Solid Mechanics – I

II B. Tech - I Semester

(AY 2021-22)

Mrs K. Hemalatha

Assistant Professor

Department of Civil Engineering

Gokaraju Rangaraju Institute of Engineering and Technology

Bachupally, Kukatpally, Hyderabad – 500 090.

Gokaraju Rangaraju Institute of Engineering and Technology Department of Civil Engineering Solid Mechanics-I Course File Check List		
S.No.	**Name of Format**	**Page No.**
1	Syllabus	
2	Time Table	
3	Program Educational Objectives	
4	Program Objectives	
5	Course Objectives	
6	Course Outcomes	
7	Students Roll List	
8	Guide lines to study the course	
9	Course Schedule	
10	Course Plan	
11	Unit Plan	
12	Lesson Plan	
13	Tutorial Sheets	
14	Assignment Sheets	
15	Evaluation Strategy	
16	Assessment in relation to COb's and CO's	
17	Rubric for course	
18	Mappings of CO's and PO's	
19	Model question papers	
20	Mid-I and Mid-II question papers	
21	Mid-I marks	
22	Mid-II marks	
23	Sample answer scripts and Assignments	
24	Course materials like Notes, PPT's, Videos, etc,.	

Syllabus

Solid Mechanics-I

Course Code: GR20A2011 L:3 T:1 P:0 C:4

II Year I Semester

Prerequisites

- Fundamentals of Engineering Mathematics
- Knowledge of Engineering Mechanics

Course objectives:

1. Knowledge of engineering materials based on first energy principles, deformation and strain, concept of strain energy, momentum balance, stress and stress states, elasticity and elasticity bounds, plasticity and yield design.
2. Skill to determine the Principal stresses and strains under different loading using analytical and Mohr's Circle method.
3. Understanding the shear force and bending moment for different types of beams which allows them to understand, modeling and design of a large range of engineering materials
4. Utility to evaluate the flexural and shear stress concepts for the different materials and shapes of the structure.
5. Knowledge on deflection of beam for different materials under various loading conditions using moment area, double integration & Macaulay's method.

Course outcomes: At the end of course, the student will be able to

1. Determine the stresses, strains, elastic constants such as modulus of elasticity, modulus of rigidity, Poisson's ratio and bulk density. And also to determine the strain energy for various types of loading.
2. Analyze the principal stresses and strains in different planes by using analytical and graphical methods
3. Determine the shear force, bending moment diagrams and identify the point of contra flexure for different types of beams such as cantilever, simple supports and fixed beams with different loading.
4. Formulate the bending equation and shear equation to calculate the bending stresses and shear stresses for the different sections of the structural members
5. Evaluate the slope and deflection of different beams for different end conditions and loads by using double integration, Macaulay's and Moment area methods.

Unit-I

Simple Stresses and Strains: Elasticity and plasticity-Types of stresses and strains-Hooke's law-Elastic constant and the relationship between them. Stress-strain diagram for mild steel-Lateral strain, poisson's ratio and volumetric strain-Bars of varying section-composite bars-Temperature stresses**,** Working stress, factor of safety.

Strain Energy: Resilience-Gradual, sudden, impact and shock loadings-simple applications.

Unit-II

Shear Force and Bending Moment: Definition of beam-Types of beams, loading and support conditions-concept of shear force and bending moment-S.F and B.M diagrams for various types of statically determinate beams like cantilever, simply supported and overhanging beams subjected to point loads, uniformly

distributed load, uniformly varying loads and applied moments and combination of these loads-point of contra flexure-Relation between S.F, B.M and rate of loading at a section of a beam

Unit-III

Stresses in Beams Flexural Stresses: Theory of simple bending-Assumptions-Derivation of pure bending equation: M/I=f/y=E/R-Neutral axis-Determination of bending stresses-section modulus of rectangular and circular sections (solid and hollow), I-Section, T-Section, Angle and Channel sections-Design of simple beam sections & flitched beams.

Shear Stresses: Derivation of formula-Shear stress distribution across various beam sections like rectangular, circular, triangular, I-Section, T-Section and angle sections.

Unit-IV

Deflection of Beams: Bending into a circular arc-slope, deflection and radius of curvature-Differential equation for the elastic line of a beam-Double integration and Macaulay's methods-Determination of slope and deflection for cantilever and simply supported beams, subjected to point loads, U.D.L, Uniformly varying loads-Mohr's theorems-moment area method-application to simple cases including overhanging beams.

Unit-V

Principal Stresses and Strains: Introduction-stresses on an inclined section of a bar under axial loading-compound stresses-Normal and Tangential stresses on an inclined plane for biaxial stresses-two perpendicular normal stresses accompanied by a state of simple shear- Mohr's circle of stresses-principal stresses and strains-Analytical and graphical solutions-Various theories of failures like Maximum Principal stress theory-Maximum shear stress theory-Maximum strain energy theory-Maximum shear strain energy theory.

Teaching Methodologies

1. White board and marker

Text Books

1. Dr. B. C. Punmia, Mechanics of Materials, Laxmi publications, 10th Edition, 2013.
2. B. S. Basavarajaiah, Strength of Materials, University Press, Hyderabad, 3rd Edition, 2010.
3. Dr. R. K. Bansal, Strength of material, Laxmi Pulications, New Delhi, 5th Edition, 2012.

Reference Books

1. Ferdinand Beer and others, Mechanics of Solid, Tata Mc. Graw Hill publications, 6th Edition, 2000.
2. Schaum's out line series, Strength of materials, Mc. Graw Hill International Editions, 6th Edition, 2011.
3. R. K. Rajput, Strength of materials, S. Chand & Co, New Delhi, 5th Edition, 2010.

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

TIME TABLE

COURSE: Solid Mechanics I

II YEAR I SEM

II B.TECH(GR20) – I SEMESTER **AY: 2021-22.** **SEC : A**

Day/Hour	9:00 - 9:55	9:55 - 10:50	10:50 - 11:45	11:45-12:25	12:45 - 1:15	1:15 - 2:05	2:05-2:55
MON				LUNCH BREAK			SM I
TUE							
WED							
THU		SM I					
FRI							
SAT	SM I						

Name of the Subject	Name of the Faculty
Solid Mechanics I	Mrs K Hemalatha(1177)

Signature of HOD

Date:

Signature of faculty

Date:

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Programme Educational Objectives (PEO's)

1. Graduates of the program will be successful in technical and professional career of varied sectors of Civil Engineering.

2. Graduates of the program will have proficiency to analyse and design real time Civil Engineering projects.

3. Graduates of the program will exhibit management and leadership qualities with good communication skills facilitating to work in a multidisciplinary team.

4. Graduates of the program will continue to engage in life-long learning with ethical and social responsibility.

Program Outcomes (PO's)

1. Apply knowledge of mathematics, science and fundamentals of Civil Engineering.

2. Analyse problem and interpret the data.

3. Design a system component, or process to meet desired needs in Civil Engineering within realistic constraints.

4. Identify, formulate, analyse and interpret data to solve Civil Engineering problems.

5. Use modern engineering tools such as CAD and GIS for the Civil Engineering practice.

6. Understand the impact of engineering solutions in a global, economic and societal context.

7. Understand the effect of Civil Engineering solutions on environment and to demonstrate the need for sustainable development.

8. Understanding of professional and ethical responsibility.

9. Work effectively as an individual or in a team and to function on multi-disciplinary context.

10. Communicate effectively with engineering community and society.

11. Demonstrate the management principles in Civil Engineering projects.

12. Recognize the need for and an ability to engage in life-long learning.

PSOs

1. Recognize the need for a sustainable environment and design smart infrastructure considering the global challenges.

2. Create and develop innovative designs with new era materials through research and development.

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

COURSE OBJECTIVES

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

The expected Objectives of this Course are

S.No.	Objectives
1	Knowledge of stresses, strains and elastic constants of different material and the concept of strain energy.
2	Skill to determine the Principal stresses and strains under different loading using Mohr's Circle method
3	Understanding of the shear e supports and fixed beams etc.
4	Ability to evaluate the flexural and shear stress concepts for the different materials and shapes of the structure.
5	Knowledge on deflection of beam for different materials under various loading conditions by moment area, double integration & Macaulay's method.

Signature of HOD

Date:

Signature of Faculty

Date:

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

COURSE OUTCOMES

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

The expected Outcomes of this Course are

S.No.	Outcomes
1	Determine the stresses, strains, elastic constants such as modulus of elasticity, modulus of rigidity, Poisson's ratio and bulk density. And also to determine the strain energy for various types of loading.
2	Analyze the principal stresses and strains in different planes by using analytical and graphical methods
3	Determine the shear force, bending moment diagrams and identify the point of contra flexure for different types of beams such as cantilever, simple supports and fixed beams with different loading.
4	Formulate the bending equation and shear equation to calculate the bending stresses and shear stresses for the different sections of the structural members.
5	Evaluate the slope and deflection of different beams for different end conditions and loads by using double integration, Macaulay's and Moment area methods.

Signature of HOD

Date:

Signature of Faculty

Date:

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

STUDENTS ROLL LIST
B.Tech Civil Engineering II Year I Semester A section(GR20) AY 2021-22

S.No	Reg No	Student Name
1	20241A0101	AADHI SRIKAR RAO
2	20241A0102	ABHIRAM SAI YADAV JANGITI
3	20241A0103	BACCHUGUDAM RITHVIK REDDY
4	20241A0104	BANDLA NAVEEN
5	20241A0105	B.PRANAV SAI
6	20241A0106	BHATTU SUPREETH CHAKRAVARTHY
7	20241A0107	BHUPATHIRAJU HIMANTHAVARMA
8	20241A0108	BOINI HEMANTH
9	20241A0109	CHALLA AJAY KUMAR
10	20241A0110	DONABOINA SRI HARI
11	20241A0111	EPPA ARNAV
12	20241A0112	G L N RAGHURAMAN
13	20241A0113	GANDLA HARSHITH KUMAR
14	20241A0114	GUGGILLA SHASHANK
15	20241A0115	GUNDA SRIKANTH
16	20241A0116	JANGILI SRAVAN KUMAR
17	20241A0117	JANJIRALA SRUTHI
18	20241A0118	JARAPULA JAYANTH
19	20241A0119	K NIKHITHA
20	20241A0120	K SANJEEV KUMAR
21	20241A0121	K.KONDAL
22	20241A0122	KAMMAMPATI UDAYKIRAN
23	20241A0123	KARNE SRITHAN
24	20241A0124	KUNCHALA VARUN KUMAR
25	20241A0125	KUNTA NITHIN REDDY
26	20241A0126	M PAVAN KALYAN
27	20241A0127	MERE MAHESH
28	20241A0128	MOHAMMED AHMED
29	20241A0129	MOTHUKURI LAXMAN
30	20241A0130	MOTTADI ADITYA TEJA
31	20241A0131	MULA SUSHMA SRI
32	20241A0132	NAYINI SWETHA
33	20241A0133	PAIDIPALLY BHARATH
34	20241A0134	P.SAI KIRAN REDDY
35	20241A0135	PASNOOR PAVAN PRATHAP REDDY

36	20241A0136	PATHLAVATH SHIVA NAYAK
37	20241A0137	PEDDIBOINA ANUSHA
38	20241A0138	POREDDY ABHINAV REDDY
39	20241A0139	PULLAGURA SANTHOSH
40	20241A0140	RACHALA BHARATH
41	20241A0141	RADHARAPU SHAJI KUMAR
42	20241A0142	RAMAVATH ROJA
43	20241A0143	RATHLAVATH SAIRAM NAYAK
44	20241A0144	RAVI TEJA PASUNUTHI
45	20241A0146	SADDI SHRIANK REDDY
46	20241A0147	SATHVIKA NARLA
47	20241A0148	SOKKULA KOUSHIKREDDY
48	20241A0149	SRIRAM PANDAVULA
49	20241A0150	T.BHARGAVI
50	20241A0151	T.BHUVANESHWARI
51	20241A0152	S.TEJA RETIESH REDDY
52	20241A0153	TEJAVATH KALYANI
53	20241A0154	TELLAPURAM PRUDHVI RAJ
54	20241A0155	THADEM ROHITH
55	20241A0156	THUMMALA RAJASHEKAR
56	20241A0157	UVSGR KAMESWARA SAI KARTHIK
57	20241A0158	SREERAM VATTEM
58	20241A0159	V VIKESH
59	20241A0160	VENNAM SRIKAR
60	21245A0101	GUMADAVELLI ARUN KUMAR
61	21245A0102	KADIRABAD SRIRAM
62	21245A0103	MANIKONDA NIKITHA
63	21245A0104	PARIDULA PRATHYUSHA
64	21245A0105	PATERU MOUNA

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

Guidelines To Study The Course/Subject

Academic Year	: 2021-22			
Semester	: I			
Name of the Program	: B.Tech	Year	: II YEAR	Section: A
Course	: Solid Mechanics-I	Course Code	: GR20A2011	
Name of the faculty	: K Hemalatha	Dept	:Civil Engineering	
Designation	: Assistant Professor			

Guidelines to study the course Solid Mechanics I

The course helps the students to study various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed to predict the response of a structure under loading and its susceptibility to various failure modes. They also find out the material properties important to construction and consider the advantages and disadvantages of steel and concrete as common building materials to handle compressive and tensile forces. The course helps the students to understand Shear force and bending moments of different beams under different types of loading.

Students should have the following prerequisites

1. Fundamentals of Engineering mathematics
2. Knowledge of Engineering Mechanics
3. Knowledge on different materials and its properties
4. Idea on different types of loads

To become expertise in this subject, students need to be perfect with the concepts of stress, strain, shear force and bending moments and also students need to apply theoretical concepts while solving problems.

Where will this subject help?

1. Solid Mechanics Is used in engineering to size your parts according to the loads that it will experience. Essentially we account for the materials strength properties and the forces acting on it to determine the geometry of the materials to meet the design requirements.
2. Basically we cannot perform any function as an engineer without fully understanding the basics of materials science. So it is fundamental to successful design, manufacture, construction and maintenance
3. Strength of material is used in design calculation to see whether part will withstand the load that it could see.

4. Students learn about the variety of materials used by engineers in the design and construction of modern bridges. They also find out about the material properties important to bridge construction and consider the advantages and disadvantages of steel and concrete as common bridge-building materials to handle compressive and tensile forces.

Books/Material

S.No.	Text Books
1	Dr B C Punmia,Mechanics of Materials, Laxmi publications,10th Edition,2013
2	B S Basavarajaiah,Strength of materials,University Press,Hyderabad,3rd Edition,2012
3	Dr R K Bansal, Strength of Materials, Laxmi publications, NewDelhi,5th Edition,2012

S.No.	Suggested / Reference Books
1	R K Rajput, Strength of Materials, S Chand & co, New Delhi,5th Edition,2010
2	Bhavikatti, strength of Materials, New age Publications, 3rd Edition,2008, Re Print 2009
3	Strength of Materials- S ramamrutham, Dhanpat raj Publishing Company,New Delhi,15th edition

S.No.	Websites
1	https://www.google.co.in/?gfe_rd=cr&ei=V7TFVaW2JenI8AfEqabADA&gws_rd=ssl#q=related:www.youtube.com/watch%3Fv%3DGkFgysZC4Vc+where+strength+of+materials+subject+help+students
2	http://freevideolectures.com/Course/2361/Strength-of-Materials
3	http://nptel.iitm.ac.in/video.php?subjectId=105105108

Course Design and Delivery System

1. The course syllabus is written into number of learning objectives and learning outcomes.
2. These learning objectives and outcomes will be achieved through lectures, assessments, assignments, experiments in the laboratory, projects, seminars and presentations, etc.,
3. Every student will be given an assessment plan, criteria for assessment, scheme of evaluation and grading method.
4. The learning process will be carried out through assessment of knowledge, skills and attitude by various methods and the student will be given guidance to refer to the textbooks, reference books, journals etc.,

The faculty be able to -

- Understand the principles of learning
- Understand the psychology of students
- Develop instructional objectives for a given topic
- Prepare course, lesson and unit plan
- Understand different methods of teaching and learning
- Use appropriate teaching and learning aids
- Plan and deliver lectures effectively
- Provide feedback system to students using various methods of assessments and tools of Evaluation
    - Act as a guide, advisor, counselor, facilitator, motivator and not just as a teacher alone.

