mm RCC slab over rolled steel I beams spaced 4m centre-to-centre. The super imposed load is 4kN/m2 and floor finish of 1.5 kN/m2. Design one of the beam as laterally supported.

Module – 5

19. A purlin is to be designed to support a GI sheet as roofing material for a truss spaced at 3.5m c/c. purlin along the principal rafters are arranged at a distance of 1.35mc/c. The pitch of truss is 0.2m. Design a section for the purlin. Assume basic wind speed as 44m/s
20. Explain the different fire-resistant design approaches used in steel structures.

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Course Contents and Lecture Schedule:

Module	Contents	Course Outcomes Addressed	Hours
1	**Module 1**		**7**
1.1	Introduction to steel and steel structures	CO 1	1
1.2	Properties of structural steel and types of Structural steel sections	CO 1	1
1.3	Introduction to design-design philosophies- Design loads and load combinations	CO 1	1
1.4	Connections: Bolted-different types-joints(lap joint, butt joint) - eccentric loaded connections-beam to beam connections	CO 1,CO2	2
1.5	Connections : Welded-different types-joints(lap joint, butt joint) - eccentric loaded connections-beam to beam connections	CO1,CO 2	2
2	**Module 2**		**7**
2.1	Introduction- Types of tension members	CO 1	1
2.2	Modes of failure	CO 1	1
2.3	Factors affecting strength of tension members	CO 1	1
2.4	Design of tension members	CO 1 ,CO2	1
2.5	Concept of shear lag	CO 1	1
2.6	Application of lug angle	CO1,CO 3	1
2.7	Connections in tension members	CO 1 & CO 3	1
3	**Module 3**		**7**
3.1	Introduction-compression members-classification-Behavior (theory only-No equations)	CO 1	1
3.2	Design of struts	CO 1,CO2	1
3.3	Solid and built up columns for axial loads alone	CO1,CO2, CO 3	1
3.4	Design of lacing system	CO 1,CO3	1
3.5	Design of battening system	CO 1,CO3	1
3.6	Column base plate introduction- Simple slab base plate-only axial	CO 1,CO2	1

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	load		
3.7	Gusseted base-only axial load	CO1,CO2, CO 4	1
4	**Module 4**		**7**
4.1	Introduction- Beams, design of Laterally restrained beams	CO 1	1
4.2	Laterally Unrestrained beams	CO 1	1
4.3	Design of simple beams	CO 1,CO2	1
4.4	Design of compound beams	CO 1,CO3	1
4.5	Plate girder design for welded connection	CO 1,CO2	1
4.6	Design of stiffeners-end bearing and intermediate stiffeners	CO2,CO 4	1
4.7	Gantry girders AND beam-column (introduction only-No design)	CO 1 & CO 4	1
5	**Module 5**		**7**
5.1	Type of roof truss-design loads and load combinations	CO 1	1
5.2	Calculation of wind loads	CO 1 & CO 4	1
5.3	Design of purlins	CO 1, CO2	1
5.4	Moment resistant and eccentric connections-in plane and out of plane-(No design)	CO 1	1
5.5	Introduction –Fire resistance criterion	CO 1	1
5.6	Fire resistance assessment of steel structure-material property at elevated temperature-design approaches and tools-different models-methods-procedures	CO 1, CO2	1
5.7	Passive protection-fire performance assessment	CO1, CO3	1

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MCN401	INDUSTRIAL SAFETY ENGINEERING	CATEGORY	L	T	P	CREDIT
		MCN	2	1	0	-

Preamble: The course is intended to give knowledge of various safety management principles, various safety systems, various machine guarding devices, hazard identification techniques, energy sources, systems & applications and the need in the present context. Learners will be able to compare different hazard identification tools and choose the most appropriate based on the nature of industry. It aims to equip students in working with projects and to take up research work in connected areas

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO1	Describe the theories of accident causation and preventive measures of industrial accidents. (Cognitive Knowledge level: **Understand**)
CO2	Explain about personal protective equipment, its selection, safety performance & indicators and importance of housekeeping. (Cognitive Knowledge level: **Understand**)
CO3	Explain different issues in construction industries. (Cognitive Knowledge level: **Understand**)
CO4	Describe various hazards associated with different machines and mechanical material handling. (Cognitive Knowledge level: **Understand**)
CO5	Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards. (Cognitive Knowledge level: **Apply**)

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Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2				2	2	2				1
CO2	2	1	2		1	1	1	1				1
CO3	2	2	2		1	1	1	1	1	1		1
CO4	2	2	2		1	1	1	1	1	1		1
CO5	2	2	2	1	1	1	1	1	1	1		1

Abstract POs defined by National Board of Accreditation			
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

	Continuous Assessment Tests		**End Semester Examination**
	1	**2**	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

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Mark distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment - Test : 25 marks

Continuous Assessment - Assignment : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

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Syllabus

MCN401- Industrial Safety Engineering (35 hrs)

Module I (Safety introduction- 5 hrs)

Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.

Module II (Personal protection in work environment- 7 hrs)

Personal protection in the work environment, Types of PPEs, Personal protective equipment-respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

Module III (Safety issues in construction- 7 hrs)

Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.

Module IV (Safety hazards in machines- 8 hrs)

Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices. Safety in turning, and grinding. Welding and Cutting-Safety Precautions of Gas

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welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries.

Module V (Hazard identification and analysis- 8 hrs)

Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants - The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operability study (HAZOP)) – methodology, criticality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets (MSDS).

Text Books:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997). *Safety management in Industry*. Jaico Publishing House, New Delhi.
4. John V. Grimaldi and Rollin H.Simonds. (1989) *Safety management*. All India Traveller Book Seller, Delhi.
5. Ronald P. Blake. (1973). *Industrial safety.* Prentice Hall, New Delhi.
6. Alan Waring. (1996). *Safety management system*. Chapman & Hall, England.
7. Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai.
8. AIChE/CCPS. (1992). *Guidelines for Hazard Evaluation Proce*dures. (second edition). Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York.