Signature of HOD

Date:

Signature of Faculty

Date:

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering
COURSE SCHEDULE

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

Schedule for the whole course is:

S.No.	Description	Duration (Date)		Total No. of Periods
		From	To	
1	UNIT 1- Simple Stresses and Strains, Strain Energy	07/10/2021	22/10/2021	12
2	UNIT II- Compund Stresses and Strains	23/10/2021	30/10/2021	12
3	UNIT III- Bending Moment and Shear Force Diagrams	31/10/2021	08/01/2022	12
4	UNIT IV-Bending Stresses and Shear Stresses	09/01/2022	17/01/2022	12
5	UNIT V- Deflection of beams	18/01/2022	07/02/2022	12

Total No. of Instructional periods available for the course: 60 Hours / Periods

Signature of HoD

Date :

Signature of faculty

Date:

:

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

SCHEDULE OF INSTRUCTIONS
COURSE PLAN

Academic **Y**ear : 2021-22
Semester : I
Name of the Program: B.Tech Civil Engineering Year: II Section: A
Course/Subject : Solid Mechanics-I Course Code: GR20A2011
Name of the Faculty : Mrs K Hemalatha Dept.: Civil Engineering

S.No.	Date	Unit No.	Session Duration	Topics
1	07/10/2021	1	1	Introduction to stresses and strains,
2	07/10/2021	1	1	Types of stress, Stress Strain diagram
3	09/10/2021	1	1	Elastic Moduli and different types
4	09/10/2021	1	1	Elastic Moduli and different types
5	11/10/2021	1	1	Composite bars of varying sections
6	18/10/2021	1	1	Composite bars of varying sections
7	18/10/2021	1	1	Thermal stresses of composite section
8	20/10/2021	1	1	Thermal stresses of composite section
9	23/10/2021	2	1	Strain energy under gradual loadings
10	23/10/2021	2	1	Strain energy under sudden loadings
11	24/10/2021	2	1	Strain energy under Impact loadings
12	27/10/2021	2	1	Simple applications
13	27/10/2021	2	1	Introduction to SF & BM, Definition of beams and its types
14	27/10/2021	2	1	Concept of shear force and bending moment
15	27/10/2021	2	1	Problems on SFD and BMD for cantilever beam subjected to point loads, UDL
16	27/10/2021	2	1	Problems on SFD and BMD for cantilever beam subjected to UDL, UVL.
17	27/10/2021	2	1	Problems on SFD and BMD for cantilever beam subjected to UVL

18	30/10/2021	2	1	Problems on SFD and BMD for simply supported beam subjected to point load, UDL
19	30/10/2021	2	1	Problems on SFD and BMD for simply supported beam subjected to UDL , UVL
20	30/10/2021	2	1	Problems on SFD and BMD for simply supported beam subjected to UDL and UVL
21	30/10/2021	2	1	Problems on SFD and BMD for overhanging beams subjected to point load, UDL
22	23/10/2021	2	1	Problems on SFD and BMD for overhanging beams subjected to UDL, UVL
23	23/10/2021	2	1	Problems on SFD and BMD for overhanging beams subjected to UDL, UVL
24	24/10/2021	2	1	Problems on Point of contraflexure
25	31/10/2021	3	1	Introduction to flexural stresses theory of simple bending
26	03/01/2022	3	1	Assumption and derivation of simple bending
27	03/01/2022	3	1	Concept of neutral axis, section modulus and problems on different sections
28	06/01/2022	3	1	Determination of bending stresses
29	06/01/2022	3	1	Problems on determination of bending stresses
30	07/01/2022	3	1	Bending stress of unsymmetrical sections
31	07/01/2022	3	1	Problems on bending stress of unsymmetrical sections
32	08/01/2022	3	1	Design of simple beam sections.
33	08/01/2022	3	1	Shear stress distribution over rectangular, triangular sections
34	08/01/2022	3	1	Shear stress distribution over circular sections
35	08/01/2022	3	1	Shear stress distribution over I-sections
36	08/01/2022	3	1	Shear stress distribution over miscellaneous sections

37	09/01/2022	4	1	Introduction to deflection of beams and radius of curvature
38	10/01/2022	4	1	Problems on Double integration
39	10/01/2022	4	1	Problems on Macaulay's Methods
40	11/01/2022	4	1	Determination of slope and deflection for cantilever and simply supported under point load, UDL
41	11/01/2022	4	1	Determination of slope and deflection for cantilever and simply supported under UDL
42	12/01/2022	4	1	Determination of slope and deflection for cantilever and simply supported under UVL
43	15/01/2022	4	1	Mohrs theorem and problems
44	15/01/2022	4	1	Problems on Moment area method
45	15/01/2022	4	1	Problems on Moment area method
46	17/01/2022	4	1	Problems on Moment area method
47	17/01/2022	4	1	Application to simple cases including overhanging beams
48	17/01/2022	4	1	Application to simple cases including overhanging beams
49	18/01/2022	5	1	Introduction to principal stresses and strains
50	22/01/2022	5	1	Problems on stresses on inclined section of a bar under axial loading
51	24/01/2022	5	1	Problems on stresses on inclined section of a bar under axial loading
52	25/01/2022	5	1	Problems on Compound stresses
53	29/01/2022	5	1	normal and tangential stresses on an inclined section for biaxial stress
54	31/01/2022	5	1	normal and tangential stresses on an inclined section for biaxial stress
55	01/02/2022	5	1	Mohrs circle of stresses, Graphical method for principal stresses and Strains
56	05/02/2022	5	1	Mohrs circle of stresses, Graphical method for principal stresses and Strains

57	07/02/2022	5	1	Mohrs circle of stresses, Graphical method for principal stresses and Strains
58	07/02/2022	5	1	Theories of failures- maximum principal stress theory
59	07/02/2022	5	1	Theories of failures- maximum principal strain theory
60	07/02/2022	5	1	Maximum shear stress theory

Signature of H.O.D

Date :

Signature of faculty

Date:

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

Unit No.	Topics/Sub Topics	Date	No. of Periods	Blooms Taxonomy	Objectives & Outcomes No.	References (Text book, Journal…)
I	Introduction to stresses and strains,	07/10/2021	1	K1	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Types of stress, Stress Strain diagram	07/10/2021	1	K2	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Elastic Moduli and different types	09/10/2021	1	K2	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Elastic Moduli and different types	09/10/2021	1	K2	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Composite bars of varying sections	11/10/2021	1	K3	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Composite bars of varying sections	18/10/2021	1	K3	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Thermal stresses of composite section	18/10/2021	1	K3	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B

						C Punmia,Mechanics of Materials
	Thermal stresses of composite section	20/10/2021	1	K3	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Strain energy under gradual loadings	21/10/2021	1	K2	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Strain energy under sudden loadings	21/10/2021	1	K2	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Strain energy under Impact loadings	22/10/2021	1	K2	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Simple applications	22/10/2021	1	K3	1 & 1	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials

Signature of Faculty

Date:

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

Unit No.	Topics/Sub Topics	Date	No. of Periods	Blooms Taxonomy	Objectives & Outcomes No.	References (Text book, Journal…)
UNIT II	Introduction to SF & BM, Definition of beams and its types	23/10/2021	1	K1	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Concept of shear force and bending moment	23/10/2021	1	K2	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for cantilever beam subjected to point loads, UDL	24/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for cantilever beam subjected to UDL, UVL.	27/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for cantilever beam	27/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C

	subjected to UVL					Punmia,Mechanics of Materials
	Problems on SFD and BMD for simply supported beam subjected to point load, UDL	27/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for simply supported beam subjected to UDL , UVL	27/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for simply supported beam subjected to UDL and UVL	27/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for overhanging beams subjected to point load, UDL	27/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for overhanging beams subjected to UDL, UVL	30/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on SFD and BMD for overhanging beams subjected to UDL, UVL	30/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on Point of contraflexure	30/10/2021	1	K3	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C

						Punmia,Mechanics of Materials
	Relation between SF, BM and rate of loading	30/10/2021	1	K2	2&2	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

Unit No.	Topics/Sub Topics	Date	No. of Periods	Blooms Taxonomy	Objectives & Outcomes No.	References (Text book, Journal…)
Unit III	Introduction to flexural stresses theory of simple bending	31/10/2021	1	K1	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Assumption and derivation of simple bending	03/01/2022	1	K1	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Concept of neutral axis , section modulus and problems on different sections	03/01/2022	1	K2	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Determination of bending stresses	06/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on determination of bending stresses	06/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Bending stress of unsymmetrical sections	07/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on bending stress	07/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S

	of unsymmetrical sections					ramamrutham, Dr B C Punmia,Mechanics of Materials
	Design of simple beam sections.	08/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Shear stress distribution over rectangular, triangular sections	08/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal&S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Shear stress distribution over circular sections	08/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Shear stress distribution over I-sections	08/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Shear stress distribution over miscellaneous sections	08/01/2022	1	K3	3 & 3	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

Unit No.	Topics/Sub Topics	Date	No. of Periods	Blooms Taxonomy	Objectives & Outcomes No.	References (Text book, Journal…)
Unit IV	Introduction to deflection of beams and radius of curvature	09/01/2022	1	K1	4 & 4	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on Double integration	10/01/2022	1	K3	4 & 4	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on Macaulay's Methods	10/01/2022	1	K3	4 & 4	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Determination of slope and deflection for cantilever and simply supported under point load, UDL	11/01/2022	1	K3	4 & 4	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Determination of slope and deflection for cantilever and simply supported under UDL	11/01/2022	1	K3	4 & 4	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Determination of slope and	12/01/2022	1	K3	4 & 4	Strength of Materials- Dr R K Bansal& S

	deflection for cantilever and simply supported under UVL					ramamrutham, Dr B C Punmia,Mechanics of Materials
	Mohrs theorem and problems	15/01/2022	1	K3	4 & 4	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on Moment area method	15/01/2022	1	K3	4 & 4	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on Moment area method	15/01/2022	1	K3	4 & 4	Strength of Materials-Dr R K Bansal&S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on Moment area method	17/01/2022	1	K3	4 & 4	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Application to simple cases including overhanging beams	17/01/2022	1	K3	4 & 4	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Application to simple cases including overhanging beams	17/01/2022	1	K3	4 & 4	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic Year : 2021-22
Semester : I
Name of the Program : B.Tech Year : II YEAR Section: A
Course : Solid Mechanics-I Course Code : GR20A2011
Name of the faculty : K Hemalatha Dept :Civil Engineering

Designation : Assistant Professor

Unit No.	Topics/Sub Topics	Date	No. of Periods	Blooms Taxonomy	Objectives & Outcomes No.	References (Text book, Journal…)
Unit No 5	Introduction to principal stresses and strains	18/01/2022	1	K1	5 & 5	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on stresses on inclined section of a bar under axial loading	22/01/2022	1	K3	5 & 5	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on stresses on inclined section of a bar under axial loading	24/01/2022	1	K3	5 & 5	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Problems on Compound stresses	25/01/2022	1	K3	5 & 5	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	normal and tangential stresses on an inclined section for biaxial stress	29/01/2022	1	K3	5 & 5	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	normal and tangential stresses on an inclined	31/01/2022	1	K3	5 & 5	Strength of Materials- Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials

	section for biaxial stress					
	Mohrs circle of stresses, Graphical method for principal stresses and Strains	01/02/2022	1	K3	5 & 5	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Mohrs circle of stresses, Graphical method for principal stresses and Strains	05/02/2022	1	K3	5 & 5	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Mohrs circle of stresses, Graphical method for principal stresses and Strains	07/02/2022	1	K3	5 & 5	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Theories of failures-maximum principal stress theory	07/02/2022	1	K2	5 & 5	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Theories of failures-maximum principal strain theory	07/02/2022	1	K2	5 & 5	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials
	Maximum shear stress theory	07/02/2022	1	K2	5 & 5	Strength of Materials-Dr R K Bansal& S ramamrutham, Dr B C Punmia,Mechanics of Materials

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 1 Duration of Lesson: 1hr.

Lesson Title: Introduction about simple stresses and strains

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to learn:

1. Detailed concept on definitions of stress and strain.
2. Various types of stresses such as tensile and compressive stresses, positive and negative shear stresses, volumetric stress.
3. Various types of strains such as longitudinal strain, lateral strain, shear strain.
4. Strain energy absorbed by a body during deformation.

TEACHING AIDS :White board

TEACHING POINTS :

1. Students are introduced to the concepts of stress and strain with examples that illustrate the characteristics and importance of these forces in our everyday lives.
2. Explore the factors that affect stress, why engineers need to know about it, and the ways engineers describe the strength of materials.
3. understanding of forces, stress, strain and material properties to create safe designs for structures, equipment and products.

Assignment / Questions:

1. Define stress and strain.Explain clearly different types of strains?
   (Objective No: 1 & Outcome No:1)
2. Distinguish between a) stress and strain b) Force and stress c) Tensile and compressive stress
   (Objective No: 1 & Outcome No:1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 2 Duration of Lesson: 1hr.

Lesson Title: Types of stress, Stress Strain diagram

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to learn:

1. The stress strain curve and the behaviour of the material under testing.
2. Stress strain curves generated from tensile test helps students about the relationship between stress and strain for a particular material.
3. The typical regions that can be observed in a stress-strain curve like Elastic region, Yielding, Strain Hardening, Necking and Failure.

TEACHING AIDS :White board& testing in laboratory

1. Explaining the concept about stress strain behavior of different materials under testing.
2. Explaining different regions under testing from one point to other point ie., from elastic limit to failure limit.
3. Brief description on different stresses at each limit in graph by testing mild steel material in strength of materials laboratory.

TEACHING POINTS :

Assignment / Questions:

1. State Hooke's law?
(Objective No: 1 & Outcome No: 1)
2. Explain briefly about stress- strain diagram for tensile test on steel specimen?
(Objective No: 1 & Outcome No:1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 09/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 3 Duration of Lesson: 2 hrs.

Lesson Title: Elastic Modulii and different types

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. define modulus of elasticity
2. Explandifferent types of elastic Modulii and the relationship between them.

TEACHING AIDS :White board

TEACHING POINTS :

1. Explaining theoretical concepts on different types of elasticity
2. Deriving expressions between different types of modulus of elasticity
3. Applying analytically from theoretical concepts.

Assignment / Questions:

1. What are the different types of elastic modulus and explain?
(Objective No: 1 & Outcome No: 1)

2. Derive the expression between modulus of elasticity and modulus of rigidity?
(Objective No: 1 & Outcome No:1)

3. Derive the expression between modulus of elasticity and bulk modulus of elasticity?
(Objective No: 1 & Outcome No: 1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 09/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 5 Duration of Lesson: 2 hrs.

Lesson Title: Composite bars of varying sections

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to learn:

1. The definition of composite bar of different material and length.
2. How the load will be distributed to all the bars based on total load.
3. How the extension of bar will be calculated based on stress and young's modulus.
4. What is the affect of stress and strain on each bar

TEACHING AIDS : White board

TEACHING POINTS :

1. Explaining theoretical concepts on composite bars by showing neat figures.
2. By showing different examples exploring the students to know the variation of stress and strain in each bar.
3. Make the students to Solve different examples on calculation of loads and extension of bar.

Assignment / Questions:

1. Two vertical rods one of steel and other of copper are each rigidly fixed at the top and 500mm apart. Diameters and length of each rod are 20mm and 4m respectively. A cross bar fixed to the rods at the lower ends carries a load of 5 KN such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. (E of steel=$2x10^5$ N/mm^2, E of copper =$1x10^5$ N/mm^2)

(Objective No: 1 & Outcome No: 1)

2. A 20mm steel bolt passes centrally through a steel sleeves 50mm external diameter and 1.25m long. The tube is closed by rigid washers of negligible thickness. Find the stresses in each when the nuts are tightened until the sleeve is reduced in length by 0.125mm. (E of steel=$2x10^5$ N/mm^2)(Objective No: 1 & Outcome No: 1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 11/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 7 Duration of Lesson: 2 hr.

Lesson Title: Thermal stresses of composite section

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the effects of temperature changes on structures and materials
2. Define thermo elastic problems
3. Determine thermal stresses in beams and plates and thermal deformation.

TEACHING AIDS : White board, PPT

TEACHING POINTS :

Thermal stress is divided into four parts:
Part I develops the fundamentals of thermo elasticity, starting with a presentation of thermodynamic foundations of the subject and leading to various alternate formulations and methods of solutions of thermo elastic problems.
Part II discusses the physical basis of heat transfer theory and methods of solution of heat conduction boundary-value problems.
Part III covers more practical aspects of thermal stress analysis, mainly from the strength-of-materials viewpoint.
Finally, Part IV presents the manner in which temperature effects can be included in inelasticity theory.

Assignment / Questions:

1. A compound rod 1m long is made up of copper rod 400mm long and steel rod 600mm long connected end to end. The cross sectional area of copper rod is 1000mm2 and that of steel rod is 1500mm2. The compound rod is then held firmly between two rigid supports and heated through 100oc. Calculate the stresses developed in copper and steel rods.E of steel=$2x10^5$ N/mm^2, E of copper =$1x10^5$ N/mm^2 ^{alpha}of copper=$18X10^{-6}$ per ^{o}c, ^{alpha} of steel =$12X10^{-6}$ per ^{o}c (Objective No: 1 & Outcome No: 1)
2. A steel bar 400mm long, 50mm diameter is turned down to 40mm diameter for one third of its length. It is heated 40^{o}c above the room temperature clamped at both ends and then allowed cool to room temperature. If the distance between the clamps in unchanged, find the maximum stress in the bar. E of steel=$2x10^5$ N/mm^2, coefficient of expansion is $12.5X10^{-6}$ per ^{o}c(Objective No: 1 & Outcome No: 1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 11/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 9 Duration of Lesson: 1hr.

Lesson Title: Strain energy under gradual loadings

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the energy absorbed in any body under different types of loading
2. Learn different types of loadings
3. Learn how the strain energy will be absorbed by gradual loading
4. Derive the expression for strain energy stored in a body due to gradually applied load

TEACHING AIDS :White board

TEACHING POINTS :

1. Teaching must begin with clear definition of energy and how the body will be strained under different types of loading like gradual loading, sudden loading and impact loading.
2. Definition of the three types of loadings
3. This concept is explained briefly on strain energy absorbed due to gradual loading with neat figures with examples.

Assignment / Questions:

1. Derive the expression for strain energy stored in a body due to gradually applied load.
   (Objective No: 1, 6, 7 & Outcome No: 1, 6)
2. A tensile load of 60 KN is gradually applied to a circular bar of 4cm diameter and 5m long. Determine stretch, stress, strain energy stored by the rod.
   (Objective No: 1,6,7 & Outcome No:1, 6)
3. A tensile load of 50 KN is gradually applied to a circular bar of 7cm diameter and 10m long. Determine stretch, stress, strain energy stored by the rod.
   (Objective No: 1, 6, 7 & Outcome No: 1, 6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 18/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 10 Duration of Lesson: 1hr.

Lesson Title: Strain energy under sudden loading

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the energy absorbed in any body under different types of loading
2. Learn how the strain energy will be absorbed by sudden loading
3. Derive the expression for strain energy stored in a body due to suddenly applied load

TEACHING AIDS : White board

TEACHING POINTS :

1. Teaching must begin with clear definition of energy and how the body will be strained under different types of loading like gradual loading, sudden loading and impact loading .
2. Definition of the three types of loadings
3. This concept is explained briefly on strain energy absorbed due to sudden loading with neat figures with examples.

Assignment / Questions:

1. Derive the expression for strain energy stored in a body due to suddenly applied load.
   (Objective No: 1 & Outcome No: 1)

2. A tensile load of 60 KN is suddenly applied to a circular bar of 4cm diameter and 5m long. Determine
   1) Maximum instantaneous stress induced in rod
   2) Instantaneous elongation on the rod
   3) strain energy stored by the rod.

   (Objective No: 1 & Outcome No: 1)

3. Calculate instantaneous stress produced in a bar 10 cm2 in area and 3m long by the sudden application of a tensile load of unknown magnitude, if the extension of the bar due to suddenly applied load is 1.5mm. also determine the suddenly applied load.
   (Objective No: 1 & Outcome No: 1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 18/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 11 Duration of Lesson: 1hr.

Lesson Title: Strain energy under Impact loading

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the energy absorbed in any body under different types of loading
2. Learn different types of loadings
3. Learn how the strain energy will be absorbed by impact loading
4. Derive the expression for strain energy stored in a body due to impact loading.

TEACHING AIDS : White board

TEACHING POINTS :

1. Teaching must begin with clear definition of energy and how the body will be strained under different types of loading like gradual loading, sudden loading and impact loading.
2. Definition of the three types of loadings
3. This concept is explained briefly on strain energy absorbed due to impact loading with neat figures with examples.

Assignment / Questions:

1. Derive the expression for strain energy stored in a body due to impact loading. (Objective No: 1 & Outcome No: 1)

2. A load of 100 N falls through a height of 2cm on to a collar rigidly attached to the lower end of a vertical bar 1.5m long and 1.5cm2 cross-sectional area.The upper end of the vertical bar is fixed. Determine:
   1) Maximum instantaneous stress induced in the vertical bar
   2) Maximum instantaneous elongation
   3) Strain energy stored in the vertical rod. (Objective No: 1 & Outcome No: 1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 18/10/2021

Semester : I

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 12 Duration of Lesson: 1hr.

Lesson Title: Simple applications

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Applications of different types of loadings on structural members
2. Applications of different types of stresses& strain on structural members
3. Application of shear forces and bending moment on different types of beams

TEACHING AIDS :White board, PPT

TEACHING POINTS :

Teaching must begin with how the concepts will be applied in future engineering and where these concepts will be applied and hence the lectures given in the classes thus discussed about all the theories involved in simple stresses and strain simple applications and detailed explanations.

Assignment / Questions:

1. What are the applications of stress- strain diagram?
   (Objective No: 1 & Outcome No:1)

2. What are the applications of strain energy absorbed by different bodies?
   (Objective No: 1 & Outcome No: 1)

3. What are the applications of different types of stresses on structural members?.
   (Objective No: 1 & Outcome No: 1)

4. What are the simple applications of flexural and bending stresses?

   (Objective No: 1 & Outcome No: 1)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 20/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 13 Duration of Lesson: 1hr.

Lesson Title: Introduction about shear force, bending moment and beams

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to learn:

1. What is shear force and bending moment
2. What is a beam and different types of beams
3. Basic shear diagram and bending moment diagram.
4. Point loads, uniformly distributed loads, uniformly varying loads and how the moments will occur due to this loads.

TEACHING AIDS :White board, PPT,marker

TEACHING POINTS :

1. Showing power point presentations on various beams regarding shear force and bending moment.
2. Representing different types of beams and loadings using power point presentation to get a clear picture in their mind.
3. Detailed explanation on sign conventions of SF and BM according to the position of loading.
4. Giving rough idea on shear force diagram and bending moment diagram by giving small examples.

Assignment / Questions:

1. Define Beam. Explain briefly different types of beams with neat figures?
   (Objective No: 2 & Outcome No: 2)
2. What is the general procedure to draw shear force and bending moment diagram?
   (Objective No: 2 & Outcome No: 2)
3. Define
   a) Shear force b) Bending moment c) Shear force diagram
   b) Bending moment diagram
   (Objective No: 2 & Outcome No: 2)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 20/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 14 Duration of Lesson: 1hr.

Lesson Title: Concept of shear force and bending moment

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Divide the beam into two sections.
2. Give the sign convention for the forces based on the direction or position of loading.
3. Decide the sign convention for the clockwise and anti-clockwise moments based on the direction of loading.
4. Calculate shear force and moments for basic diagrams.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Detailed explanation on sign conventions of SF and BM according to the position of loading.
2. Giving rough idea on shear force diagram and bending moment diagram by giving small examples.
3. Solving number of examples to get a clear idea for calculating shear force and moments to the left and right side of the section.

Assignment / Questions:

1. Explain hogging and sagging moment?
   a. (Objective No: 2, 6, 7 & Outcome No: 2, 6, 7)
2. Calculate the shear force and bending moment for a simply supported beam of 5m span with 1 KN point load at the centre.
   a. (Objective No: 2, 6, 7 & Outcome No: 2, 6, 7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 23/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 15 Duration of Lesson: 1hr

Lesson Title: Problems on SFD and BMD for cantilever beam subjected to point loads, UDL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know definition of cantilever beam and how the forces and moment will act.
2. Calculate shear force & bending moment when point load or UDL acts on cantilever beam
3. Draw shear force and bending moment diagrams as per the sign conventions when point load and UDL occurs.

TEACHING AIDS : White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts on cantilever beam and key points for how the forces will act on fixed and free end.
2. Solving different examples to calculate shear force and bending moment subjected to point load and UDL
3. Solving different examples to draw shear force and bending moment diagrams subjected to point load and UDL based on their position

Assignment / Questions:

1. A cantilever beam of length 2m carries the point loads 300N at a distance of 0.5m, 500N at a distance of 1.2m and 800 N at a distance of 2m from the fixed end. Draw the shear force and bending moment diagrams for the cantilever beam.
(Objective No: 2 & Outcome No: 2)

2. A cantilever beam of length 2m carries the uniformly distributed load of 1KN/m run over a length of 1.5m from the free end. Draw the shear force and bending moment diagrams for the cantilever beam.
(Objective No: 2 & Outcome No: 2)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 23/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 16 Duration of Lesson: 1hr

Lesson Title: Problems on SFD and BMD for cantilever beam subjected to UDL, UVL.

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to learn:

1. Know definition of cantilever beam and how the forces and moment will act.
2. Calculate shear force when combination of point load and UDL or UVL acts on cantilever beam
3. Calculate bending moment when combination of point load and or UVL acts on cantilever beam
4. Draw shear force and bending moment diagrams as per the sign conventions when combination of point load and UDL or UVL acts on cantilever.

TEACHING AIDS : White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts on cantilever beam and key points for how the forces and moments will act on fixed and free end.
2. Solving different examples to calculate shear force and bending moment subjected to UDL and UVL on the beam.
3. Solving different examples to draw shear force and bending moment diagrams subjected to UDL and UVL on the beam based on their position.

Assignment / Questions:

1. A cantilever beam of length 4m carries a gradually varying load, zero at the free end to 2 KN/m at the fixed end. Draw the shear force and bending moment diagrams for the cantilever. (Objective No: 2 & Outcome No: 2)

2. A cantilever beam of length 6m carries a gradually varying load, zero at the free end to 3 KN/m at the fixed end. Draw the shear force and bending moment diagrams for the cantilever. (Objective No: 2 & Outcome No: 2)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 24/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 17 Duration of Lesson: 1hr.

Lesson Title: Problems on SFD and BMD for cantilever beam subjected to UVL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know definition of cantilever beam and how the forces and moment will act.
2. Calculate shear force& bending moment when UVL acts on cantilever beam
3. Draws shear force and bending moment diagrams as per the sign conventions when UVL acts.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts on cantilever beam and key points for how the forces and moments will act on fixed and free end.
2. Solving different examples to calculate shear force and bending moment subjected to UVL
3. Solving different examples to draw shear force and bending moment diagrams subjected to UVL based on their position at free and fixed end of the beam.

Assignment / Questions:

1. A cantilever beam of length 6m carries a gradually varying load, zero at the free end to 2 KN/m at the fixed end. Draw the shear force and bending moment diagrams for the cantilever.
(Objective No: 2, 6, 7 & Outcome No: 2, 6)
2. A cantilever beam of length 7m carries a gradually varying load, zero at the free end to 3 KN/m at the fixed end. Draw the shear force and bending moment diagrams for the cantilever.
(Objective No: 2, 6, 7 & Outcome No: 2, 6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 27/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 18 Duration of Lesson: 1hr.

Lesson Title: Problems on SFD and BMD for simply supported beam subjected to point load, UDL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the definition of simply supported beam and how the reactions will be calculated at the supports
2. Know the differences between cantilever and simply supported beam.
3. Calculate and draw shear force& bending moment when point load and UDL acts on simply supported beam

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts of simply supported beam and key points for how the forces and moments will act on both the ends.
2. Solving different examples to calculate reactions at supports, shear force and bending moment subjected to combination of point load andUDL, UVL .
3. Solving different examples to draw shear force and bending moment diagrams subjected to combination of point load andUDL, UVL .

Assignment / Questions:

1. A simply supported beam of length 6m, carries a point load of 3 KN and 6 KN at a distance of 2m and 4m from the left end. Draw the shear force and bending moment diagrams for the beam (Objective No: 2 & Outcome No: 2)
2. A simply supported beam carrying UDL of 2 KN/m over a length of 3m from the right end . The length of beam is 6m. Draw the shear force and bending moment diagrams for the beam (Objective No: 2 & Outcome No: 2)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 27/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 19 Duration of Lesson: 1hr.

Lesson Title: Problems on SFD and BMD for simply supported beam subjected to UDL , UVL

INSTRUCTIONAL/LESSON OBJECTIVES:

Oncompletion of this lesson the student shall be able to:

1. Know the definition of simply supported beam and how the reactions will be calculated at the supports
2. Calculate shear force & bending moment when UDL and UVL acts on simply supported beam
3. Draw shear force and bending moment diagrams as per the sign conventions when UDL and UVL acts on beam.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts of simply supported beam and key points for how the forces and moments will act on both the ends.
2. Solving different examples to calculate reactions at supports, shear force and bending moment subjected to combination of point load andUDL, UVL .
3. Solving different examples to draw shear force and bending moment diagrams subjected to combination of point load andUDL, UVL.

Assignment / Questions:

1. Draw the shear force and bending moment diagrams for a simply supported beam of length 8m and carrying a uniformly distributed load of 10 KN/m for a distance of 4m from the left end. (Objective No: 2, 6, 7 & Outcome No: 2, 6)
2. Draw the shear force and bending moment diagrams for a gradually varying load from zero at each end to w per metre length at the centre.

(Objective No: 2, 6, 7 & Outcome No: 2, 6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 30/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 20 Duration of Lesson: 1hr.

Lesson Title: Problems on SFD and BMD for simply supported beam subjected to UDL , UVL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the definition of simply supported beam and how the reactions will be calculated at the supports
2. Calculate shear force& bending moment when UVL acts on simply supported beam
3. Draw shear force and bending moment diagrams as per the sign conventions when UVL acts on beam.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts of simply supported beam and key points for how the forces and moments will act on both the ends.
2. Solving different examples to calculate reactions at supports, shear force and bending moment subjected to UVL .
3. Solving different examples to draw shear force and bending moment diagrams subjected to, UVL.

Assignment / Questions:

1. Draw the shear force and bending moment diagrams for a gradually varying load from zero at one end to w per metre length at the other end.

(Objective No: 2, 6, 7 & Outcome No: 2, 6)

2. A simply supported beam of length 5m carries a uniformly increasing load of 800 N/m run to 1600 N/m run at the other end. Draw the shear force and bending moment diagram for the beam. Also calculate the position and magnitude of maximum bending moment.

(Objective No: 2, 6, 7 & Outcome No: 2, 6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 30/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 21 Duration of Lesson: 1hr.

Lesson Title: Problems on SFD and BMD for overhanging beams subjected to point load, UDL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the definition of overhanging beam and how the reactions will be calculated at the supports
2. Know the differences between cantilever, simply supported beam and overhanging beam.
3. Calculate shear force & bending moment when point load or UDL acts on overhanging beam
4. Draw shear force and bending moment diagrams as per the sign conventions when point load or UDL acts on overhanging beam

TEACHING AIDS : White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts of overhanging beam and key points for how the forces and moments will act at the ends.
2. Solving different examples to calculate reactions at supports, shear force and bending moment subjected to point load or UDL
3. Solving different examples to draw shear force and bending moment diagrams subjected to, subjected to point load or UDL.

Assignment / Questions:

1. Draw the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 2KN/m over the entire length and a point load of 2KN as shown in figure.
(Objective No: 2, 6, 7 & Outcome No: 2, 6)

2. A beam of length 12m is simply supported at two supports which are 8m apart, with an overhang of 2m on each sideas shown in figure.The beam carries a concentrated load of 1 KN at each end.Draw the shear force and bending moment diagram for the beam.
(Objective No: 2, 6, 7 & Outcome No: 2, 6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 30/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 22 Duration of Lesson: 1hr.

Lesson Title: Problems on SFD and BMD for overhanging beams subjected to UDL, UVL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the definition of overhanging beam and how the reactions will be calculated at the supports
2. Know the differences between cantilever, simply supported beam and overhanging beam.
3. Calculate shear force & bending moment when UDL or UVL acts on overhanging beam
4. Draw shear force and bending moment diagrams as per the sign conventions when UDL or UVL acts

TEACHING AIDS : White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts of overhanging beam and key points for how the forces and moments will act at the ends.
2. Solving different examples to calculate reactions at supports, shear force and bending moment subjected to UDL or UVL
3. Solving different examples to draw shear force and bending moment diagrams subjected to, subjected to UDL or UVL.

Assignment / Questions:

1. Draw the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 3KN/m over the entire length and a point load of 3KN as shown in figure. (Objective No: 2 & Outcome No: 2)
2. A horizontal beam 10m long is carrying a uniformly distributed load of 1 KN/m. The beam is supported on two supports 6m apart. Find the position of the supports so that the beam is as small as possible. (Objective No: 2 & Outcome No: 2)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 30/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 23 Duration of Lesson: 1hr.

Lesson Title: Problems on SFD and BMD for overhanging beams subjected to UDL, UVL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the definition of overhanging beam and how the reactions will be calculated at the supports
2. Know the differences between point load, UDL and UVL.
3. Calculate shear force and bending moment when UVL acts on overhanging beam
4. Draw shear force and bending moment diagrams as per the sign conventions when UVL acts

TEACHING AIDS :White board

TEACHING POINTS :

1. Explaining theoretical concepts of overhanging beam and key points for how the forces and moments will act at the ends.
2. Solving different examples to calculate reactions at supports, shear force and bending moment subjected toUVL
3. Solving different examples to draw shear force and bending moment diagrams subjected to, subjected toUVL.

Assignment / Questions:

1. Draw the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 2.5KN/m over the entire length of 6m and a point load of 2.5 KN at a distance of 2m .

(Objective No: 2, 6, 7 & Outcome No: 2, 6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 31/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 24 Duration of Lesson: 1hr.

Lesson Title: Problems on Point of contra flexure

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Learn and apply the concept ofpoint of contra flexure
2. Apply the concept of point of contra flexure on simply supported, continuous beam and overhanging beam.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts of point of contra flexure on different types of beams.
2. Solving different examples to apply the concept on different beams.

Assignment / Questions:

1. Draw the shear force and bending moment diagrams for the overhanging beam carrying uniformly distributed load of 2KN/m over the entire length and a point load of 2KN as shown in figure. Locate the point of contra flexure

(Objective No: 2 & Outcome No: 2)

2. A simply supported beam of length 8m rests on supports 6m apart, the right hand end is overhang by 2m. The beam carries a uniformly distributed load of 1500 N/m run over the entire length. Draw the shear force and bending moment diagrams and locate the point of contra flexure

(Objective No: 2 & Outcome No: 2)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 31/10/2021

Semester : I UNIT No: 2

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 24 Duration of Lesson: 1hr.

Lesson Title: Relation between SF, BM and rate of loading

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Learn shear force, load and bending moment
2. Calculate shear force and bending moments of different beams under different loading conditions.
3. Draw the Shear force and bending moments of all the conditions
4. Give the relationship between load, shear force and bending moment.

TEACHING AIDS :White board,marker

TEACHING POINTS :

1. Explaining theoretical concepts of shear force, moments and different loads.
2. Deriving the expression for relationship between load, shear and bending moment.

Assignment / Questions:

1. A simply supported beam of length 8m rests on supports 6m apart, the right hand end is overhang by 2m. The beam carries a uniformly distributed load of 1500 N/m run over the entire length. Draw the shear force and bending moment diagrams and locate the point of contra flexure
(Objective No: 2 & Outcome No: 2)
2. Derive the expression for relationship between load, shear force and bending moment.
(Objective No: 2 & Outcome No: 2)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 31/10/2021

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 25 Duration of Lesson: 1hr.

Lesson Title: Introduction to flexural stresses and theory of simple bending

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Aim the nature of internal forces involved in bending.
2. Learn the relationship between beam geometry, bending moment and resulting bending stress
3. Determine suitable materials, cross sectional shape and orientation of beams with respect to the direction of forces for civil Engineering applications.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Investigating the significance of geometry particularly to develop a relationship between distance from neutral axis and strength
2. Representing different types of beams and loadings using power point presentation
3. Practical examples by showing icecream sticks in place of beam and applying load to show the bending.

Assignment / Questions:

1. What do you mean by direct stresses and bending stresses?
   (Objective No: 3, 6, 7 & Outcome No: 3, 6,7)
2. Define the terms: 1) Neutral axis 2) Section modulus 3) Pure bending
   (Objective No: 3, 6, 7 & Outcome No: 3, 6, 7)
3. Explain briefly about theory of simple bending?
   (Objective No: 3, 6, 7 & Outcome No: 3, 6, 7)
4. What are the assumptions made in theory of simple bending?
   (Objective No: 3, 6, 7 & Outcome No: 3, 6, 7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 03/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 26 Duration of Lesson: 1hr.

Lesson Title: Derivation of simple bending equation

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the theory of simple bending and their assumptions
2. Know the idea on neutral axis of different sections
3. Derive expression formoment of resistance
4. Derive the expression for bending stress equation

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining theoretical concepts on neutral axis and moment of resistance acting on beams
2. Deriving the algebraic expressions for bending stresses acting on beams
3. Giving idea on simple and pure bending of beams.

Assignment / Questions:

1. What do you understand by neutral axis and moment of resistance

(Objective No: 3 & Outcome No: 3)

2. Prove the relation M/I= F/Y =E/R.(Objective No: 3 & Outcome No: 3)
3. Derive an expression for bending stress at a layer in a beam.

(Objective No: 3 & Outcome No: 3)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 03/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 27 Duration of Lesson: 1hr

Lesson Title: Concept of neutral axis, section modulus and problems on different sections

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate the minimum stresses and maximum stresses in beam due to bending.
2. Derive the bending formulae for beams
3. Determine the position of centroid of different sections.
4. Calculate neutral axis and section modulus of square, rectangle and circular sections.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining the concept involved in centroid of different sections
2. Applying the position of centroid to calculate neutral axis, section modulus of different sections
3. Solving different examples on neutral axis and section modulus of square, rectangular and circular sections and stresses in beams due to bending.