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Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. Which are the various accident causation theories? Explain.
2. Define terms: Accident, Reportable accident, Dangerous occurrence.

Course Outcome 2 (CO2):

1. Discuss different types of personal protective equipment
2. Discuss about how to compare the safety performance of two industries.
3. Discuss the significance of work permit system in accident prevention.

Course Outcome 3 (CO3):

1. Distinguish ladders and scaffolds along with their safety features**.**
2. Discuss the safety requirement for a confined space entry.
3. Explain the important provision in the National Building Code.

Course Outcome 4 (CO4):

1. Explain the various principles used in machine guarding.
2. Explain the issues in mechanical material handling.

Course Outcome 5 (CO5):

1. Selection of different types of fire extinguishers accordance to type of fire.
2. Conduct a HAZOP study for a batch rector of your choice.
3. Determine different types of Chemical hazards associated with industries

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Model Question Paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

VII SEMESTER B. TECH DEGREE EXAMINATION

MCN401- INDUSTRIAL SAFETY ENGINEERING

Maximum: 100 Marks **Duration: 3 hours**

PART A

Answer all questions, each question carries 3 marks

1. Differentiate Unsafe act and Unsafe conditions with suitable examples
2. Discuss the significance of a safety committee in improving the safety performance of an industry
3. Which are the different types of permit? Highlight its suitability.
4. Which are five 'S' used in housekeeping?
5. List the various safety features of ladders.
6. How safety of the workers can be ensured during a demolition operations.
7. Which are the hazards associated with manual material handling?
8. Discuss the safety issues of Gas welding operations.
9. Differentiate Hazard and Risk.
10. Why MSDS is mandatory for chemical products.

(10 X 3 = 30 Marks)

PART B

Answer one full question from each module

Module 1

11. List the various accident causation theories and explain any one in details. (14 Marks)
12. a) Discuss the significance of safety policy in reducing the accidents. (4 Marks)

    b) Safety and productivity are the two sides of a coin'. Are you agreeing with this statement? Explain with your arguments. (10 Marks)

Module 2

13. a) Classify the personal protective equipment. List the suitability of at least fifteen types of PPEs. (10 Marks)

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b) How will you calculate the frequency rate? Explain with an example. (4 Marks)

14. a) How will you compare the safety performance of two industries? Explain with suitable example. (10 Marks)
    b) Which are the steps to be followed in confined space entry to protect the life a worker. (4 Marks)

Module 3

15. Discuss the safety and fire protection facilities required for a high rise building as per National building code. (14 Marks)
16. a) Identify the various hazards during the different stages of building construction. (7 Marks)
    b) Discuss the important types of ergonomic hazards associated with industries. (7 Marks)

Module 4

17. Which are the various types of machine guarding devices used industries. Discuss the suitability of each machine guarding devices. (14 Marks)
18. With suitable sketches briefly explain seven defects of wire ropes. (14 Marks)

Module 5

19. What is Hazard and Operability Analysis? How do you conduct a HAZOP analysis? (14 Marks)
20. Discuss about different types of chemical hazards. (14 Marks)

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Course Contents and Lecture Schedule

No.	Topic	No. of Lectures/ Tutorials L-T
1	**Introduction to Industrial safety Engineering**	
1.1	Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence. Reportable accidents	1
1.2	Theories of accident causation. Safety organization.	2
1.3	Role of management, supervisors, workmen, unions, government and voluntary agencies in safety.	3
1.4	Safety Officer-responsibilities, authority.	4
1.5	Safety committee-need, types, advantages.	5
2	**Personal protection in the work environment**	
2.1	Types of PPEs, respiratory and non-respiratory equipment.	6
2.2	Standards related to PPEs	7
2.3	Monitoring Safety Performance: Frequency rate, severity rate	8,
2.4	Monitoring Safety Performance: incidence rate, activity rate.	9
2.5	Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping.	10
2.6	Work permit system- objectives, hot work and cold work permits.	11
2.7	Typical industrial models and methodology. Entry into confined spaces.	12
3	**Introduction to construction industry and safety**	
3.1	Excavation and filling – Under-water works – Under-pinning & Shoring	13
3.2	Ladders & Scaffolds – Tunneling	14
3.3	Blasting –Demolition – Confined space	15
3.4	Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety.	16
3.5	Relevance of ergonomics in construction safety.	17
3.6	Ergonomics Hazards	18

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CET453	CONSTRUCTION PLANNING AND MANAGEMENT	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PEC	3	0	0	3	2019

Preamble: Construction Planning and Management is an elective course designed to provide in-depth knowledge in the planning and management of construction projects. The course details various operations encountered in a construction project in different phases throughout the lifecycle of a project, from planning, design, construction and operations. The course also helps students to develop the required skills to plan and manage various types of construction projects effectively and efficiently using the latest technologies like BIM.

Prerequisite: CET 309 Construction Technology and Management

Course Outcomes: After the completion of this course the student will be able to

Course Outcome	Description of Course Outcome	Prescribed learning level
CO1	Apply knowledge of Planning and Management for planning and execution of Construction Projects	Applying
CO2	Explain techniques for Project Planning, Scheduling, Construction Administration and Management	Understanding
CO3	Identify the criteria for selecting the appropriate method and tools as per the requirement of each project or site.	Understanding
CO4	Discuss the latest industry standards and technologies used in construction projects for planning and management.	Understanding
CO5	Explain the financial and legal aspects involved in a construction project.	Understanding

Mapping of course outcomes with program outcomes (Minimum requirement)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2				2				2		3	2
CO2	2	2		2			1		2		3	2
CO3	2	2	2		2	2	1		2	1	3	2
CO4	2	1		1	1	2	1		2	3	3	2
CO5	2	2	2	1	2		1	3	2		3	2

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Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	30	30	70
Apply	10	10	20
Evaluate			
Analyse			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project :15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question carries 14 marks and can have maximum 2 sub-divisions.

Course Level Assessment (Sample) Questions

CO1: Apply knowledge of Planning and Management for planning and execution of Construction Projects

1. How do you structure a team for a project? What do you consider?
2. What are the functions of construction management and give its applications?
3. What actions would you take if a project is falling behind schedule or exceeding the project's budget?
4. What would you do if some of your workers were not using the necessary safety equipment?

CO2: Explain techniques for Project Planning, Scheduling , Construction Administration and Management

1. List out the various network techniques in construction management.
2. Name the resource allocation methods and give the steps involved in any one

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of the resource allocation methods.

3. Explain the different costs involved in material management for material, labour and expenses.

CO3: Identify the criteria for selecting the appropriate method and tools as per the requirement of each project or site.

1. What methods do you use to monitor and track the progress of your construction project?
2. Elucidate the methods to prioritize the necessary tasks for a project.
3. How do you know when a construction project is well-executed and what do you look for in quality control?

CO4: Discuss the latest industry standards and technologies used in construction projects for planning and management.

1. What are some of the major uses of BIM?
2. What is the difference between Retained Logic & Override Logic in progress update?
3. What is Clash Detection? How does it help in Construction Projects?

CO5: Explain the financial and legal aspects involved in a construction project.

1. What factors would you consider before negotiating contracts or rates?
2. Explain the different laws relating to wages.
3. Explain legal and financial aspects of accidents in construction projects.

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Syllabus

Module 1

Introduction: Objectives of construction planning and management. Importance of Management in Construction, Construction team- Roles, responsibilities and skills.

Organisation and Hierarchy in Construction Projects – Types, Characteristics, Functions and Flow charts.

Construction scheduling: Review of CPM and PERT (AoN network), Time-cost trade-off – Cost optimization through the crashing of a network, Resource smoothing and resources levelling – concept only.

Module 2

Introduction to BIM Technology: Define BIM and BIM model, Describe workflow in using BIM in the building lifecycle, Model-Based cost estimating, Perform Simulations, Apply BIM to reduce error and change orders in projects, Evaluate and communicate ideas related to the use of BIM in the building life cycle, BIM Benefits: Case Studies, Organizational Maturity and Dimensions, Construction Management and Planning using BIM

Labour Legislations pertaining to the construction industry, Payment of Wages Act, Minimum Wages Act, Contract Labour Act, Labour Welfare Fund Act, Workmen's Compensation Act.

Module 3

Human Resource Management: manpower estimation at various stages, recruitment, training, under and overmanning.

Materials Management: Materials of construction, classification codification, ABC analysis, estimation of materials procurement, inventory/stock control, Economic Order Quantity, purchase procedure, stores management

Quality control in Construction: Importance of quality, elements of quality, organization for quality control, quality assurance technique.

Construction Safety Management: Important causes of accidents on construction sites, safety measures, safety benefits to employees, employees and customers.

Module 4

Economics of Project Management: Economic analysis of projects – NPV, Rate of return analysis, cost-benefit analysis.

Tendering – E Tendering / Electronic Process.

Contract – Contract documents and conditions of Contract, Contract agreement

Technical terms only - Administrative approval, Technical Sanction, Secured Advance, Mobilization Advance, Heads of accounts in government organization, Earnest money deposit (EMD) and Security deposit (SD). Accounting- Terms only- Work Abstract, Cash book, Work register, Accounting for the materials, Measurement book, Muster roll and Record of Bills

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Module 5

Budgetary Control Systems: Types of budgets, new approaches for budgeting, responsibility of accounting, profit centre approach.

Financial Management: Meaning and scope, financial statement analysis, financial ratio analysis, funds flow analysis.

Working Capital Management: Meaning, policy for working capital, estimating working capital needs. Capital investment decision, long term financing working of financial institutions in India and abroad, self-financing, financing mechanisms.

Text Books:

1. Srinath, L.S. PERT and CPM Principles and Applications, 3rd ed. Affiliated East-West Press, New Delhi 2015.
2. Kumar Neeraj Jha, Construction Project Management, 2nd ed Pearson, Dorling Kindersley (India) pvt. Ltd 2015
3. K. K. Chitkara, Construction Project Management Planning Scheduling & Controlling, Tata McGraw Hill, New Delhi 2014.

References:

1. Gupta, B.L. and Gupta, Amit. Construction Management, Machinery and Accounts, 3rd ed. Standard Pub, 2005.
2. Loraine, R.K. Construction Management in Developing Countries. Thomas Telford, London, 1993.
3. Singh, Harpal. Construction Management and Accounts 14th ed. Tata McGraw-Hill Pub., New Delhi, 1981.
4. Gould, E. Frederick and Joyce, E. Nancy. Construction Project Management. Prentice Hall, New Jersey, 2000.
5. Shrivastava, U.K. Construction Planning and Management, 3rd ed. Galgotia Pub., New Delhi, 2004
6. Brad Hardin, Dave McCool . BIM and Construction Management: Proven Tools, Methods, and Workflows Paperback – 2017 .