Assignment / Questions:

1. Derive the section modulus for various shapes like square, rectangular, hollow rectangular, circular and hollow circular section
(Objectives No 3 & Outcomes No 3)

2. A steel plate of width 120mm and of thickness 20mm is bent into a circular arc of radius 10m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. ($E=2X10^5$ N/mm^2)
(Objectives No 3 & Outcomes No 3)

3. Calculate the minimum stress induced in a cast iron pipe of external diameter 30mm, internal diameter 10mm and of length 3m when the pipe is supported at its ends and carries a point load of 50N at its centre. (Objectives No 3 & Outcomes No 3)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 03/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 28 Duration of Lesson: 1hr

Lesson Title: Determination of bending stresses

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to learn:

1. Calculate different model problems on stresses in beams due to bending
2. Calculate neutral axis and moment resistance on beams
3. Calculate minimum stresses and maximum stresses in beam due to bending based on neutral axis and its position
4. Determine the position of neutral axis in different sections of beam

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining the concept about locating position of neutral axis and centroid.
2. Solving different examples on location of neutral axis of square, rectangular and circular sections
3. Solving different examples to determine minimum and maximum stresses in beams due to bending

Assignment / Questions:

1. A beam is simply supported and carries a UDL of 40 KN/m run over the whole span. The section of the beam is rectangular having depth as 500mm. If the maximum stress of the beam is 150 N/mm^2 and $I=7X10^8$ mm^4, find the span of the beam.
(Objective No: 3, 6, 7 & Outcome No: 3, 6, 7)

2. A timber beam of rectangular section is to support a load of 20 KN uniformly distributed over a span of 3.6m when beam is simply supported.If the depth of section is twice the width, and the stress in the timber is not to exceed 7 N/mm^2, find the dimensions of the cross section.
(Objective No: 3, 6, 7 & Outcome No: 3, 6, 7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 06/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 29 Duration of Lesson: 1hr.

Lesson Title: Problems on determination of bending stresses

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate different model problems on stresses in beams due to bending
2. Calculate neutral axis and moment resistance on beams
3. Calculate minimum stresses and maximum stresses in beam due to bending based on neutral axis and its position

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. Explaining the concept about locating position of neutral axis and centroid.
2. Solving different examples on location of neutral axis and section modulus of square, rectangular and circular sections
3. Solving different examples to determine minimum and maximum stresses in beams due to bending.

Assignment / Questions:

1. A timber beam of rectangular section of length 8m is simply supported. The beam carries a UDL of 12KN/m run over the entire length and a point load of 10Kn at 3m from the left support. If the depth is two times the width and the stress in the timber is not to exceed $8N/mm^2$. Find the suitable dimensions of the beam
   (Objective No: 3 & Outcome No: 3)
2. A rolled steel joist of I section has the dimensions of overall depth 400mm, width of top and bottom flanges are 200mm and thickness of web and flange are 20mm carries a UDL of 40 KN/m run on a span of 10m. Calculate the maximum stress due to bending.
   (Objective No: 3 & Outcome No: 3)
3. A water main of 500mm internal diameter and 20mm thick is running full. The water main is of cast iron and is supported at two points 10m apart. Find the maximum stress in the metal. The cast iron and water weigh $72000N/m^3$ and $10000N/m^3$ respectively.
   (Objective No: 3 & Outcome No: 3)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 06/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 30 Duration of Lesson: 1hr.

Lesson Title: Problems on Bending stress of unsymmetrical sections

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Locate the position of neutral axis (maximum value) and calculation of centre of gravity
2. Calculate different model problems on stresses in unsymmetrical beams due to bending
3. Calculate neutral axis, centre of gravity and moment resistance on beams
4. Calculate tensile stresses and compressive stresses in beam due to bending based on neutral axis and its position.

TEACHING AIDS :White board, marker

Teaching points:

1. First the calculation of centre of gravity will be explained for unsymmetrical section and then determining the position of neutral axis
2. Solving different examples on location of neutral axis and section modulus of unsymmetrical I sections, L and T sections
3. Solving different examples to determine minimum and maximum stresses in unsymmetrical beams due to bending.

Assignment / Questions:

1. A cast iron bracket subjected to bending has the cross section of I-form with unequal flanges. The dimensions of the section are shown in figure. Find the position of neutral axis and moment of inertia of the section about the neutral axis. If the maximum bending on the section is 40 MN-mm, determine the maximum bending stress.What is the nature of stress
   (Objective No: 3, 6, 7 & Outcome No: 3, 6, 7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 06/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 31 Duration of Lesson: 1hr.

Lesson Title: Problems on bending stress of unsymmetrical sections

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Locate the position of neutral axis (maximum value) and calculation of centre of gravity
2. Calculate different problems on stresses in unsymmetrical sections like I, L, and T due to bending.
3. Calculate neutral axis, centre of gravity and moment resistance on beams
4. Calculate tensile stresses and compressive stresses in beam due to bending based on neutral axis and its position.

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. First the calculation of centre of gravity will be explained for unsymmetrical section and then determining the position of neutral axis
2. Solving different examples on location of neutral axis and section modulus of unsymmetrical I sections, L and T sections
3. Solving different examples to determine minimum and maximum stresses in unsymmetrical beams due to bending.

Assignment / Questions:

1. A simply supported beam of length 3m carries a point load of 15 KN at a distance of 4m from left support. The cross section of the beam is shown in figure. Determine the compressive and tensile stresses.
   (Objective No: 3, 6, 7 & Outcome No: 3, 6, 7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 06/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 32 Duration of Lesson: 1hr.

Lesson Title: Design of simple beam sections.

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate the position of neutral axis and centre of gravity for both symmetrical and unsymmetrical sections of beam
2. Calculate tensile stress and compressive stress of both the sections.
3. Design the section of beam and distribute maximum and minimum stresses of different types of beams.
4. Draw stress distribution diagrams along the section of beam

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. First the calculation of centre of gravity will be explained for unsymmetrical section and then determining the position of neutral axis
2. Design of section of beam will be explained for both the sections.
3. Solving different examples to determine compressive and tensile stresses in symmetrical and unsymmetrical beams due to bending.

Assignment / Questions:

1. How would you find the bending stresses in unsymmetrical sections? (Objective No: 3 & Outcome No: 3)
2. A simply supported beam of length 4m carries a point load of 16KN at a distance of 3m from left support. The cross section of beam as shown in the below figure. Determine the maximum tensile and compressive stresses at a section which is at a distance of 2.25m from the left end. (Objective No: 3 & Outcome No: 3)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 33 Duration of Lesson: 1hr.

Lesson Title: Shear stress distribution over rectangular, triangular sections

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the variation between bending stresses and shear stresses.
2. Get idea on horizontal and transversal shear stress.
3. Calculate centre of gravity and locate the position of neutral axis.
4. Find the maximum and minimum shear stress across the triangular and rectangular section of the beam

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. The calculation of centre of gravity will be explained for rectangular section and then determining the position of neutral axis
2. Design of section of beam will be explained
3. Solving different examples to determine maximum and minimum shear stress across the rectangular, triangular section.

Assignment / Questions:

1. A wooden beam 100mm wide and 150mm deep is simply supported over a span of 4 metres. If shear force at a section of beam is 4500N, find the shear stress at a distance of 25mm above the neutral axis.
   (Objectives No 3 & Outcomes No 3)

2. Prove that the shear stress at any point in the cross section of a beam which is subjected to a shear force F is given by $\tau = FAY/(bI)$
   (Objectives No 3,6,7& Outcomes No 3,6,7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 34 Duration of Lesson: 1hr.

Lesson Title: Shear stress distribution over circular sections

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the variation between bending stresses and shear stresses.
2. Get idea on horizontal and transversal shear stress.
3. Calculate centre of gravity and locate the position of neutral axis of circular section.
4. Find the maximum and minimum shear stress across the circular section of the beam

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. The calculation of centre of gravity will be explained for circular section and then determining the position of neutral axis
2. Design of section of beam will be explained
3. Solving different examples to determine maximum and minimum shear stress across the circular section.

Assignment / Questions:

1. Derive expression for maximum shear stress of circular section with radius 'R'
   (Objective No: 3 & Outcome No: 3)
2. Prove that maximum shear stress is 4/3 times of average stress.
   (Objective No: 3 & Outcome No: 3)
3. A circular beam of 100mm diameter is subjected to a shear force of 5KN. Calculate:

1) Average shear stress 2) Maximum shear stress 3)Shear stress at a distance of 40mm from NA
   (Objective No: 3 & Outcome No: 3)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 35 Duration of Lesson: 1hr.

Lesson Title: Shear stress distribution over I-section, T-section

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the variation between bending stresses and shear stresses.
2. Get idea on horizontal and transversal shear stress.
3. Calculate centre of gravity and locate the position of neutral axis of T, I-section.
4. Find the maximum and minimum shear stress across the I, T- section of the beam

TEACHING AIDS : White board, marker

TEACHING POINTS :

1. The calculation of centre of gravity will be explained for I,T - section and then determining the position of neutral axis
2. Design of section of beam will be explained
3. Solving different examples to determine maximum and minimum shear stress across the I-section.
4. Explaining the shear stress distribution diagram across the section.

Assignment / Questions:

1. An I-section beam 350mmX150mm has a web thickness of 10mm and a flange thickness of 20mm. If the shear force acting on the section is 40 KN. Find the maximum shear stress developed in the I-section (Objective No: 3 & Outcome No: 3)
2. The shear force acting on the beam is 50 KN. The section of the beam is of T shaped dimensions 100mmX100mmX20mm. The moment of inertia about the horizontal neutral axis is $314.221X10^4 mm^4$. calculate the shear stress at the neutral axis and at the junction of web and flange.(Objective No: 3 & Outcome No: 3)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/01/2022

Semester : I UNIT No: 3

Name of the Program: B.Tech Year: II YEAR Section: A

Course : Solid Mechanics-I Course Code: GR20A2011

Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 36 Duration of Lesson: 1hr.

Lesson Title: Shear stress distribution over miscellaneous sections

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Know the variation between bending stresses and shear stresses.
2. Get idea on horizontal and transversal shear stress.
3. Calculate centre of gravity and locate the position of neutral axis of miscellaneous section.
4. Find the maximum and minimum shear stress across the miscellaneous- section of the beam
5. Draw the shear stress distribution across the section

TEACHING AIDS :White board, marker

TEACHING POINTS :

1. The calculation of centre of gravity will be explained for miscellaneous - section and then determining the position of neutral axis
2. Design of section of beam will be explained
3. Solving different examples to determine maximum and minimum shear stress across the section.
4. Explaining the shear stress distribution diagram across the miscellaneous sections.

Assignment / Questions:

1. The shear force acting on a beam at an I section with unequal flanges is 50KN. The section is shown in figure. The moment of inertia of the section about NA is $2.849X10^4$. Calculate the shear stress at the NA and also draw the shear stress distribution over the depth of the section. (Objective No: 3 & Outcome No: 3)

2. A beam of square section is used as abeam with one diagonal horizontal. The beam is subjected to a shear force F at a section. Find the maximum shear in the cross section of the beam and draw the shear stress distribution diagram for the section.
(Objective No: 3 & Outcome No: 3)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering
Designation : Assistant Professor
Lesson No: 37 Duration of Lesson: 1hr.
Lesson Title: Introduction to deflection of beams and radius of curvature

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the behavioral characteristics of loaded beams
2. Determine the support reactions, slope and deflection due to bending in cantilever and simply supported beams with combined concentrated and uniformly distributed load.
3. Determine suitable materials, cross sectional shape , modulus of rigidity and orientation of beams with respect to the direction of forces for civil Engineering applications.
4. Derive expression for slope, deflection and radius of curvature.

TEACHING AIDS : White board

TEACHING POINTS :

1. Explaining the behavior of beam under deflections due to different type of loadings.
2. Explaining problems related to modulus of rigidity, slope, deflection, rate of loading, shear force and bending moment
3. Recalling the previous concepts to determine support reactions, shear force, bending moment.

Assignment / Questions:

1. Derive an expression for the slope and deflection of a beam subjected to uniform bending moment.(Objectives No 4 & Outcomes No 4)
2. Prove that the relation $M=EI(d^2y/dx^2)$(Objectives No 4 & Outcomes No 4)
3. Prove that the relation $F=EI(d^3y/dx^3)$(Objectives No 4 & Outcomes No 4)
4. Prove that the relation rate of loading $=EI(d^4y/dx^4)$(Objectives No 4 & Outcomes No 4)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 09/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor
Lesson No: 38 Duration of Lesson: 1hr.
Lesson Title: Problems on Double integration method

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Use the double integration technique to determine transverse deflections in slender beams under distributed or concentrated loads.
2. Know different types of methods to calculate deflection of beams
3. Evaluate slope and deflection in a slender beam in bending
4. Derive differential equation of beams in bending.

TEACHING AIDS :White board
TEACHING POINTS :

1. Explaining and recalling the previous concepts on method of integration
2. Solving different examples on double integration method to calculate slope and deflection of different beams under different loads.
3. Explaining problems related to modulus of rigidity, slope, deflection, rate of loading, shear force and bending moment.

Assignment / Questions:

1. What do you understand by neutral axis and moment of resistance

(Objective No: 4 & Outcome No:4)

2. Prove the relation M/I= F/Y =E/R.(Objective No:4 & Outcome No: 4)
3. Derive an expression for bending stress at a layer in a beam.(Objective No: 4 & Outcome No: 4)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 09/01/2022
Semester : I UNIT No: 4
Name of the Program : B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering

Designation : Assistant Professor

Lesson No: 39 Duration of Lesson: 1hr
Lesson Title: Problems on Macaulay's Methods

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Use the Macaulay's technique to determine transverse deflections in slender beams under distributed or concentrated loads.
2. Solve the slope and deflection of a
   a) Cantilever with a point load at the end
   b) Cantilever with uniformly distributed load
   c) Simply supported beam with point load at the middle
   d) Simply supported beam with UDL
3. Evaluate slope and deflection in a slender beam in bending
4. Calculate shear force, bending moment, reaction, slope and deflection at a section of beam.

TEACHING AIDS : White board
TEACHING POINTS :

1. Explaining the concept involved in Macaulays method to determine slope and deflection.
2. Solving different examples to calculate deflection acting on different types of beams under different loading conditions
3. Make the students to solve different conditions to calculate forces, bending moments, deflections.

Assignment / Questions:

1. Derive an expression for deflection of a simply supported beam with an eccentric point load. (Objectives No 4 & Outcomes No 4)

2. A beam of length 6m is simply supported at its ends and carries two point loads of 48KN and 40KN at a distance of 1m and 3m respectively from the left support. Find the point at which maximum deflection occurs (I=85X10^6 mm^4)
   (Objectives No 4 & Outcomes No 4)
3. A beam of length 8m is simply supported at its ends. It carries a uniformly distributed load 40Kn/m . Determine the deflection of the beam at its mid point and also the position of maximum deflection. (I=4.3X10^8 mm^4)
   (Objectives No 4 & Outcomes No 4)

4. A beam of length 6m is simply supported at its ends and carries two point loads of 48KN and 40KN at a distance of 1m and 3m respectively from the left support. Find:
   1) Deflection under each load
   2) Maximum deflection and
   (Objectives No 4 & Outcomes No 4)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 444

LESSON PLAN

Academic Year : 2021-22 10/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor
Lesson No: 40 Duration of Lesson: 1hr
Lesson Title: Determination of slope and deflection for cantilever and simply supported under point load, UDL, UVL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate slope and deflection for cantilever beam subjected to point load
2. Calculate slope and deflection for cantilever beam subjected to uniformly distributed load.
3. Calculate slope and deflection of simply supported beam subjected to point load
4. Calculate slope and deflection of simply supported beam subjected to uniformly distributed load.

TEACHING AIDS :White board

TEACHING POINTS :

1. Recalling the previous concepts to calculate shear force, bending moments and support reactions in case of cantilever and simply supported beams.
2. Solving different examples on slope and deflection of cantilever bream subjected to point and UDL.
3. Solving different examples on slope and deflection of simply supported beam subjected to point and UDL.

Assignment / Questions:

1. A cantilever of length 2.5m carries UDL of 16.4KN per metre length over the entire length. If I=7.97X1067mm^4 , determine the deflection at free end
   (Objectives No 4 & Outcomes No 4)
2. A cantilever beam of length 3m carries UDL 2.5KN/m over the entire length of 1.25m from fixed end and a point load of 1 KN at the free end.Find the deflection at free end if the section is rectangular 12cm wide and 24cm deep
   (Objectives No 4 & Outcomes No 4)
3. A beam is simply supported of length 5m carries appoint load of 5KN at a distance of 3m from the left end. Determine the slope at left support and deflection under the point load.
   (Objectives No 4 & Outcomes No 4)
4. A beam of length 8m is simply supported at its ends. It carries a uniformly distributed load 40Kn/m . Determine the deflection of the beam at its mid point and also the position of maximum deflection. (I=4.3X10^8 mm^4) (Objectives No 4 & Outcomes No 4)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 11/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 41 Duration of Lesson: 1hr.
Lesson Title: Determination of slope and deflection for cantilever and simply supported under UDL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate slope and deflection for cantilever beam subjected to uniformly distributed load.
2. Calculate slope and deflection of simply supported beam subjected to uniformly distributed load.
3. Calculate shear force, bending moment, support reactions at a section of beams.

TEACHING AIDS :White board
TEACHING POINTS :

1. Recalling the previous concepts to calculate shear force, bending moments and support reactions in case of cantilever and simply supported beams.
2. Solving different examples on slope and deflection of cantilever bream subjected to point and UDL.
3. Solving different examples on slope and deflection of simply supported beam subjected to point and UDL

Assignment / Questions:

1. A cantilever of length 2m carries a UDL 2KN/m over a length of 1m from the free end and a point load of 1KN at the free end. Find the slope and deflection at the free end. ($I = 6.667X10^7 mm^4$) (Objectives No 4,6,7 & Outcomes No 2,4,6,7)
2. A cantilever of length 2m carries UDL of 2.5KN/m run for a length of 1.25m from the fixed end and a point load of 1kn at the free end . Find the deflection at the free end if it is rectangular 12cm wide and 24cm deep. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)
3. A beam of length 8m is simply supported at its ends and carries two point loads of 48KN and 60KN at a distance of 1m and 3m respectively from the left support. Find:
   1) Deflection under each load
   2) Maximum deflection and(Objectives No 4,6,7 & Outcomes No 2,4,6,7)
4. A beam is simply supported of length 5m carries appoint load of 5KN at a distance of 3m from the left end. Determine the slope at left support and deflection under the point load. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 12/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 42 Duration of Lesson: 1hr.

Lesson Title: Determination of slope and deflection for cantilever and simply supported under UVL

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate slope and deflection for cantilever beam subjected to uniformly varying load.
2. Calculate slope and deflection of simply supported beam subjected to uniformly varying load.
3. Calculate shear force, bending moment, support reactions at a section of beams.

TEACHING AIDS : White board
TEACHING POINTS :

1. Recalling the previous concepts to calculate shear force, bending moments and support reactions in case of cantilever and simply supported beams.
2. Solving different examples to find modulus of rigidity (EI)
3. Solving different examples on slope and deflection of simply supported beam subjected to UVL

Assignment / Questions:

2. A cantilever of length 4m carries a uniformly varying load of zero intensity at the free end, and 50KN/m at the fixed end. If E= 2X10^5 N/mm2 and I=1068 mm4, Find the slope and deflection at the free end. (Objectives No 4 & Outcomes No 4)
3. A cantilever of length 2m carries a uniformly varying load of 25 KN/m at the free end, and 75KN/m at the fixed end. If E= 1X10^5 N/mm2 and I=10^8 mm4, Find the slope and deflection at the free end. (Objectives No 4 & Outcomes No 4)
4. A simply supported beam of length 2m carries a uniformly varying load of 0 KN/m at one end, and 75KN/m at the other end. If E= 1X10^5 N/mm2 and I=10^8 mm4, Find the slope and deflection at the free end. (Objectives No 4 & Outcomes No 4)
5. A simply supported beam of length 2m carries a uniformly varying load of 25 KN/m at one end, and 75KN/m at the other end. If E= 1X10^5 N/mm2 and I=10^8 mm4, Find the slope and deflection at the free end. (Objectives No 4 & Outcomes No 4)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 12/01/2022
Semester : I UNIT No: 4
Name of the Program : B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering
Designation : Assistant Professor
Lesson No: 43 Duration of Lesson: 1hr
Lesson Title: Mohr's theorem and problems

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the reaction forces of a structure and draw the M/EI diagram of the structure.
2. Find the rotations, change of slopes and deflections of the structure by using the geometric mathematics.
3. Assume and draw the deflection shape of the structure by looking at M/EI diagram.
4. Calculate the slope and deflection at different sections of the beam.

TEACHING AIDS :White board

TEACHING POINTS :

1. Explaining modulus of rigidity which was crucial part to determine slope and deflection between any two points using Mohr's theorem.
2. Explaining the concepts involved in calculation of slope and deflection between any two points.
3. Algebraic expressions to determine the change of slope between two points and total deflection between any two points of cantilever and simply supported beams.

Assignment / Questions:

1. Calculate slope and deflection of a simply supported beam carrying point load at the centre by Mohr's theorem. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)
2. Calculate slope and deflection of a simply supported beam carrying uniformly distributed load by Mohr's theorem. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)
3. Calculate slope and deflection of a cantilever beam carrying point load at the free end by Mohr's theorem. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)
4. Calculate slope and deflection of a cantilever beam carrying uniformly distributed load by Mohr's theorem. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 12/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 44 Duration of Lesson: 1hr.

Lesson Title: Problems on Mohrs theorem

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the reaction forces of a structure and draw the M/EI diagram of the structure.
2. Find the rotations, change of slopes and deflections of the structure by using the geometric mathematics.
3. Assume and draw the deflection shape of the structure by looking at M/EI diagram.
4. Calculate the slope and deflection at different sections of the beam.

TEACHING AIDS : White board

TEACHING POINTS :

1. Solving different examples on modulus of rigidity which is used to calculate slope and deflection.
2. Applying the algebraic expressions in calculation of slope and deflection between any two points.
3. Solving different examples to determine the change of slope between two points and total deflection between any two points of cantilever and simply supported beams.

Assignment / Questions:

1. Calculate slope and deflection of a simply supported beam of length 3m carrying point load 30KN at the centre by Mohr's theorem. (Objectives No 4 & Outcomes No 4)
2. Calculate slope and deflection of a simply supported beam of length 2m carrying uniformly distributed load of 3KN/m by Mohr's theorem. (Objectives No 4 & Outcomes No 4)
3. Calculate slope and deflection of a cantilever beam of length 2m carrying point load of 20KN at the free end by Mohr's theorem. (Objectives No 4 & Outcomes No 4)
4. Calculate slope and deflection of a cantilever beam of length 1.5m carrying uniformly distributed load of 500N/m by Mohr's theorem.
   (Objectives No 4 & Outcomes No 4,6,7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 15/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 45 Duration of Lesson: 1hr.
Lesson Title: Problems on Mohrs theorem

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Determine the reaction forces of a structure and draw the M/EI diagram of the structure.
2. Find the rotations, change of slopes and deflections of the structure by using the geometric mathematics.
3. Assume and draw the deflection shape of the structure by looking at M/EI diagram.
4. Calculate the slope and deflection at different sections of the beam.

TEACHING AIDS : White board
TEACHING POINTS :

1. Solving different examples on modulus of rigidity which is used to calculate slope and deflection.
2. Applying the algebraic expressions in calculation of slope and deflection between any two points.
3. Solving different examples to determine the change of slope between two points and total deflection between any two points of cantilever and simply supported beams.

Assignment / Questions:

1. A beam of length 10m is simply supported at its ends carrying two point loads of 100 KN and 60 KN at a distance of 2m and 5m from left support. Calculate the deflection under each load and also the maximum deflection.(Objectives No 4,6,7 & Outcomes No 2,4,6,7)
2. A cantilever of length 3m is carrying a point load of 50 KN at a distance of 2m from the fixed end. If $I=10^8 mm^4$ and $E=2X10^5$ N/mm^2. Find slope at the free end and deflection at the free end (Objectives No 4,6,7 & Outcomes No 2,4,6,7)
3. A simply supported beam of length 5m carries a point load of 5 KN at a distance of 3m from the left end. If $E=2X10^5$ N/mm^2 and $I=10^8 mm^4$, determine the slope at the left support and deflection under the point load using Mohr's theorem.
   (Objectives No 4,6,7 & Outcomes No 2,4,6,7)
4. Calculate slope and deflection of a cantilever beam of length 2.5m carrying uniformly distributed load of 900N/m by Mohr's theorem. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 17/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 46 Duration of Lesson: 1hr.
Lesson Title: Problems on Mohrs theorem

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Determine the reaction forces of a structure and draw the M/EI diagram of the structure.
2. Find the rotations, change of slopes and deflections of the structure by using the geometric mathematics.
3. Assume and draw the deflection shape of the structure by looking at M/EI diagram.
4. Calculate the slope and deflection at different sections of the beam.

TEACHING AIDS : White board
TEACHING POINTS :

1. Solving different examples on modulus of rigidity which is used to calculate slope and deflection.
2. Applying the algebraic expressions in calculation of slope and deflection between any two points.
3. Solving different examples to determine the change of slope between two points and total deflection between any two points of cantilever and simply supported beams.

Assignment / Questions:

1. A beam of length 8m is simply supported at its ends carrying two point loads of 90 KN and 50 KN at a distance of 2m and 5m from left support. Calculate the deflection under each load and also the maximum deflection using Mohr's theorem
   (Objectives No 4 & Outcomes No 4)
2. A cantilever of length 3m is carrying a point load of 50 KN at a distance of 2m from the fixed end. If $I=10^8 mm^4$ and $E=2X10^5$ N/mm^2. Find slope at the free end and deflection at the free end using Mohr's theorem (Objectives No 4 & Outcomes No 4)
3. A simply supported beam of length 6m carries a point load of 8 KN at a distance of 3m from the left end. If $E=2X10^5$ N/mm^2 and $I=10^8 mm^4$, determine the slope at the left support and deflection under the point load using Mohr's theorem.(Objectives No 4 & Outcomes No 4)
4. Calculate slope and deflection of a cantilever beam of length 3.5m carrying uniformly distributed load of 900N/m by Mohr's theorem. (Objectives No 4 & Outcomes No 4)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 15/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 47 Duration of Lesson: 1hr.
Lesson Title: Application to simple cases including overhanging beams

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Apply the simple cases involved in cantilever beams on different type of structures like buildings, bridges, industrial structures.
2. Apply the simple cases involved in cantilever beams on different type of structures like buildings, bridges, industrial structures.
3. Apply the simple cases involved in cantilever beams on different type of structures like buildings, bridges, industrial structures.
4. Calculate the slope and deflections using different methods between any two points of different beams including overhanging beams.

TEACHING AIDS :White board
TEACHING POINTS :

1. Applying the concepts of slope and deflection of cantilever, simply supported and overhanging beams in practical purposes like building structures, industrial structures, bridge structures.
2. Solving different examples on different beams including overhanging beams to get an idea for their application in future engineering.

Assignment / Questions:

1. An overhanging beam ABC is loaded as shown in figure. Find the slopes over each support and at the right end. Find also the maximum upward deflection between the supports and deflection at the right end. ($E=2X10^5$ N/mm^2 and $I=5X10^8$mm^4
   (Objectives No 4,6,7 & Outcomes No 2,4,6,7)

2. A beam ABC of length 9m has one support of the left end and the other support at a distance of 6m from the left end.The beam carries a point load of 1KN at right end and also carries a uniformly distributed load of 4KN/m over a length of 3m as shown in figure. Determine the slope and deflection at point C. (Objectives No 4,6,7 & Outcomes No 2,4,6,7)

3. An overhanging beam ABC is loaded as shown in figure. Determine the deflection of the beam at point C. ($E=2X10^5$ N/mm^2 and $I=5X10^8$mm^4)(Objectives No 4 & Outcomes 4)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 15/01/2022
Semester : I UNIT No: 4
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 48 Duration of Lesson: 1hr.
Lesson Title: Application to simple cases including overhanging beams

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Apply the simple cases involved in cantilever beams on different type of structures like buildings, bridges, industrial structures.
2. Apply the simple cases involved in cantilever beams on different type of structures like buildings, bridges, industrial structures.
3. Apply the simple cases involved in cantilever beams on different type of structures like buildings, bridges, industrial structures.
4. Calculate the slope and deflections using different methods between any two points of different beams including overhanging beams.

TEACHING AIDS : White board
TEACHING POINTS :

1. Applying the concepts of slope and deflection of cantilever, simply supported and overhanging beams in practical purposes like building structures, industrial structures, bridge structures.
2. Solving different examples on different beams including overhanging beams to get an idea for their application in future engineering.

Assignment / Questions:

1. An overhanging beam ABC is loaded as shown in figure. Find the slopes over each support and at the right end. Find also the maximum upward deflection between the supports and deflection at the right end. ($E=2X10^5$ N/mm^2 and $I=5X10^8$mm^4
   (Objectives No 4 & Outcomes No 4)
2. A beam ABC of length 10m has one support of the left end and the other support at a distance of 6m from the left end.The beam carries a point load of 2KN at right end and also carries a uniformly distributed load of 5KN/m over a length of 3m as shown in figure. Determine the slope and deflection at point C.(Objectives No 4 & Outcomes No 4)
3. An overhanging beam ABC is loaded as shown in figure. Determine the deflection of the beam at point C. ($E=2X10^5$ N/mm^2 and $I=5X10^8$mm^4)
   (Objectives No 4,6,7 & Outcomes No 2,4,6,7)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 18/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 49 Duration of Lesson: 1hr.
Lesson Title: Introduction to principal stresses and strains

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Understand the concepts of stress and strain
2. Determine the direction of stresses acting along the plane such as direct stresses and shear stresses.
3. Determine the resultant stresses which are acting neither normal nor tangential to the plane.
4. Understand the stresses acting on an inclined plane or oblique section and methods to determine the stresses on oblique section.

TEACHING AIDS :White board
TEACHING POINTS :

5. Main Avenue used to convey knowledge to the student are lectures. They are presented in the traditional way, using whiteboard.
6. In this topic, lecture is given to introduce the normal stresses, shear stresses and the direction of stresses acting on an inclined plane or acting tangentially to the plane.
7. Algebraic expressions to determine stresses on oblique section.

Assignment / Questions:

1. Derive an expression for a member subjected to a direct stress in one plane. (Objectives No 5 & Outcomes No 5)

2. Derive an expression for a member subjected to like direct stress in two mutually perpendicular directions. (Objectives No 5 & Outcomes No 5)
3. Define
   a)Principal stress b) Principal strain c) Principal plane (Objectives No 5 & Outcomes 5)
4. The tensile stresses at a point across two mutually perpendicular planes are 120N/mm^2 and 60N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 30^o to the axis of minor stress. Objectives No 5 & Outcomes No 5

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 18/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 50 Duration of Lesson: 1hr.
Lesson Title: Problems on stresses on inclined section of a bar under axial loading

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the normal, tangential and resultant stresses on a plane
2. Determine different types of stresses acting on a plane inclined at certain angle
3. Determine the minor and major principal stresses.
4. Determine the magnitude and direction of resultant stress acting on a plane inclined at certain angle to the axis of major or minor stress.

TEACHING AIDS :White board
TEACHING POINTS :

1. Solving number of problems to determine normal, tangential, direct and resultant stresses.
2. Determine the minor and major principal stresses.
3. Solving different examples to determinethe magnitude and direction of resultant stress acting on a plane inclined at certain angle to the axis of major or minor stress.
4. Plenty of example problems are solved in class and the students are allowed to practice the problem solutions through various homework assignments.

Assignment / Questions:

1. The tensile stresses at a point across two mutually perpendicular planes are 100N/mm^2 and 80N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 40^o to the axis of minor stress. Objectives No 5 & Outcomes No 5
2. The stresses at a point in a bar are 200N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60^o to the axis of the major stress Objectives No 5 & Outcomes No 5
3. The stresses at a point in a bar are 300N/mm^2(tensile) and 150 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 50^o to the axis of the major stress. Also0 determine the maximum intensity of shear stress in the material at the point. Objectives No 5 & Outcomes No 5
4. At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50^o to the axis of major principal stress. Also determine the maximum shear stress at the point. Objectives No 5 & Outcomes No 5

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 444

LESSON PLAN

Academic Year : 2021-22 18/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 51 Duration of Lesson: 1hr
Lesson Title: Problems on stresses on inclined section of a bar under axial loading

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Determine the normal, tangential and resultant stresses on a plane
2. Determine different types of stresses acting on a plane inclined at certain angle
3. Determine the minor and major principal stresses.
4. Determine the magnitude and direction of resultant stress acting on a plane inclined at certain angle to the axis of major or minor stress.

TEACHING AIDS :White board
TEACHING POINTS :

4. Solving number of problems to determine normal, tangential, direct and resultant stresses.
5. Determine the minor and major principal stresses.
6. Solving different examples to determinethe magnitude and direction of resultant stress acting on a plane inclined at certain angle to the axis of major or minor stress.
7. Plenty of example problems are solved in class and the students are allowed to practice the problem solutions through various homework assignments.

Assignment / Questions:

1. At a point in a strained material the principal tensile stresses across two perpendicular planes, are 80 N/mm^2 and 40 N/mm^2. Determine the normal stress, shear stress and resultant stress on a plane inclined at 20^o to the axis of major principal plane. Determine also the obliquity.What will be the intensity of stress, which acting along will produce same maximum strain.(poisons ratio=1/4) Objectives No 5 & Outcomes No 5
2. At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 40 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 50^o to the axis of the major principal stress. What is the maximum intensity of shear stress at the point?Objectives No 5 & Outcomes No 5
3. The stresses at a point in a bar are 300N/mm^2 (tensile) and 150 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 50^o to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at the point.Objectives No 5 & Outcomes No 5
4. At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50^o to the axis of major principal stress. Also determine the maximum shear stress at the point. Objectives No 5 & Outcomes No 5

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 22/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 52 Duration of Lesson: 1hr
Lesson Title: Problems on Compound stresses

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine any member subjected to simple shear along the plane.
2. Understand the concept of member subjected to direct stresses in two mutually perpendicular direction accompanied by simple shear stress.
3. Calculate major principal stress, minor principal stress, maximum shear stress and their magnitude of shear stress on two planes.

TEACHING AIDS :White board

TEACHING POINTS :

1. Recalling the previous concepts to calculate shear stress, normal stress, resultant stress and its direction from the axis
2. Explaining concept when direct stresses in two mutually perpendicular direction accompanied by simple shear stress and subjected to simple shear along the plane
3. Solving different examples when compound stresses exist on two mutually perpendicular planes

Assignment / Questions:

1. At a point within a body subjected to two mutually perpendicular directions, the stresses are 80N/mm^2 tensile and 40 N/mm^2 tensile. Each of the above stresses is accompanied by a shear stress of 60N/mm^2. Determine the normal stress, shear stress and resultant stress on an oblique plane inclined at an angle of 45^o with the axis of minor stress.
   Objectives No 5 & Outcomes No 5
2. A rectangular block of material is subjected to a tensile stress of 110 N/mm2 on one plane and a tensile stress of 47N/mm2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63N/mm2 and that associated with the former tensile stress tends to rotate the block anti clockwise: Find 1) The direction and magnitude of each of the principal stress2) The magnitude of the greatest shear stress
   Objectives No 5 & Outcomes No 5
3. Direct stresses of 120 N/mm2 tensile and 90 N/mm2 compression exists on two mutually perpendicular planes at a certain point in a body. They are also accompanied by shear stress on the planes. The greatest principal stress at the point due to these is 150 N/mm2.What must be the magnitude of the shearing stresses on the two planes.
   Objectives No 5 & Outcomes No 5

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 22/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering
Designation : Assistant Professor
Lesson No: 53 Duration of Lesson: 1hr.
Lesson Title: Normal and tangential stresses on an inclined section for biaxial stress

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the normal, tangential and resultant stresses on a plane
2. Determine different types of stresses acting on a plane inclined at certain angle
3. Understand the concept of member subjected to direct stresses in two mutually perpendicular direction accompanied by simple shear stress
4. Calculate normal and tangential stresses on an inclined section for biaxial stress

TEACHING AIDS :White board
TEACHING POINTS :

1. Recalling the previous concepts to calculate shear stress, normal stress, resultant stress and its direction from the axis
2. Explaining concept when direct stresses in two mutually perpendicular direction accompanied by simple shear stress and subjected to simple shear along the plane
3. Plenty of example problems are solved in class and the students are allowed to practice the problem solutions through various homework assignments on normal and tangential stresses on an inclined section for biaxial stress

Assignment / Questions:

1. The normal stress in two mutually perpendicular directions are 600N/mm^2 and 300N/mm^2 both tensile. The complimentary shear stress in these directions are of intensity 450N/mm^2. Find the normal and tangential stresses on the two planes which are equally inclined to the planes carrying normal stresses. (Objectives No 5& Outcomes No 5)
2. The intensity of resultant stress on a plane AB as shown in figure at a point in a material under stress on 800N/cm^2 and it is inclined at 30^o to the normal to that plane. The normal component of stress on another plane BC at right angles to plane AB is 600N/cm^2. Determine: The resultant stress on the plane BC, The principal stress and their direction,
   Maximum shear stress and their direction (Objectives No 5 & Outcomes No 5)
3. At a point in a strained material under stress the intensity of the resultant stress on a vertical plane is 1000N/cm^2 inclined at 30^o to the normal to that plane and the stress on a horizontal plane has a normal tensile component of intensity 600N/cm^{2}as shown in figure. Find the magnitude and direction of resultant stress on the horizontal plane and the principal stresses.Objectives No 5,6& Outcomes No 1,5,6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 24/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor

Lesson No: 54 Duration of Lesson: 1hr.