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Course Contents and Lecture Schedule

Module	Topic Course	Course Outcomes Addressed	No. of Lectures
1	**Module I : Total lecture hours : 7**		
1.1	Introduction: Objectives of construction planning and management. Importance of Management in Construction, Construction team- Roles, responsibilities and skills.	CO2	1
1.2	Organisation and Hierarchy in Construction Projects -Types, Characteristics, Functions and Flow charts.	CO1, CO2	2
1.3	Review of CPM and PERT, Time-cost trade-off – Cost optimization through the crashing of a network, Resource smoothing and resources levelling – concept only.	CO1, CO2	4
2	**Module II: Total lecture hours: 7**		
2.1	Introduction to BIM Technology: Define BIM and BIM model, Describe workflow in using BIM in the building lifecycle, Model-Based cost estimating, Apply BIM to reduce error and change orders in projects	CO2, CO3, CO4	3
2.2	Evaluate and communicate ideas related to the use of BIM in the building life cycle, BIM Benefits: Case Studies, Organizational Maturity and Dimensions, Construction Management and Planning using BIM	CO1, CO3, CO4	2
2.3	Labour Legislations pertaining to the construction industry, Payment of Wages Act, Minimum Wages Act, Contract Labour Act, Labour Welfare Fund Act, Workmen's Compensation Act.	CO2, CO5	2
3	**Module III: Total lecture hours: 6**		
3.1	Human Resource Management: manpower estimation at various stages, recruitment, training, under and overmanning.	CO1	1
3.2	Materials Management: Materials of construction, classification codification, ABC analysis, Estimation of materials procurement, inventory/stock control, Economic Order Quantity, purchase procedure, stores management.	CO1	2
3.3	Quality control in Construction: Importance of quality, elements of quality, organization for quality control, quality assurance technique.	CO1	1
3.4	Construction Safety Management: Important causes of accidents, safety measures, safety benefits to employees, employees and customers.	CO2	2
4	**Module IV: Total lecture hours: 7**		
4.1	Economics of Project Management: Economic analysis of projects, – NPV, Rate of return analysis, cost-benefit	CO2, CO4	2

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	analysis.		
4.2	Tendering – E Tendering / Electronic Process.	CO2, CO4	1
4.3	Contract – Contract documents and conditions of Contract, Contract agreement	CO2	2
4.4	Technical terms only - Administrative approval, Technical Sanction, Secured Advance, Mobilization Advance, Heads of accounts in government organization, Earnest money deposit (EMD) and Security deposit (SD). Accounting- Terms only- Work Abstract, Cash book, Work register, Accounting for the materials, Measurement book, Muster roll and Record of Bills	CO2	2
5	**Module V: Total lecture hours: 8**		
5.1	Budgetary Control Systems: Types of budgets, new approaches for budgeting, responsibility of accounting, profit centre approach.	CO2, CO5	2
5.2	Financial Management: Meaning and scope, financial statement analysis, financial ratio analysis, fund flow analysis.	CO2, CO5	2
5.3	Working Capital Management: Meaning, policy for working capital, estimating working capital needs. Capital investment decision	CO2, CO5	2
5.4	Long term financing working of financial institutions in India and abroad, self-financing, financing mechanisms.	CO2, CO5	2

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Model Question Paper

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CET453
Course Name: CONSTRUCTION PLANNING AND MANAGEMENT

Marks : 100 Duration : 3 hrs

PART A
(Answer all Questions. Each Question carries 3 Marks)

1. Differentiate between resource smoothing and resource levelling.
2. List out members of the construction team and write the responsibilities.
3. Explain BIM Technology.
4. What is meant by Organizational Maturity of BIM?
5. Explain Economic Order Quantity.
6. List the important causes of accidents on construction sites.
7. Explain rate of return analysis.
8. What is meant by administrative approval?
9. Discuss any two types of construction budgets.
10. Explain the sources of long-term financing of construction projects.

PART B
(Answer one full question from each module, Each question carries 14 marks)

Module 1

11. a) Explain the Functions of construction project management.
    b) Describe any two types of organisation structures for construction projects.
12. With an example, explain the procedure for the time-cost tradeoff.

Module 2

13. Explain any two labour legislations pertaining to the construction industry.
14. Explain the following
    i) BIM Model
    ii) Clash Detection
    iii) Model Based Cost Estimating
    iv) Dimensions of BIM

Module 3

15. Explain the need for Quality assurance and Quality control in construction projects.
16. Discuss in detail ABC analysis for Material Management

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Module 4

17. a) Give the salient features of the contract document.
    b) Explain any two important conditions of the contract.
18. Discuss the major steps involved in E Tendering and the process of awarding the contract.

Module 5

19. Analyse the important benefits of the following:
    i) Fund Flow Analysis
    ii) Financial Ratio Analysis
20. Explain, with examples, the different Methods for Estimating Working Capital Requirement.

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CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
MET445	RENEWABLE ENERGY ENGINEERING	OEC	2	1	0	3

Preamble: The course is intended to give knowledge of various renewable energy sources, systems and applications and the need in the present context. Students will be able to compare different renewable energy techniques and choose the most appropriate based on local conditions. To equip students in working with projects and to take up research work in connected areas.

Prerequisite: Nil

Course Outcomes: After completion of the course the student will be able to

CO1	Explain renewable energy sources and evaluate the implication of renewable energy. To predict solar radiation at a location
CO2	Explain solar energy collectors, storages, solar cell characteristics and applications
CO3	Explain the different types of wind power machines and control strategies of wind turbines
CO4	Explain the ocean energy and conversion devices and different Geothermal sources
CO5	Explain biomass energy conversion devices. Calculate the Net Present value and payback period

Mapping of course outcomes with program outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

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Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions:

Course Outcome 1 (CO1):

1. What are the main renewable energy sources? Advantages and limitations
2. What is energy efficiency? How is it different from renewable energy use?
3. Define terms : Angle of Incidence, Declination, Solar constant

Course Outcome 2 (CO2):

1. Discuss different types of solar collectors
2. Discuss about different types of thermal storage devices
3. Draw the I-V characteristics of Solar cell under varying temperature and irradiation level

Course Outcome 3 (CO3):

1. Types of wind turbine and components
2. Difference between wind mill and wind turbine
3. Explain importance of drag and lift force in wind power generation.

Course Outcome 4 (CO4):

1. Explain with neat sketch the working of hybrid OTEC system
2. Explain with neat sketch the vapour dominated geothermal system

Course Outcome 5 (CO5):

1. Distinguish between Fixed dome plant and floating dome type biomass plant.
2. Write a short note on solar saving.
3. Derive expression for payback period

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Model Question Paper

MODEL QUESTION PAPER

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

VII SEMESTER B.TECH DEGREE EXAMINATION

MET445 RENEWABLE ENERGY ENGINEERING

Maximum: 100 Marks **Duration: 3 hours**

PART A

Answer all questions, each question carries 3 marks

1. Discuss in brief advantages of renewable energy.
2. Explain the following terms related to solar geometry (i) Hour Angle ((ii) Zenith Angle (iii) Surface azimuth angle
3. List different types of solar collectors
4. Discuss about solar pond
5. List the different methods used to estimate wind speed at a location.
6. What are the advantages of wind energy conversion systems?
7. List the geothermal resources.
8. Discuss advantages and disadvantages of a tidal power plant
9. Name the different processes used for hydrogen production
10. List the need for economic analysis of renewable energy system.

(10 X 3 = 30 marks)

PART B

Answer one full question from each module

Module 1

11. Elucidate the necessity of energy storage in the context of renewable sources of energy (14 Marks)
12. (a) Calculate the number of daylight hours in Srinagar for 22nd June .The latitude of Srinagar as 34º05'N. (4 Marks)

(b) Compare the construction and working of Pyranometer and Pyrheliometer. (10 Marks)

Module 2

13. (a) How solar thermal power plants classified. List the methods for converting solar energy into electric power (10 Marks)

(b) Briefly explain the applications of a solar PV system.. (4 Marks)

14. (a) Draw and explain the operation of flat plate collectors. (10 Marks)

(b) Explain the thermal methods of energy storage (4 Marks)

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Module 3

15. With a neat diagram explain the construction of a propeller type wind power system (14 marks)
16. (a) Derive the expression for power in the wind turbine. (7 marks)

b) Explain control mechanism in wind turbines (7 marks)

Module 4

17. State the principle of Ocean Thermal Energy Conversion (OTEC). Explain working of closed cycle OTEC system. (14 marks)
18. . Explain binary cycle Geothermal system (14 marks)

Module 5

19. Explain the construction and working of KVIC (floating type) bio gas plant (14 marks)
20. a.Define (1) Payback time (2) Return on investment .
    (3) Life cycle cost (6 marks)
    b. A solar PV system consisting with two lamps, a battery and other associated components cost Rs. 55000. The cost of conventional energy saved due to its installation is Rs. 4000 in the first year and this cost inflates at the rate of 5 % per year. Assume discounting rate is 9%. Calculate the payback period of the system with and without discounting (8 marks)

Syllabus

Module 1

The Energy Scenario- Commercial energy sources -World's production and reserves-India' Production and reserves, Energy Alternatives, Need for alternatives –solar option-nuclear options

Principles of solar radiation : Solar radiation outside the earth's atmosphere and at the earth's surface , Solar Constant, Basic Sun-Earth Angles, Instruments for measuring solar radiation and sunshine , Solar radiation data

Module 2

Solar Energy collectors: Solar thermal collectors -Flat plate collectors –Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector) –Solar Air Heaters

Solar thermal electric power generation -Thermal Energy storage, sensible heat storage, latent heat storage , Thermo chemical storage , photovoltaic system for power generation , Solar pond -Solar Cells-Types of solar cells , principle of working and performance characteristics, Production process- Block diagram only

Applications- Solar space heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air-conditioning, heliostat, solar furnace

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Module 3

Wind Energy- classification of wind turbines and power performance curve, Energy in wind, calculation of energy content, Power coefficients, Betz limit theory, , tip speed ratio, solidity of turbine' power control strategies, Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS

Module 4

Ocean Energy – Devices for Wave Energy conversion, Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Geothermal energy: Introduction, hot dry rock resources, magma resources, vapor and liquid dominated systems, binary cycle, advantages and disadvantages

Module 5

Bio Mass Energy- Biomass conversion technologies –Bio Gasification, Bio ethanol, Bio Diesel , Biogas production from waste biomass, factors affecting biogas generation Bio Gas -KVIC and Janata model ,Hydrogen Energy – various routes for production of Hydrogen energy,

Economic Analysis – Initial and annual cost, basic definitions, present worth calculations, repayment of loan in equal annual installments, annual savings, cumulative saving and life cycle cost, economic analysis of add on solar system, payback period(derivation)

Text Books:

1. S P Sukhatme , J K Nayak, Solar Energy: Principles of Thermal Collection and Storage, Mc Graw Hill ,2015
2. Tiwari G N, Ghosal M K ,Fundamentals of renewable energy sources, Alpha Science International Ltd.,2007
3. Jefferson W Tester et.a., Sustainable Energy Choosing among options,PHI,2006

Reference Books:

1. D.P. Kothari Renewable energy resources and emerging technologies, Prentice Hall of India Pvt. Ltd,2011
2. Mehmet KanoğluYunus A. Çengel John M. Cimbala , Fundamentals and Applications of Renewable Energy, Mc Graw Hill ,2019
3. Roland Wengenmayr, Thomas Buhrke, 'Renewable Energy: Sustainable energy concepts for the future, Wiley – VCH, 2012