Lesson Title: Normal and tangential stresses on an inclined section for biaxial stress

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the normal, tangential and resultant stresses on a plane
2. Determine different types of stresses acting on a plane inclined at certain angle
3. Understand the concept of member subjected to direct stresses in two mutually perpendicular direction accompanied by simple shear stress
4. Calculate normal and tangential stresses on an inclined section for biaxial stress

TEACHING AIDS :White board
TEACHING POINTS :

1. Recalling the previous concepts to calculate shear stress, normal stress, resultant stress and its direction from the axis
2. Explaining concept when direct stresses in two mutually perpendicular direction accompanied by simple shear stress and subjected to simple shear along the plane
3. Plenty of example problems are solved in class and the students are allowed to practice the problem solutions through various homework assignments on normal and tangential stresses on an inclined section for biaxial stress

Assignment / Questions:

1. The normal stress in two mutually perpendicular directions are 500N/mm^2 and 200N/mm^2 both tensile. The complimentary shear stress in these directions are of intensity 550N/mm^2. Find the normal and tangential stresses on the two planes which are equally inclined to the planes carrying normal stresses.(Objectives No 5& Outcomes No 5)
2. At a point in a strained material under stress the intensity of the resultant stress on a vertical plane is 900N/cm^2 inclined at 50^o to the normal to that plane and the stress on a horizontal plane has a normal tensile component of intensity 500N/cm^2 as shown in figure. Find the magnitude and direction of resultant stress on the horizontal plane and the principal stresses.(Objectives No 5& Outcomes No 5)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 24/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 55 Duration of Lesson: 1hr.
Lesson Title: Mohrs circle of stresses, Graphical method for principal stresses and Strains

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Know the concept of graphical method to determine stresses by Mohr's circle.
2. Determine the normal, tangential and resultant stresses on an oblique plane by Mohr's circle.
3. Determine the maximum shear stresses on an oblique plane by Mohr's circle.
4. Determine when a body is subjected to two mutually perpendicular stresses of unequal intensities.

TEACHING AIDS :White board
TEACHING POINTS :

1. Explaining step wise method to draw mohr's circle to find the normal,tangential and resultant stresses
2. Finding principal normal stresses, principal shear stresses, components on an arbitrary plane, orientation of the principal planes
3. Solving different examples by assuming a material under a state of stress by showing figures with the plane of one of its sides oriented x^o with respect to the horizontal plane using the Mohr circle

Assignment / Questions:

1. Derive an expression when a body is subjected to two mutually perpendicular principal tensile stresses of unequal intensities. (Objectives No 5, 6 & Outcomes No 1,5,6)
2. Derive an expression when a body is subjected to two mutually perpendicular principal stresses which are unequal and unlike.(Objectives No 5, 6 & Outcomes No 1,5,6)
3. Explain the procedure in step wise to determine stresses using Mohr's circle (Objectives No 5, 6 & Outcomes No 1,5,6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 25/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 56 Duration of Lesson: 1hr.
Lesson Title: Mohrs circle of stresses, Graphical method for principal stresses and Strain

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Know the concept of graphical method to determine stresses by Mohr's circle.
2. Determine the normal, tangential and resultant stresses on an oblique plane by Mohr's circle.
3. Determine the maximum shear stresses on an oblique plane by Mohr's circle.
4. Determine when a body is subjected to two mutually perpendicular principal stresses which are unequal and unlike.(one is tensile and other is compressive)

TEACHING AIDS :White board
TEACHING POINTS :

1. Explaining step wise method to draw mohr's circle to find the normal, tangential and resultant stresses
2. Finding principal normal stresses, principal shear stresses, components on an arbitrary plane, orientation of the principal planes under different cases.
3. Solving different examples by assuming a material under a state of stress by showing figures with the plane of one of its sides oriented x^o with respect to the horizontal plane using the Mohr circle

Assignment / Questions:

1. Derive an expression when a body is subjected to two mutually perpendicular principal tensile stresses accompanied by a simple shear stress.(Objectives No 5 & Outcomes No 5)
2. Determine maximum value of shear stress and normal stress when a body is subjected to two mutually perpendicular principal tensile stresses accompanied by a simple shear stress (Objectives No 5 & Outcomes No 5)
3. A point in a strained material is subjected to stresses shown in figure using Mohr's circle method, determine the normal and tangential stresses across the oblique plane (Objectives No 5 & Outcomes No 5)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 29/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 57 Duration of Lesson: 1hr.
Lesson Title: Mohr's circle of stresses, Graphical method for principal stresses and Strains

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. Know the concept of graphical method to determine stresses by Mohr's circle.
2. Determine the normal, tangential and resultant stresses on an oblique plane by Mohr's circle.
3. Determine the maximum shear stresses on an oblique plane by Mohr's circle.
4. Know the different cases to be drawn using Mohr's circle.

TEACHING AIDS :White board
TEACHING POINTS :

1. Explaining step wise method to draw mohr's circle to find the normal, tangential and resultant stresses
2. Finding principal strain on an oblique plane due to normal stresses in X and Y plane and shear stresses.
3. Solving different examples by assuming a material under a state of stress by showing figures with the plane of one of its sides oriented x^o with respect to the horizontal plane using the Mohr circle

Assignment / Questions:

1. Derive an expression when a body is subjected to strain on an oblique plane due to stress in X direction. (Objectives No 5 & Outcomes No 5)
2. Derive an expression when a body is subjected to strain on an oblique plane due to stress in X direction. (Objectives No 5 & Outcomes No 5)
3. Derive an expression when a body is subjected to strain on an oblique plane due to shear stress (τ).(Objectives No 5 & Outcomes No 5)
4. Derive an expression for maximum and minimum values of strain on oblique plane. (Objectives No 5 & Outcomes No 5)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 444

LESSON PLAN

Academic Year : 2021-22 29/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 58 Duration of Lesson: 1hr.
Lesson Title: Theories of failures- maximum principal stress theory

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. The student shall understand the behaviour of materials under anystructural system.
2. Student should be able to deal with the effect of various types ofloading include bending, torsion, etc.,
3. Students will demonstrate the ability to analyse the principal stressesdeveloped in a material.
4. Students will be equipped with the importance of determining stresses their applications, theories offailures.

TEACHING AIDS :White board
TEACHING POINTS :

1. Mohr's circle analysis and once principal stresses are known failure theories will be able to formulate condition of failure in actual case.
2. Discussing theory of failures- Maximum Principal stress theory
3. The maximum principal stress induced in a material under complex load condition exceeds the maximum normal strength in a simple tension test the material fails. So the failure condition can be expressed.

Assignment / Questions:

1. Derive an expression when a body is subjected to two mutually perpendicular principal tensile stresses of unequal intensities.(Objectives No 5 & Outcomes No 5)
2. Derive an expression when a body is subjected to two mutually perpendicular principal stresses which are unequal and unlike. (Objectives No 5 & Outcomes No 5)
3. Explain theories of failures under Maximum principal stress theory.
   (Objectives No 5 & Outcomes No 1,5,6)
4. Determine normal, tangential and resultant stresses using Mohr's circle method. (120N/mm^2 and 60N/mm^2 tensile stresses and angle 30^o)

   (Objectives No 5, 6 & Outcomes No 1,5,6)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 31/01/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 59 Duration of Lesson: 1hr.
Lesson Title: Theories of failures- maximum principal strain theory

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. The student shall understand the behaviour of materials under any structural system.
2. Student should be able to deal with the effect of various types of loading include bending, torsion, etc.,
3. Students will demonstrate the ability to analyse the principal strain developed in a material.
4. Students will be equipped with the importance of determining principal strain, their applications, and theories of failures.

TEACHING AIDS :White board
TEACHING POINTS :

1. Mohr's circle analysis and once principal stresses are known failure theories will be able to formulate condition of failure in actual case.
2. Discussing theory of failures- Maximum Principal strain theory
3. The maximum normal strain in actual case is more than maximum normal strain occurred in simple tension test case the material fails. The maximum principal strain in actual case is determined.

Assignment / Questions:

1. Derive an expression when a body is subjected to strain on an oblique plane due to stress in X direction. (Objectives No 5 & Outcomes No 5)
2. Derive an expression when a body is subjected to strain on an oblique plane due to stress in X direction. (Objectives No 5 & Outcomes No 5)
3. Derive an expression when a body is subjected to strain on an oblique plane due to shear stress (τ). (Objectives No 5 & Outcomes No 5)
4. Explain about theories of failures under maximum principal strain theory (Objectives No 5 & Outcomes No 5)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

LESSON PLAN

Academic Year : 2021-22 07/02/2022
Semester : I UNIT No: 5
Name of the Program: B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering

Designation : Assistant Professor
Lesson No: 60 Duration of Lesson: 1hr.
Lesson Title: Theories of failures- maximum shear stress theory

INSTRUCTIONAL/LESSON OBJECTIVES:
On completion of this lesson the student shall be able to:

1. The student shall understand the behaviour of materials under any structural system.
2. Student should be able to deal with the effect of various types ofloading include bending, torsion, etc.,
3. Students will demonstrate the ability to analyse the shear stressesdeveloped in a material.
4. Students will be equipped with the importance of determiningshear stresses, their applications, theories offailures.

TEACHING AIDS :White board
TEACHING POINTS :

1. Mohr's circle analysis and once shear stresses are known failure theories will be able to formulate condition of failure in actual case.
2. Discussing theory of failures- Maximum shear stress theory
3. The maximum shear strength in actual case exceeds maximum allowable shear stress in simple tension test the material case. Maximum shear stress in actual case in represented.

Assignment / Questions:

1. What are the industrial applications of failure theories. (Objectives No 5 & Outcomes No 5)
2. Derive an expression to find maximum value of shear stress when a body is subjected to two mutually perpendicular tensile stresses accompanied by a simple shear stress. (Objectives No 5 & Outcomes No 5)
3. Explain theories of failures under Maximum shear stress theory. (Objectives No 5 & Outcomes No 5)
4. Determine normal, tangential and resultant stresses using Mohr's circle method. (120N/mm^2 and 60N/mm^2 tensile stresses and angle 30^o)

(Objectives No 5 & Outcomes No 5)

Signature of faculty

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department Of Civil Engineering
TUTORIAL SHEET I

Academic Year : 2021-22 Date: 30/9/21
Semester : I
Name of the Program : B. Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor
The tutorial sheet corresponds to Unit I

1. A bar of 31mm diameter and 1.5m long has a collar at one end. It is suspended vertically with the collar at the lower end and a load of 25 KN is gradually dropped to the collar producing an extension in the bar 0.5mm. Find the height of fall if the maximum tensile stress in the bar is to be 100 N/mm^2

2. a) State and explain the Hooke's law.

b) Draw the stress strain diagram for mild steel and explain its features.

c) Write the relation between E and G, E and K and derive the relation among them.

3. Find the elongation of a bar, length L and cross sectional area under the action of its own weight. Assume the unit weight of the bar is w per metre length.

4. a) Explain elastic and plastic material

b) What are the advantages of compound cylinder? Explain analytically?

5. A mild steel bar 25mm in diameter and 500mm long is encased in a brass tube having external diameter 40mm and internal diameter 32mm. The composite bar is heated through 500oc. Calculate the stresses induced in each metal. The coefficient of expansion of steel and brass are 1.08X10-5

Course Objective No: 1

Course Outcome No: 1

Signature of HoD **Signature of Faculty**

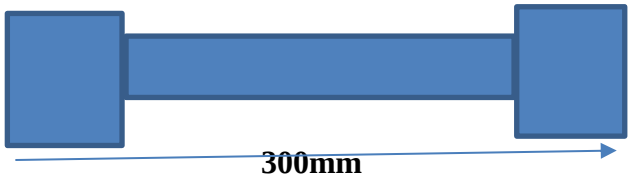
Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department Of Civil Engineering
ASSIGNMENT SHEET I

Academic Year : 2021-22 Date:30 /9/21
Semester : I
Name of the Program: B. Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor

The assignment sheet corresponds to Unit I

1. A tie bar has enlarged ends of square section 60mm X 60mm having tensile load of 87.5 KN at the ends as shown in fig., If the middle portion of the bar is also of square section, find the size and length of the middle portion if the stress is 140 N/mm^2 and the total extension of the bar is 0.14mm. (E=2x10^5 N/mm^2)



2. Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 500mm apart. Diameters and length of each rod are 20mm and 4m respectively. A cross bar fixed to the rods at the lower ends carries a load of 5 KNsuch that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. (E of steel=2x10^5 N/mm^2, E of copper =1x10^5 N/mm^2)

3. A 20mm steel bolt passes centrally through a steel sleeves 50mm external diameter and 1.25m long. The tube is closed by rigid washers of negligible thickness. Find the stresses in each when the nuts are tightened until the sleeve is reduced in length by 0.125mm.(E of steel=2x10^5 N/mm^2)

4. A steel tube 50m external diameter and 3mm thick encloses centrally a solid copper bar of 35mm diameter. The bar and tube are rigidly connected at the ends at a temperature of 20oc. Find the stress in each material when heated to 170oc. Also find the increase in length, if the original length is 350mm.(E of steel=2x10^5 N/mm^2, E of copper =1x10^5 N/mm^2) coefficient of expansion is 1.7X10^{-5} per ^{o}c

Course Objective No: 1

Course Outcome No: 1

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering
TUTORIAL SHEET II

Academic Year : 2021-22 Date:20/10/21
Semester : I
Name Of The Program: B.Tech Year: II Year Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name Of The Faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor

The tutorial sheet corresponds to Unit II

1. A beam 6m long carries a uniformly distributed load of 25 KN/m. The beam is simply supported at left end and at a point distant x from the right hand end. Determine the value of x if the midpoint of the beam is to be a point of contraflexure and for this position draw the shear force and bending moment diagrams.
2. Draw the shear force and bending moment diagrams for a simply supported beam of span 4.5m subjected to UDL of 40KN/m over the entire length and 30KN point load at centre. Locate the salient points
3. Draw the shear force and bending moment diagrams for a overhanging beam oh length 10m with simply supported at $1/3^{rd}$ of span carrying point load 50KN at the extreme ends and UDL at middle third span.

Course Objective No: 2 **Course Outcome No: 2**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering
ASSIGNMENT SHEET II

Academic Year	:	2021-22	Date: 20/10/21
Semester	:	I	
Name of the Program	:	B.Tech	Year: II YEAR Section: A
Course	:	Solid Mechanics-I	Course Code: GR20A2011
Name of the faculty	:	K Hemalatha	Dept: Civil Engineering
Designation	:	Assistant Professor	

The assignment sheet corresponds to Unit II

1. The intensity of loading simply supported of 5m span increases uniformly from 8 KN/m at one end to 16 KN/m at the other end . Find position and magnitude of maximum bending moment. Also draw shear force and bending moment diagram.
2. A beam 9m long is simply supported at its ends. It carries a uniformly distributed load of 25.28 KN/m run over the blength of left half of its span together with concentrated loads of 20 KN, 30 KN and 20 KN situated at 1.2m, 2.1m and 4.5m respectively from right hand support. Draw shear force and bending moment diagram for bean and find out magnitude and position of maximum bending moment takes place in beam.
3. Develop bending moment and shear force as shown in the figure indicating the maximum and minimum values.

4. A simply supported beam is loaded as shown in the figure. Draw shear force and bending moment diagrams indicating the significant values along the beam.

Course Objective No: 2 **Course Outcome No: 2**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering
TUTORIAL SHEET III

Academic Year : 2021-22 Date:30/10/21
Semester : I
Name of the Program : B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor
The tutorial sheet corresponds to Unit III

1. a) Derive the formula for horizontal shearing stress from first principles.
   b) Derive the relation between horizontal and vertical shearing stresses

2. At a point in a beam section there is a longitudinal bending stress of 120 N/mm^2 tensile and a transverse shear stress of 50 N/mm^2. Find the resultant stress on a plane inclined at 30^o to the longitudinal axis.

3. A simply supported beam 125mm wide and 200mm deep and 6m long carries a uniformly distributed load of 5KN/m. determine the shear stress developed at horizontal layers 60mm apart from top to bottom for a section 1.5m from the right support. Also determine the maximum shearing stress developed in the beam.

4. A I section 250mmX125mm has flanges 12.5mm thick and web 6.9mm thick. Compare its flexural strength with that of a beam of rectangular section of same weight, the depth being twice the width.

Course Objective No:3 **Course Outcome No:3**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering
Assignment Sheet III

Academic Year : 2021-22 Date:30/10/21
Semester : I
Name of the Program : B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor
The assignment sheet corresponds to Unit III

1. Explain briefly about the assumptions made in theory of simple bending.

2. Compare the flexural strength of two similar beams of the same material each of square cross section one placed with two sides vertical and the other placed with one diagonal vertical. The maximum bending stress is to be the same in two cases.

3. The cross section of I section beam with flange width and thickness 200mm and 10mm, web width and height of 8mm and 380mm. If the permissible stress is 150 N/mm2, find the moment of resistance. Compare it with equivalent section of same area with a) square section b) Rectangular section with depth twice the width and c) circular section

4. A steel beam having a T section of flange width 100mm and 20mm thickness with overall length 100mmis simply supported over a span of 5m. If the maximum allowable stress is 50 N/mm2, calculate the maximum uniformly distributed load the beam will carry over the entire span.

5. Determine the magnitude and the location of the maximum shear stress developed in a beam with cross section shown in the figure due to the action of a shear force.

Course Objective No:1 **Course Outcome No:3**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering
TUTORIAL SHEET IV

Academic Year : 2021-22 Date:30/10/27
Semester : I
Name of the Program : B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor
The tutorial sheet corresponds to Unit IV

1. Compute the maximum deflections and support rotations in the beams of the following figure using a) method of integration and b) Method of moment area.

2. Compute the maximum deflections and support rotations in the beams of the following figure using a) method of integration and b) Method of moment area.

3. Determine the deflection profile of a simply supported beam of 8m span with an overhang of 2.5m at one end when subjected to a clockwise moment of 100KN-M at 3m from its left support. Assume EI=20MN/m^2

4. Determine the mid-span displacements and slopes at the supports in the beams shown in figure using the Macaulay's method. Assume constant flexural rigidity for the beams.