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Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	**The Energy Scenario**	**(5)**
1.1	Commercial energy sources -World's production and reserves India' Production and reserves	**1**
1.2	,Energy Alternatives- Need for alternatives –solar options	**1**
	Principles of solar radiation	
1.3	Solar radiation outside the earth's atmosphere and at the earth's surface , Solar Constant,	**1**
1.4	Basic Sun-Earth Angles, Instruments for measuring solar radiation and sunshine , Solar radiation data	**2**
2	**Solar Energy**	**(11)**
2.3	Solar thermal collectors -Flat plate collectors	**2**
2.4	Solar concentrators (parabolic trough, parabolic dish, Central Tower Collector	**2**
2.5	Solar Air Heaters-types - Solar thermal electric power generation Thermal Energy storage, sensible heat storage, latent heat storage , Thermo chemical storage	**2**
2.7	Photovoltaic system for power generation	**2**
2.8	Solar Cells-Types of solar cells , principle of working and performance characteristics, Production process- Block diagram only	**2**
2.9	Applications- Solar space heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air-conditioning, heliostat, solar furnace	**1**
3	**Wind Energy**	**(6)**
3.1	Classification of wind turbines	**1**
3.2	power performance curve, Energy in wind, calculation of energy content,	**2**
3.3	Power coefficients, Betz limit theory, , tip speed ratio, solidity of turbine' power control strategies	**2**
3.4	Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of WECS	**1**
4	**Ocean Energy**	**(6)**
4.1	Devices for Wave Energy conversion Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system,	**1**

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4.2	Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC)	**2**
4.3	Geothermal energy: Introduction , hot dry rock resources, magma resources	**1**
4.4	vapor and liquid dominated systems, binary cycle, advantages and disadvantages	**2**
5	**Bio Mass Energy**	**(8)**
5.1	Biomass conversion technologies –Bio Gasification, Bio ethanol, Bio Diesel	**1**
5.2	Biogas production from waste biomass, factors affecting biogas generation Bio Gas -KVIC and Janata model.	**2**
5.3	Hydrogen Energy – various routes for production of Hydrogen energy	**1**
5.3	**Economic Analysis – I**nitial and annual cost, basic definitions,	**1**
5.4	present worth calculations, repayment of loan in equal annual installments, annual savings, cumulative saving and life cycle cost	**2**
5.5	economic analysis of add on solar system, payback period(derivation)	**1**

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CEQ413	SEMINAR	CATEGORY	L	T	P	CREDIT
		PWS	0	0	3	2

Preamble: The course 'Seminar' is intended to enable a B.Tech graduate to read, understand, present and prepare report about an academic document. The learner shall search in the literature including peer reviewed journals, conference, books, project reports etc., and identify an appropriate paper/thesis/report in her/his area of interest, in consultation with her/his seminar guide. This course can help the learner to experience how a presentation can be made about a selected academic document and also empower her/him to prepare a technical report.

Course Objectives:

- To do literature survey in a selected area ofstudy.
- To understand an academic document from the literate and to give a presentation about it.
- To prepare a technical report.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1	Identify academic documents from the literature which are related to her/his areas of interest (Cognitive knowledge level: **Apply**).
CO2	Read and apprehend an academic document from the literature which is related to her/ his areas of interest (Cognitive knowledge level: **Analyze**).
CO3	Prepare a presentation about an academic document (Cognitive knowledge level: **Create**).
CO4	Give a presentation about an academic document (Cognitive knowledge level: **Apply**).
CO5	Prepare a technical report (Cognitive knowledge level: **Create**).

Mapping of course outcomes with program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	1		2	1					3
CO2	3	3	2	3		2	1					3
CO3	3	2			3			1		2		3
CO4	3				2			1		3		3
CO5	3	3	3	3	2	2		2		3		3

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Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

General Guidelines

- The Department shall form an Internal Evaluation Committee (IEC) for the seminar with academic coordinator for that program as the Chairperson/Chairman and seminar coordinator & seminar guide as members. During the seminar presentation of a student, all members of IEC shall be present.
- Formation of IEC and guide allotment shall be completed within a week after the University examination (or last working day) of the previous semester.
- Guide shall provide required input to their students regarding the selection of topic/ paper.
- Choosing a seminar topic: The topic for a UG seminar should be current and broad based rather than a very specific research work. It's advisable to choose a topic for the Seminar to be closely linked to the final year project area. Every member of the project team could choose or be assigned Seminar topics that covers various aspects linked to the Project area.
- A topic/paper relevant to the discipline shall be selected by the student during the semester break.
- Topic/Paper shall be finalized in the first week of the semester and shall be submitted to the IEC.
- The IEC shall approve the selected topic/paper by the second week of the semester.
- Accurate references from genuine peer reviewed published material to be given in the report and to be verified.

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Evaluation pattern

Total marks: 100, only CIE, minimum required to pass 50

Seminar Guide: 20 marks (Background Knowledge – 10 (The guide shall give deserving marks for a candidate based on the candidate's background knowledge about the topic selected), Relevance of the paper/topic selected – 10).

Seminar Coordinator: 20 marks (Seminar Diary – 10 (Each student shall maintain a seminar diary and the guide shall monitor the progress of the seminar work on a weekly basis and shall approve the entries in the seminar diary during the weekly meeting with the student), Attendance – 10).

Presentation: 40 marks to be awarded by the IEC (Clarity of presentation – 10, Interactions – 10 (to be based on the candidate's ability to answer questions during the interactive session of her/his presentation), Overall participation – 10 (to be given based on her/his involvement during interactive sessions of presentations by other students), Quality of the slides – 10).

Report: 20 marks to be awarded by the IEC (check for technical content, overall quality, templates followed, adequacy of references etc.).

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CED415	PROJECT PHASE I	CATEGORY	L	T	P	CREDIT
		PWS	0	0	6	2

Preamble: The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems.

Course Outcomes [COs] : After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: **Apply**).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: **Apply**).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: **Apply**).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: **Apply**).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: **Analyze**).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: **Apply**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2	2	1	1	1	1	2
CO2	2	2	2		1	3	3	1	1		1	1
CO3									3	2	2	1
CO4					2			3	2	2	3	2
CO5	2	3	3	1	2							1
CO6					2			2	2	3	1	1

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Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

PROJECT PHASE I

Phase 1 Target

- Literature study/survey of published literature on the assigned topic
- Formulation of objectives
- Formulation of hypothesis/ design/ methodology
- Formulation of work plan and task allocation.
- Block level design documentation
- Seeking project funds from various agencies
- Preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility study
- Preparation of Phase 1 report

Evaluation Guidelines & Rubrics

Total: 100 marks (Minimum required to pass: 50 marks).

- Project progress evaluation by guide: 30 Marks.
- Interim evaluation by the Evaluation Committee: 20 Marks.
- Final Evaluation by the Evaluation Committee: 30 Marks.
- Project Phase - I Report (By Evaluation Committee): 20 Marks.

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor).

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CIVIL ENGINEERING

Evaluation by the Guide

The guide/supervisor shall monitor the progress being carried out by the project groups on a regular basis. In case it is found that progress is unsatisfactory it shall be reported to the Department Evaluation Committee for necessary action. The presence of each student in the group and their involvement in all stages of execution of the project shall be ensured by the guide. Project evaluation by the guide: 30 Marks. This mark shall be awarded to the students in his/her group by considering the following aspects:

Topic Selection: innovativeness, social relevance etc. (2)

Problem definition: Identification of the social, environmental and ethical issues of the project problem. (2)

Purpose and need of the project: Detailed and extensive explanation of the purpose and need of the project. (3)

Project Objectives: All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified. (2)

Project Scheduling & Distribution of Work among Team members: Detailed and extensive Scheduling with timelines provided for each phase of project. Work breakdown structure well defined. (3)

Literature survey: Outstanding investigation in all aspects. (4)

Student's Diary/ Daily Log: The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily/weekly activity diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students. The daily/weekly activity diary shall be signed after every day/week by the guide. (7)

Individual Contribution: The contribution of each student at various stages. (7)

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EVALUATION RUBRICS for PROJECT Phase I: Interim Evaluation						
No.	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
1-a	Topic identification, selection, formulation of objectives and/or literature survey. (Group assessment) [CO1]	10	The team has failed to come with a relevant topic in time. Needed full assistance to find a topic from the guide. They do not respond to suggestions from the evaluation committee and/or the guide. No literature review was conducted. The team tried to gather easy information without verifying the authenticity. No objectives formed yet.	The team has identified a topic. The originally selected topic lacks substance and needs to be revised. There were suggestions given to improve the relevance and quality of the project topic. Only a few relevant references were consulted/ studied and there is no clear evidence to show the team's understanding on the same. Some objectives identified, but not clear enough.	Good evidence of the group thinking and brainstorming on what they are going to build. The results of the brainstorming are documented and the selection of topic is relevant. The review of related references was good, but there is scope of improvement. Objectives formed with good clarity, however some objectives are not realistic enough.	The group has brainstormed in an excellent manner on what they were going to build. The topic selected is highly relevant, real world problem and is potentially innovative. The group shows extreme interest in the topic and has conducted extensive literature survey in connection with the topic. The team has come up with clear objectives which are feasible.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-b	Project Planning, Scheduling and Resource/ Tasks Identification and allocation. (Group assessment) [CO4]	10	No evidence of planning or scheduling of the project. The students did not plan what they were going to build or plan on what materials / resources to use in the project. The students do not have any idea on the budget required. The team has not yet decided on who does what. No project journal kept.	Some evidence of a primary plan. There were some ideas on the materials /resources required, but not really thought out. The students have some idea on the finances required, but they have not formalized a budget plan. Schedules were not prepared. The project journal has no details. Some evidence on task allocation among the team members.	Good evidence of planning done. Materials were listed and thought out, but the plan wasn't quite complete. Schedules were prepared, but not detailed, and needs improvement. Project journal is presented but it is not complete in all respect / detailed. There is better task allocation and individual members understand about their tasks. There is room for improvement.	Excellent evidence of enterprising and extensive project planning. Gantt charts were used to depict detailed project scheduling. A project management/version control tool is used to track the project, which shows familiarity with modern tools. All materials / resources were identified and listed and anticipation of procuring time is done. Detailed budgeting is done. All tasks were identified and incorporated in the schedule. A well-kept project journal shows evidence for all the above, in addition to the interaction with the project guide. Each member knows well about their individual tasks.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
Phase 1 Interim Evaluation Total Marks: 20						

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EVALUATION RUBRICS for PROJECT Phase I: Final Evaluation						
Sl. No.	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
1-c	Formulation of Design and/or Methodology and Progress. (Group assessment) [CO1]	5	None of the team members show any evidence of knowledge about the design and the methodology adopted till now/ to be adopted in the later stages. The team has not progressed from the previous stage of evaluation.	The students have some knowledge on the design procedure to be adopted, and the methodologies. However, the team has not made much progress in the design, and yet to catch up with the project plan.	The students are comfortable with design methods adopted, and they have made some progress as per the plan. The methodologies are understood to a large extent.	Shows clear evidence of having a well- defined design methodology and adherence to it. Excellent knowledge in design procedure and its adaptation. Adherence to project plan is commendable.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
1-d	Individual and Teamwork Leadership (Individual assessment) [CO3]	10	The student does not show any interest in the project activities, and is a passive member.	The student show some interest and participates in some of the activities. However, the activities are mostly easy and superficial in nature.	The student shows very good interest in project, and takes up tasks and attempts to complete them. Shows excellent responsibility and team skills. Supports the other members well.	The student takes a leadership position and supports the other team members and leads the project. Shows clear evidence of leadership.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)
1-e	Preliminary Analysis/ Modeling / Simulation/ Experiment / Design/ Feasibility study [CO1]	10	The team has not done any preliminary work with respect to the analysis/modeling/ simulation/experiment/desig n/feasibility study/ algorithm development.	The team has started doing some preliminary work with respect to the project. The students however are not prepared enough for the work and they need to improve a lot.	There is some evidence to show that the team has done good amount of preliminary investigation and design/ analysis/ modeling etc. They can improve further.	Strong evidence for excellent progress in the project. The team has completed the required preliminary work already and are poised to finish the phase I in an excellent manner. They have shown results to prove their progress.
			(0 – 3 Marks)	(4 – 6 Marks)	(7 - 9 Marks)	(10 Marks)