Course Objective No:4 **Course Outcome No:4**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department Of Civil Engineering
ASSIGNMENT SHEET IV

Academic Year : 2021-22 Date:20/01/22
Semester : I
Name of the Program: B.Tech CIVIL Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept:Civil Engineering
Designation : Assistant Professor

The assignment sheet corresponds to Unit IV

1. A horizontal cantilever of uniform section and length 'L' carries a load 'W' at a distance L/4 from the free end. Derive from the first principles the deflection at the free end in terms of W, L, E and I.
2. Determine the mid span displacements and slopes at the supports in the beam shown in figure using method of integration. Assume flexural rigidity for the beams.

3. A horizontal beam of uniform section and 6m long is simply supported at its ends. Two vertical loads of 48 KN act at 1m and 3m respectively from the left hand support. Determine the position and magnitude of maximum deflection. Take E=200GN/mm^2 and I=85X10^6 mm^4
4. Determine the mid span displacement and slope at the supports in beam shown in figure using Macaulay's method. Assume flexural rigidity for the beams.

Course Objective:4 **Course Outcome:4**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering
TUTORIAL SHEET V

Academic Year	:	2021-22	Date:10/01/22
Semester	:	I	
Name of the Program	:	B.Tech	Year: II YEAR Section: A
Course	:	Solid Mechanics-I	Course Code: GR20A2011
Name of the faculty	:	K Hemalatha	Dept: Civil Engineering
Designation	:	Assistant Professor	

The tutorial sheet corresponds to Unit V

1. A rectangular steel bar is subjected to a tensile stress of 80 N/mm^2 as well as a shear stress of 30 N/mm^2. Determine the principle stress and strain. Find also what stress acting alone can produce the same maximum strain (poison's ratio=0.31)

2. At a point the principle stress es are 140N/mm^2 and 75 N/mm^2 both tensile. Find the normal and tangential stresses on a plane inclined at 60^o to the axis of the major principle stress.

3. When a certain thin walled tube is subjected to internal pressure and torque the stresses in the tube wall are

a) 60 N/mm^2 tensile

b) 30 N.mm^2 tensile in a direction right angle to a)

c) shear stress of 45 N/mm^2 in the direction of a) and b)

Calculate the normal stress and tangential stress on the two planes which are equally inclined to a) and b)

4.When a certain thin walled tube is subjected to internal pressure and torque the stresses in the tube wall are
a) 60 N/mm^2 tensile
b) 30 N.mm^2 tensile in a direction right angle to a)
c) Shear stress of 45 N/mm^2 in the direction of a) and b)
What are the results due to an end thrust b) is compressive a) and c) being unchanged.

Course Objective:5 **Course Outcome: 5**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

ASSIGNMENT SHEET V

Academic Year : 2021-22 Date:30/12/22
Semester : I
Name of the Program : B.Tech Year: II YEAR Section: A
Course : Solid Mechanics-I Course Code: GR20A2011
Name of the faculty : K Hemalatha Dept: Civil Engineering
Designation : Assistant Professor
The assignment sheet corresponds to Unit V

1. At a point in a strained material the principal stresses are 1000 N/mm^2 and 50 N/mm^2. Find the normal and shear stress at a section inclined at 30^o with the axis of major principal stress.

2. At apoint in a strained material the principal stresses are 60 N/mm^2 and 40 N/mm^2. Find the position of the plane across which the resultant stress is most inclined to the normal and determine the value of this stress.

3. At a certain point in a piece of elastic material are normal stress of 45 N/mm^2 tension and 30 N/mm^2 compressions on two planes at right angles to one another together with shearing stress of 22.50 N/mm^2 on the same planes. If loading on the material is increased to that the stresses reach values of K times those given, find the maximum direct stress is not to exceed 120N/mm^2 and the maximum shearing stress is not to exceed 75 N/mm^2

4. Direct stress of 100 N/mm^2 (tensile) and 90 N/mm^2 (compressive) exist in two mutual perpendicular planes at a certain point in a body. They are also accompanied by shear stress at the point due to these is 150 N/mm^2. Find

a) The shear stress on these planes

b) The maximum shear stress at the point

Course Objective:5 **Course Outcome: 5**

Signature of HoD **Signature of Faculty**

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

Department of Civil Engineering

Evaluation Strategy

Academic Year	: 2021-22		
Semester	: I		
Name of the Program	: B.Tech	Year	: II Year Section: A
Course	: Solid Mechanics-I	Course Code	: GR20A2011
Name of the faculty	: K Hemalatha	Dept	:Civil Engineering
Designation	: Assistant Professor		

1. Target:
   A. Percentage for pass : 80%
   B. Percentage of the class :

   Total Strength of the class: 64

S.No.	Class / Division	No. of students
1	First class with distinction	15
2	First class	37
3	Pass class	12

2. Course Plan & Content Delivery

S.No.	Plan	Brief Description
a	Practice classes	75 practice classes for A Section, 70 practice classes for B Section
b	Presentation	Presentation on four topics: 1) The relation of externally applied loads and its internal effects on the body, tensile & compressive forces in single sections and composite bars. 2) Explanation of shear forces and bending moments under different types of loading. 3) Explanation of shear stresses, bending stresses, flexural stresses. 4) principal stresses and strains
c	Demonstration	Exercises in each unit are designed to calculate stresses, strain, elastic moduli, shear forces, bending moments under different loadings, shear stresses, bending stresses across various sections, principal stresses and principal strain using different methods.

3. Method Of Evaluation

a	Internal Examination	2
b	Seminars,quiz,assignments,projects	2
c	External Examination	1

3.1 Continuous Assessment examinations (CAE-I, CAE-II)

A. Assignments: Exercises in each unit are designed to calculate stresses, strain, elastic moduli, shear forces, bending moments under different loadings, shear stresses, bending stresses across various sections, principal stresses and principal strain using different methods.

B. Seminars: Assessing the skills of students in applying their knowledge to practical applications.

C. Quiz: Assessing the overall knowledge on various concepts.

D. **Internal Examination**: To assess their overall knowledge on Solid Mechanics I and their applications.

3.2 Semester / End Examination: To test their abilities in using Solid Mechanics I and to approve their abilities learnt during classes.

4. List out any new topics or any innovation you would like to introduce in teaching the subjects in this semester.

Introducing new concepts related to building or industrial structures.

Signature of HOD

Date:

Signature of Faculty

Date:

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

MAPPING

GR20A2011/ **Solid Mechanics-I**	**Course Outcomes**				
Course Objectives	1	2	3	4	5
1	X				
2		X			
3			X		
4				X	
5					X

Assessments in Relation to COs and CObs

Assessments:

1. Assignment
2. Internal Examination
3. External Examination

Course outcomes / Assessments	1	2	3	4	5
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X

Assignments & Assessments –Course objectives (CObs) Relationship matrix

Assessments:

1. Assignment
2. Internal Examination
3. External Examination

Course objectives / Assessments	1	2	3	4	5
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X

Course Objectives – Program Outcomes (POs) Relationship Matrix

Program -Outcomes / Course Objectives	a	b	c	d	e	f	g	h	i	j	k	l
1	X	X	X	X			X				X	X
2	X	X	X	X			X		X	X	X	X
3	X	X	X	X			X					X
4	X	X	X	X			X		X	X	X	X
5	X	X	X	X			X				X	X

Course Outcomes – Program Outcomes (POs) Relationship Matrix

Program -Outcomes / Course-Outcomes	a	b	c	d	e	f	g	h	i	j	k	L
1	X	X	X	X			X				X	X
2	X	X	X	X			X		X	X	X	X
3	X	X	X	X			X					X
4	X	X	X	X			X		X	X	X	X
5	X	X	X	X			X				X	X

Courses (with title & code) – Program Outcomes (POs) Relationship Matrix
Course: Solid Mechanics I

Program -Outcomes / Courses	a	b	c	d	e	f	g	h	i	j	k	L
1	X	X	X		X			X	X		X	X

Program Educational Objectives (PEOs) – Program Outcomes Relationship Matrix

PEOs / Course Outcomes	1	2	3
1		X	X
2	X	X	X
3		X	
4	X	X	X
5		X	

Assessments –Program outcomes (POs) Relationship matrix

Assessments:

1. Assignment
2. Internal Examination
3. External Examination

Programme outcomes / Assessments	A	b	c	d	e	f	g	h	i	j	k	L
1	x	x	x	x			x		x		x	x
2	x	x	x	x			x		x		x	x
3	x	x	x	x			x		x		x	x

Assignments & Assessments –Program Educational Objectives (PEOs) Relationship matrix

Assessments:

1. Assignment
2. Internal Examination
3. External Examination

PEOs / Assessments	1	2	3
1	X	X	X
2	X	X	X
3	X	X	X

GR20A2011/Solid Mechanics-I														
COs/POs	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**PSO's**	
													1	**2**
1. Determine the stresses, strains, elastic constants such as modulus of elasticity, modulus of rigidity, Poisson's ratio and bulk density. And also to determine the strain energy for various types of loading	H	M	M	M		M	M	M		M	M	M	M	M
2. Analyze the principal stresses and strains in different planes by using analytical and graphical methods	H	M	M	M		M	M	M		M	M	M		
3. Determine the shear force, bending moment diagrams and identify the point of contra flexure for different types of beams such as cantilever, simple supports and fixed beams with different loading.	H	H	H	H	M	M	M	M	M	H	H	H	M	H
4. Formulate the bending equation and shear equation to calculate the bending stresses and shear stresses for the different sections of the structural members.	H	H	H	H	M	M	M	M	M	H	H	H		M
5. Evaluate the slope and deflection of different beams for different end conditions and loads by using double integration, Macaulay's and Moment area methods.	H	H	H	H	M	M	M	M	M	H	H	H		H

RUBRIC TEMPLATE

Course: Solid Mechanics I | Academic Year: 2021-22
Class: II Year B. Tech Sem I | Department: Civil
Faculty: K Hemalatha | Designation: Asst. Prof

Objective: To Learn Theory and Concepts Of Solid Mechanics I

Student Outcomes: Analyse and Design Structural Members Subjected To Tension, Compression, Torsion, Bending And Combined Stresses Using The Fundamental Concepts Of Stress, Strain And Elastic Behaviour Of Materials And Utilize Appropriate Materials In Design Considering Engineering Properties, Sustainability, Cost And Weight.

			Beginning	Developing	Reflecting development	Accomplished	Exemplary	
S No	Name of the student	Performance criteria	1	2	3	4	5	score
1	21245 A0105 Pateru Mouna	Level of knowledge on different types of stress, strainand elastic modulii	Low level of knowledge on different types of stress, strain and elastic moduli	Able to understand different types of stresses, strain and elastic modulii	Ability to explain the basic difference between different stresses, strains, elastic modulii	Full knowledge on different types of stress, strain and modulus of elasticity required for designing any structural member.	Analyzing and application of knowledge on types of stress, strain and modulus of elasticity required for designing any structural member.	4
		Level of knowledge on shear force and bending moment diagrams of different beams	Low level of knowledge on types of beams and concept of shear force and bending moment	Able to calculate the shear force and bending moment diagrams of point load and UDL on different beams	Ability to apply the knowledge of shear force, BM diagrams in design of a structural member.	Full knowledge on calculation of SF, BM under point load, UDL and UVL	Analyzing and application of shear force and bending moments in designing of individual structural member	5
		Level of knowledge on calculation of slope and deflections of different beams under different loads	Low level of knowledge on calculation of slope and deflection of beams.	Able to calculate slope and deflection of different beams under different loading conditions.	Ability to apply the knowledge of slope and deflection of different beams	Full knowledge on calculation of slope and deflection of different beams under different loading conditions	Analyzing and application of slope and deflection calculations of different beams to design a member.	4
			Beginning	Developing	Reflecting development	Accomplished	Exemplary	
S No	Name of the student	Performance criteria	1	2	3	4	5	score

1	20241A0139 Pullagura Santhosh	Level of knowledge on different types of stress, strainand elastic modulii	Low level of knowledge on different types of stress, strain and elastic moduli	Able to understand different types of stresses, strain and elastic modulii	Ability to explain the basic difference between different stresses, strains, elastic modulii	Full knowledge on different types of stress, strain and modulus of elasticity required for designing any structural member.	Analyzing and application of knowledge on types of stress, strain and modulus of elasticity required for designing any structural member.	3
		Level of knowledge on shear force and bending moment diagrams of different beams	Low level of knowledge on types of beams and concept of shear force and bending moment	Able to calculate the shear force and bending moment diagrams of point load and UDL on different beams	Ability to apply the knowledge of shear force, BM diagrams in design of a structural member.	Full knowledge on calculation of SF, BM under point load, UDL and UVL	Analyzing and application of shear force and bending moments in designing of individual structural member	3
		Level of knowledge on calculation of slope and deflections of different beams under different loads	Low level of knowledge on calculation of slope and deflection of beams.	Able to calculate slope and deflection of different beams under different loading conditions.	Ability to apply the knowledge of slope and deflection of different beams	Full knowledge on calculation of slope and deflection of different beams under different loading conditions	Analyzing and application of slope and deflection calculations of different beams to design a member.	3

			Beginning	Developing	Reflecting development	Accomplished	Exemplary	
S No	Name of the student	Performance criteria	1	2	3	4	5	score
1	20241A0105 B.Pranav Sai	Level of knowledge on different types of stress, strainand elastic modulii	Low level of knowledge on different types of stress, strain and elastic moduli	Able to understand different types of stresses, strain and elastic modulii	Ability to explain the basic difference between different stresses, strains, elastic modulii	Full knowledge on different types of stress, strain and modulus of elasticity required for designing any structural member.	Analyzing and application of knowledge on types of stress, strain and modulus of elasticity required for designing any structural member.	1
		Level of knowledge on shear force and bending moment diagrams of different beams	Low level of knowledge on types of beams and concept of shear force and bending moment	Able to calculate the shear force and bending moment diagrams of point load and UDL on different beams	Ability to apply the knowledge of shear force, BM diagrams in design of a structural member.	Full knowledge on calculation of SF, BM under point load, UDL and UVL	Analyzing and application of shear force and bending moments in designing of individual structural member	1
		Level of knowledge on calculation of slope and deflections of different beams under different loads	Low level of knowledge on calculation of slope and deflection of beams.	Able to calculate slope and deflection of different beams under different loading conditions.	Ability to apply the knowledge of slope and deflection of different beams	Full knowledge on calculation of slope and deflection of different beams under different loading conditions	Analyzing and application of slope and deflection calculations of different beams to design a member.	1

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

COURSE COMPLETION STATUS

Academic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering Year: II Section: A

Course/Subject: Solid Mechnics-I

Course Code: **Sub Code: GR20 A2011**

Name of the Faculty: Mrs K Hemalatha Dept.: Civil Engineering

Designation: Asst.Professor

Actual Date of Completion & Remarks, if any

Units	**Remarks**	**Objectives Achieved**	**Outcomes Achieved**
Unit I	22-10-2021 Unit covered on time	1	1
Unit II	30-10-2021 Unit covered on time	2	2
Unit III	08-01-2022 Unit covered on time	3	3
Unit IV	17-01-2022 Unit covered on time	4	4
Unit V	07-02-2022 Unit covered on time	5	5

Signature of HOD Signature of faculty

Date: Date:

Note: After the completion of each unit mention the number of Objectives & Outcomes Achieved.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY

(Autonomous)

II B.Tech I Semester Mid- I Examinations(AY 2021-22)

SOLID MECHANICS I

(Civil Engineering Department)

Time: 40 Minutes **Max Marks: 20**

SUBJECTIVE
(Answer any Two questions)

Time: 30 Minutes **2 * 5 = 10 Marks**

1	a) A steel tube 50m external diameter and 3mm thick encloses centrally a solid copper bar of 35mm diameter. The bar and tube are rigidly connected at the ends at a temperature of 20 ^{o}c. Find the stress in each material when heated to 170^{o}c. Consider E of steel=2x10^{5} N/mm^{2}, E of copper =1x10^{5} N/mm^{2} coefficient of expansion is 1.7X10^{-5} per ^{o}c.	**[5]**	**CO1**	**BL2**
2	The principal stresses at a point in a bar are 260N/mm^{2} (tensile) and 100 N/mm^{2} (compressive). Determine the resultant stresses in magnitude and direction on a plane inclined at 50^{o} to the axis of major principal stress. Also determine the maximum intensity of shear stress in the material at the point.	**[5]**	**CO2**	**BL2**
3	(a) Draw the Shear Force diagram and bending moment diagram for cantilever beam carrying point load 50KN at the free end. (b) Draw the Shear Force diagram and bending moment diagram for simply supported beam carrying uniformly distributed load over the entire span.	**[5]**	**CO3**	**BL3**

OBJECTIVE

Multiple Choice Questions (MCQs)

(Answer ALL questions. All questions carry equal marks)

Time: 10 Minutes **10 *1 = 10 Marks**

1	Which of the following materials is more elastic? A) Rubber B) Glass C) Steel D) Wood	**[ ]**
2	Shape of true stress-strain curve for a material depends on A) Stress B) Strain rate C) Temperature D) A,B,C	**[ ]**
3	Strain in a direction at right angle to the direction of applied force is .. A) Lateral strain B) Shear strain C) Volumetric strain D) None	**[ ]**
4	If linear expansion of copper is more than that of steel then ……& …… type of stresses will develop in steel and copper. A) Compressive & Tensile B) Tensile & Compressive C) Shear and Tensile D) Shear & Compressive	**[ ]**
5	Relationship between modulus of rigidity and bulk modulus is given by A) $E= 2K (1+\mu)$ B) $E= 2K (1-2\mu)$ C) $E= 3K(1+2\mu)$ D) $E= 3K(1-2\mu)$	**[ ]**
6	Principal strain theory is proposed by A) Haigh B) Rankine C) Guest D) Venant	**[ ]**
7	The shear stress acting on principal plane is A) One B) Zero C) Maximum D) Minimum	**[ ]**
8	The maximum shear stress by Mohr's circle method is equal to ……. A) Diameter B) Radius C) not defined D) Normal stress	**[ ]**
9	A beam with one end fixed and another end free is A) Cantilever B) Simply supported C) Fixed D) Continuous	**[ ]**
10	Number of unknown reactions for roller support is A) One B) Two C) Three D) Zero	**[ ]**

*****

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

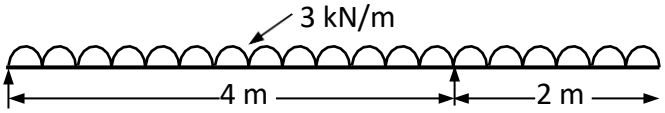
II YEAR B.TECH II MID EXAMINATION 2021-22 AY