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1-f	Documentation and presentation. (Individual & group assessment). [CO6]	5	The team did not document the work at all. The project journal/diary is not presented. The presentation was shallow in content and dull in appearance. The individual student has no idea on the presentation of his/her part.	Some documentation is done, but not extensive. Interaction with the guide is minimal. Presentation include some points of interest, but overall quality needs to be improved. Individual performance to be improved.	Most of the project details were documented well enough. There is scope for improvement. The presentation is satisfactory. Individual performance is good.	The project stages are extensively documented in the report. Professional documentation tools like LaTeX were used to document the progress of the project along with the project journal. The documentation structure is well-planned and can easily grow into the project report. The presentation is done professionally and with great clarity. The individual's performance is excellent.
			(0 – 1 Marks)	(2 – 3 Marks)	(4 Marks)	(5 Marks)
Total		**30**	**Phase - I Final Evaluation Marks: 30**			

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EVALUATION RUBRICS for PROJECT Phase I: Report Evaluation						
Sl. No.	**Parameters**	**Marks**	**Poor**	**Fair**	**Very Good**	**Outstanding**
1-g	Report [CO6]	20	The prepared report is shallow and not as per standard format. It does not follow proper organization. Contains mostly Unacknowledged content. Lack of effort in preparation is evident.	Project report follows the standard format to some extent. However, its organization is not very good. Language needs to be improved. All references are not cited properly in the report.	Project report shows evidence of systematic documentation. Report is following the standard format and there are only a few issues. Organization of the report is good. Most of references are cited properly.	The report is exceptionally good. Neatly organized. All references cited properly. Diagrams/Figures, Tables and equations are properly numbered, and listed and clearly shown. Language is excellent and follows standard styles.
			(0 - 7 Marks)	(8 - 12 Marks)	(13 - 19 Marks)	(20 Marks)
Phase - I Project Report Marks: 20						

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CEL411	ENVIRONMENTAL ENGG LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	2	2019

Preamble: This lab provides the knowledge on tests used to analyse the physio-chemical and bacteriological properties of water and explains the various method followed in the test along with its suitability as a drinking water.

Prerequisite: CET 304 Environmental Engineering

Course Outcomes: After the completion of the course, the student will be able to:

Course outcome	Description
CO1	Analyse various physico-chemical and biological parameters of water
CO2	Compare the quality of water with drinking water standards and recommend its suitability for drinking purposes

Mapping of course outcomes with program outcomes:

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO12
CO1	3	3	3	1	-	3	3	-	-	-	-	3
CO2	3	3	3	1	-	3	3	-	-	-	-	3

Assessment Pattern:

Mark distribution

Total marks	CIE	ESE	ESE Duration
150	75	75	3 Hrs

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Continuous Internal Evaluation (CIE) Pattern:

Attendance	:15 marks
Continuous Assessment	:30 marks
Internal Test	:30 marks

End Semester Examination (ESE) Pattern:

The following guidelines should be followed regarding award of mark

(a) Preliminary work	: 15 Marks
(b) Implementing the work/Conducting the experiment	: 10 Marks
(c) Performance, result and inference (usage of equipment and trouble shooting)	: 25 Marks
(d) Viva voce	: 20 Marks
(e) Record	: 5 Marks

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Instructions:

- Any 12 of the 18 experiments included in the list of experiments need to be performed mandatorily.
- Virtual Lab facility cannot be used to substitute the conduct of these mandatory experiments.
- Periodic maintenance and calibration of various testing instruments needs to be made.
- Practical examination to be conducted covering entire syllabus given below. Evaluation is to be conducted under the equal responsibility of both the internal and external examiners. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Syllabus

1. Determination of pH, Electrical Conductivity and Turbidity*
2. Determination of TS, TDS and TSS, TVS *
3. Determination of Alkalinity and Acidity *
4. Determination of Hardness *
5. Determination of Chlorides
6. Determination of Total Iron
7. Determination of Biochemical Oxygen Demand*
8. Determination of Chemical Oxygen Demand*
9. Optimum Coagulant dosage*
10. Break point Chlorination *
11. Determination of Available Chlorine in a sample of bleaching powder
12. Determination of Sulphates
13. Determination of Fluoride
14. Determination of Dissolved Oxygen*
15. Determination of nitrates
16. Determination of phosphates
17. Determination of any two Heavy Metal concentration

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18. Total coliforms *

Note: * mandatory

References

1. Standard Methods for the Examination of Water and Wastewater, 23rd edition, American Public Health Association, American Water Works Association, Water Environment Federation, 2017.
2. Water Supply Engineering, 33rd edition, Santhosh Kumar Garg, Khanna publishers.
3. Sewage Disposal and Air Pollution Engineering, 39th edition, Santhosh Kumar Garg, Khanna publishers.
4. IS: 10500:2012 Drinking Water - Specification, Second revision, Bureau of Indian Standards, 2012.

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