Name of the subject: Solid Mechanics I **Date: 05/02/2022 (FN)**

Course Code: GR20A2011 **Time: 10 minutes**

Answer any two questions: **Marks: 2X5= 10M**

1. Draw the shear force and bending moment diagram for the overhanging beam carrying uniformlydistributed load of 3 KN/m over the entire length as shown in Figure. Also locate the point of contraflexure (5M)



2. a)Prove that bending stress at any section of beam is directly proportional to the distance from neutral layer.

b) The shear force acting on a section of a beam is 50 kN. The section of the beam is of T shaped of dimensions 100mm x 100mm x 20mm. The flange thickness and web thickness are 20 mm. Find the shear stress at the neutral axis and the junction of web and flange ($I = 3.14 \times 10^6$ mm^4) (5M)

2. a) Explain briefly different methods to find slope and deflection and mention their merits and demerits

b) A simply supported beam of length L carries uniformly distributed load of w over the entire length. Ifthe modulus of elasticity is E, find the slope at the supports and maximum deflection. 5M

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

II YEAR B.TECH I SEMESTER MID II EXAMINATION 2021-22 AY

Name of the subject: Solid Mechanics I (GR20A2011) **Time: 10 minutes**

Roll No……. **05/02/2022 (AN)**

CHOOSE THE CORRECT ANSWERS 10X1 = 10 Marks

1. The shear stress at a fiber in a section of beam is given by ( )
   a) (FxAy/Ib) b) (FxAy/Id) c) (FxAx/Ib) d) None of the above
2. The shear stress is maximum at the NA for a circular section is given by ( )
   a) (3/4)avg b) (2/3)avg c) (4/3)avg d) (3/2)avg
3. For maximum deflection, slope dy/dx is ( )
   a) 1 b)0 c)05 d)2
4. The deflection at the center of simply supported beam carrying point load at center is given by ( )
   a) $yc=(wl^2/584EI$ b) $yc=(wl^2/384EI)$ c) $yc=(wl^2/48EI)$ d) None of the above
5. The slope dy/dx of a cantilever beam when a point load at free end is given by ( )
   a) Wl^2 / 2EI b) Wl^2 / 3EI c) Wl^2/4EI d) Wl^2/6EI
6. The deflection by moment area method is given by ( )
   a) A/EI b) Ax /EI c) x/EI d) None of above
7. The shear stress for a triangular section is maximum at a height of ( )
   a) h/2 b) h/3 from top c) h/3 from bottom d) 2h/3 from top
8. Bending moment at Point of Contra flexure is given by ( )
   a) 1 b) 0 c) negative d) depends on load
9. Bending moment at the free end of cantilever beam is given by ( )
   a) 1 b) 0 c) negative d) depends on load
10. Which method is more suitable when multiple loads are acting ( )
    a) Double Integration b) Moment Area Theoremc) Macaulay's method d) all of the above

Cholamraju Rangaraju Institute of engineering and Technology

Name: A Srikar Rao Roll-NO: 2021 1A0101

Branch/sec: 2021 1A010 CIVIL-1A Subject: [illegible]

20/20

A	B	A	B	A	B	A	B

PART-A

1. a
2. c
3. b
4. c
5. a
6. b
7. a
8. b
9. b
10. c

10

let us calculate

Strain in EF = $\frac{\text{change in length of EF}}{\text{original length}}$

$= \frac{(R+y)\theta - dx}{dx}$

$\frac{(R+y)\theta - R\theta}{R\theta}$

$\frac{\sigma}{E} = \frac{y}{R}$

$\Rightarrow \boxed{\frac{\sigma}{y} = \frac{E}{R}} \Rightarrow \boxed{\sigma = y \times \frac{E}{R}}$

from A, we can prove, that the bending stress is directly proportional to distance from neutral layer

as $\frac{E}{R}$ = constant $\boxed{\sigma \propto y}$

2(a)

Given

shear force acting = 50kN $\Rightarrow F = 5 \times 10^4 N$

I section of dimensions

100x100x20 mm

Given $I = 3.14 \times 10^4 mm^4$

Max bending moment

$M = \frac{NL^2}{8}$

we have shear stress $\tau = \frac{FA\bar{y}}{bI}$

position of N = $\frac{A_1y_1 + A_1y_2}{A_1 + A_2} = \frac{1600(40)}{1600+1000} = 67.77 mm$

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NAME: B. RITHVIK REDDY

SUBJECT: Solid Mechanics I

ROLL NO: 2024 1A0 103

DATE: 5-02-2022

BRANCH: CIVIL

SECTION: A

PART-A (OBJECTIVE)

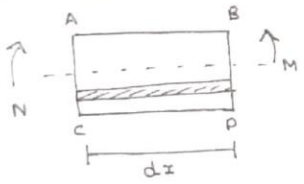
15/20

1. A - $t = (F_x A_x / I_b)$
2. B - $t_{max} = (2/3)\tau_{A\&B}$
3. B - 0
4. C - $Y_c = (\omega l^2 / 48EI)$
5. A - $WL^2/2EI$
6. B - Ax/EI
7. D - 2h/3 from top
8. B - 0
9. B - 0
10. C - Macaulay's Method

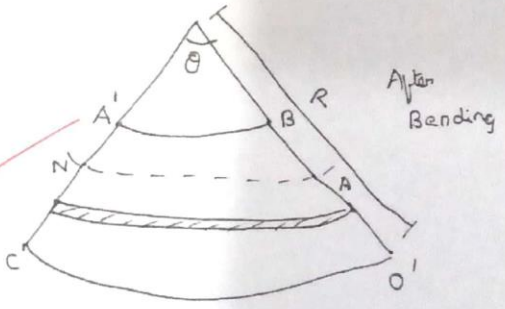
8

PART-B (SUBJECTIVE)

2. a) Let us Consider a Rectangular Beam ABCD..... & Consider a Strip EF of length dx & it is at a distance of y from Neutral Axis.



Before Bending



When After Bending:

Length of Neutral Axis = $R\theta$

Length of EF = $(R+4)\theta$

∴ Acc to Assumption Made in Simple Bending, the length of NA doesn't Change After Bending.

i.e, ⇒ Length of NA = Length of NA

Before Bending = After Bending

$$\boxed{dx = R\theta}$$

$$= \frac{(2+y)\theta - dx}{dx}$$

$$= \frac{(R+y)\theta - R\theta}{R\theta}$$

$$= \frac{y\theta}{R\theta}$$

$$\frac{n}{\epsilon} = \frac{y}{R}$$

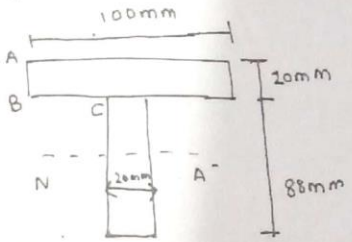
$$\Rightarrow \frac{\sigma}{y} = \frac{\epsilon}{R}$$

$$\boxed{\sigma = y \cdot \epsilon / R}$$

2b. Given, Shear Force Acting = 50KN ⇒ $F = 5 \times 10^4$ N.

I - Section of Dimensions

100 x 100 x 20 mm



Given $I = 314.221 \times 10^4$ mm^4

MAX. Bending Moment

$$M = \frac{WL^2}{8}$$

We have Shear Stress $\uparrow = \frac{FA\bar{y}}{bI}$

$$\text{Position of NA} = \frac{A_1y_1 + A_2y_2}{A_1 + A_2}$$

$$= (1600)(40) + (2000)(40) / 1600 + 2000$$

$$= 67.77 \text{ mm}$$

gitanjali Rangaraju institute of engineering and technology

Name: sai Abhiram

RollNo: 20201A0102

Branch/sec: civil/A

subject

13/20

PART-A

1) (a)
2) (c) 7
3) (b)
4) (c)
5) (c) 6
6) (b)
7) (a) 8
8) (B)
9) (B)
10) (c)

After bending

length of Neutral axis = $R\theta$

length of EF = $(R+y)\theta$.

∴ Acc of assuption in simple bending the length of NA doesn't change after bending.

$$dx = x\theta$$

let us consider.

strain in EF = $\frac{\text{change in length of EF}}{\text{original length}}$.

$$= \frac{(R+y)\theta - dx}{dx}$$

$$\epsilon = \frac{(R+y)\theta - R\theta}{R\theta} = \frac{y\theta}{R\theta}$$

$$\frac{\sigma}{\epsilon} = \frac{y}{R}$$

$\{\because L = \frac{\sigma}{\epsilon}\}$

$$\frac{\sigma}{y} = \frac{\epsilon}{R} \rightarrow \boxed{\sigma = y\frac{\epsilon}{R}}$$

From A,

$\frac{\epsilon}{R}$ = constant $\boxed{\sigma \propto y}$

GR20 2021-22 B.Tech CE 210 GR20A2011 Solid Mechanics - I Sessional Marks

S.No	Roll No	MID-I Marks	MID-II Marks	Tutorial Marks	Assessment Marks	Sessional Marks
1	20241A0101	5	20	5	5	23
2	20241A0102	2	13	5	5	18
3	20241A0103	2	15	5	5	19
4	20241A0104	14	19	5	5	27
5	20241A0105	5	19	5	5	22
6	20241A0106	2	20	5	5	21
7	20241A0107	4	14	5	5	19
8	20241A0108	10	12	3	3	17
9	20241A0109	3	20	5	5	22
10	20241A0110	4	16	5	5	20
11	20241A0111	7	20	5	5	24
12	20241A0112	11	19	5	5	25
13	20241A0113	5	20	5	5	23
14	20241A0114	3	20	5	5	22
15	20241A0115	4	20	5	5	22
16	20241A0116	4	20	5	5	22
17	20241A0117	12	19	5	5	26
18	20241A0118	13	19	5	5	26
19	20241A0119	14	14	5	5	24
20	20241A0121	12	19	5	5	26
21	20241A0122	13	20	5	5	27
22	20241A0123	12	20	5	5	26
23	20241A0124	12	19	5	5	26
24	20241A0125	6	20	5	5	23
25	20241A0126	14	20	5	5	27
26	20241A0127	9	20	5	5	25
27	20241A0128	3	20	5	5	22
28	20241A0129	15	20	5	5	28
29	20241A0130	4	14	5	5	19
30	20241A0131	6	20	5	5	23
31	20241A0132	11	17	5	5	24
32	20241A0133	2	20	5	5	21
33	20241A0134	11	19	5	5	25
34	20241A0135	6	17	5	5	22
35	20241A0136	11	18	5	5	25
36	20241A0137	15	19	5	5	27
37	20241A0138	4	20	5	5	22
38	20241A0139	3	20	5	5	22
39	20241A0140	12	19	5	5	26
40	20241A0141	3	15	5	5	19
41	20241A0142	11	17	5	5	24
42	20241A0143	14	19	5	5	27
43	20241A0144	18	20	5	5	29
44	20241A0146	8	17	5	5	23
45	20241A0147	4	20	5	5	22
46	20241A0148	1	18	5	5	20
47	20241A0149	10	18	5	5	24
48	20241A0150	13	19	5	5	26
49	20241A0151	4	19	5	5	22
50	20241A0152	6	17	5	5	22
51	20241A0153	13	19	5	5	26
52	20241A0154	16	15	5	5	26
53	20241A0155	12	20	5	5	26
54	20241A0156	5	20	5	5	23
55	20241A0157	4	20	5	5	22
56	20241A0158	12	20	5	5	26
57	20241A0159	5	19	5	5	22

58	20241A0160	8	20	5	5	24
59	21245A0101	17	20	5	5	29
60	21245A0102	18	16	5	5	27
61	21245A0103	18	20	5	5	29
62	21245A0104	17	20	5	5	29
63	21245A0105	18	20	5	5	29

Sections: A

Signatures:

CODE: GR20A2011	GR 20	SET - 1

II B.Tech I Semester Regular Examinations, February 2022
SOLID MECHANICS I
(Civil Engineering)

Time: 3 hours **Max Marks: 70**

Instructions:

1. Question paper comprises of **Part-A** and **Part-B**
2. **Part-A** (for 20 marks) must be answered at one place in the answer book.
3. **Part-B** (for 50 marks) consists of **five questions with internal choice,** answer all questions.

PART – A

(Answer ALL questions. All questions carry equal marks)

10 * 2 = 20 Marks

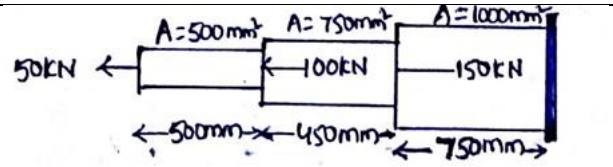
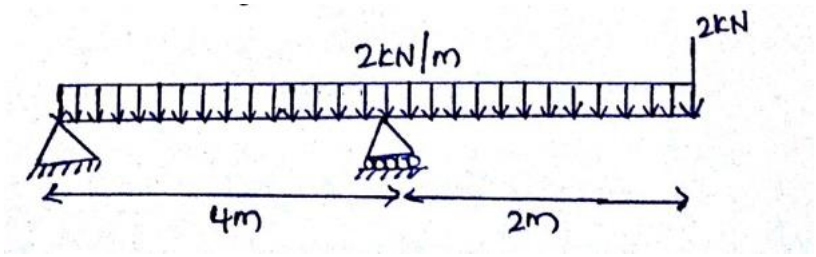
1. a.	Define the terms i)Thermal stress ii) Elastic limit iii)Modulus of Elasticity iv)shear modulus	**[2]**	**CO1**	**BL1**
b.	What is the difference between impact loading and sudden loading	**[2]**	**CO1**	**BL1**
c.	Write a note on Mohr's circle	**[2]**	**CO2**	**BL2**
d.	Define Principal stress and Principal plane.	**[2]**	**CO2**	**BL1**
e.	Define Point of Contraflexure.	**[2]**	**CO3**	**BL1**
f.	What are different types of beams and different types of loads acting on a beam?	**[2]**	**CO3**	**BL2**
g.	Define the terms i) Section modulus ii) Neutral axis iii) Pure bending iv) Moment of Resistance	**[2]**	**CO4**	**BL2**
h.	Sketch the shear stress distribution diagram across the depth of the beam for following sections: i) T Section ii) Square section with diagonal vertical	**[2]**	**CO4**	**BL3**
i.	What is the maximum slope and deflection of a simply supported beam of length 'L' carrying uniformly distributed load .	**[2]**	**CO5**	**BL1**
j.	Write the relationship between rate of loading, shear force, slope and deflection at a section of beam.	**[2]**	**CO5**	**BL2**

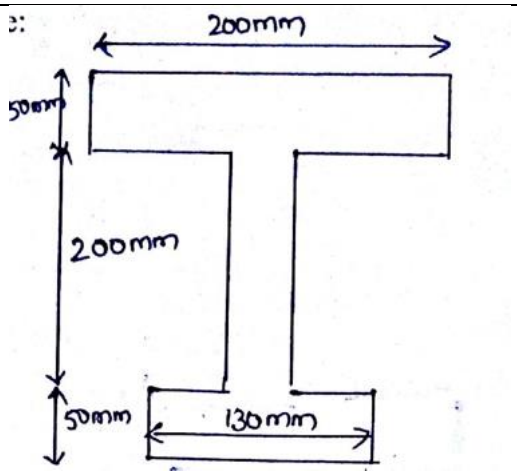
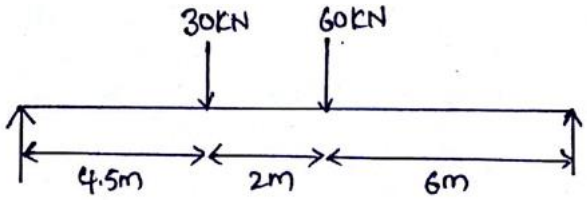
PART – B

(Answer ALL questions. All questions carry equal marks)

5 * 10 = 50 Marks

2.	(a) Draw the stress strain diagram of mild steel and explain salient points. (b) Determine the elongation of a stepped bar subjected to axial forces as shown in figure.	**[10]**	**CO1**	**BL3**

				
	OR			
3.	A steel rod of 20mm diameter passes centrally through a copper tube of 50mm external diameter and 40mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly on the projected parts of the rod. If the temperature of assembly is raised by 50oc. Calculate the stresses in copper and steel. $Es=2X10^5N/mm^2$ $Ecu=10^5N/mm^2$, $\alpha_s=12X10^{-6}/^oc$, $\alpha_{cu}=18X10^{-6}/^oc$	**[10]**	**CO1**	**BL3**
4.	a) The principal stresses at a point in a bar are $160N/mm^2$ (tensile) and $80 N/mm^2$ (compressive). Determine the resultant stresses in magnitude and direction on a plane inclined at 60^o to the axis of major principal stress. Also determine the maximum intensity of shear stress in the material at the point. b) Explain in detail the procedure to draw Mohr's circle for carrying tensile stresses in axial direction.	**[10]**	**CO2**	**BL3**
	OR			
5.	(a) Derive the expression for Maximum Principal Strain Theory (b) Derive the expression for Maximum Strain energy Theory.	**[10]**	**CO2**	**BL3**
6.	Draw the shear force and bending moment diagram for the beam as shown in figure and locate the point of contraflexure. 	**[10]**	**CO3**	**BL4**
	OR			
7.	(a) Define beam and explain different types of beams with neat figures. (b) Draw the Shear Force diagram and bending moment diagram for simply supported beam carrying point load at centre.	**[10]**	**CO3**	**BL4**
8.	a) Prove that bending stress at any section of beam is directly proportional to the distance from neutral layer. b) A simply supported beam of span 5m carrying point load 25KN at the centre. The moment of inertia about section is $2.85X10^4$ mm^4.Determine the bending stress over the depth of section as shown in figure.	**[10]**	**CO4**	**BL4**

				
	OR			
9.	The shear force acting on a section of a beam is 50 KN. The section of the beam is of T shaped of dimensions 100mm x 100mm x 20mm. The flange thickness and web thickness are 20 mm. Find the shear stress at the neutral axis and the junction of web and flange and also draw a neat sketch of stress distribution diagram.	**[10]**	**CO4**	**BL4**
10.	Compute the maximum deflection and support rotations of the following beam using a) Method of Integration b) Moment Area method 	**[10]**	**CO5**	**BL4**
	OR			
11.	(a) A cantilever of length 2m carries UDL of 2KN/m over a length of 1m from free end and a point load of 1KN acting at free end. Find the slope and deflection at the free end using Double Integration method. I= $6.67X10^7$ mm^4 $E=2X10^5N/mm^2$ (b) Explain briefly different methods to find slope and deflection and mention their merits and demerits	**[10]**	**CO5**	**BL4**

*****