Solid Mechanics-II

(Course Code: GR20A2016)

II Year B.Tech - II Semester

(AY 2021-22)

Dr. T. SRINIVAS

Professor

Department of Civil Engineering

Gokaraju Rangaraju Institute of Engineering and Technology

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

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering
Strength of Materials – II

Course File Check List

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GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SOLID MECHANICS II

Course Code: GR20A2016 **L/T/P/C: 2/1/0/3**

II Year II Semester

UNIT I:

THIN AND THICK CYLINDERS

Derivation of formula for longitudinal and calculation of hoop stress, longitudinal stress in a cylinder, longitudinal and volumetric strains, changes in diameter, volume of thin cylinders and sphere subjected to internal pressures. Introduction -Lame's theory for thick cylinders- Derivation of Lame's formulae, distribution of hoop, radial stresses across thickness due to internal pressure, design of thick cylinders and thick spherical shells.

UNIT-II

TORISION OF CIRCULAR SHAFTS:

Derivation of torsion equation and its assumptions**,** Torsional moment of resistance, polar section modulus, power transmitted by shafts, torsional rigidity, combined bending, torsion and end thrust of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

Springs Introduction, types of springs, analysis of close coiled helical spring.

UNIT-III

COLUMNS AND STRUTS:

Introduction –Types of columns – short, medium and long columns – Axially loaded compression members- crushing load – Euler's theorem for long columns – assumptions – derivation of Euler's critical load formulae for various end conditions- Equivalent length of a column- slenderness ratio- Euler's critical stress – Limitations of Euler's theory- Rankine – Gordon formula- long columns subjected to eccentric loading – secant formula – Empirical formulae – Straight line formula- Prof. Perry's formula.

BEAM COLUMNS

Laterally loaded struts- subjected to uniformly distributed and concentrated loads –Maximum B.M and stress due to transverse and laterally loading.

UNIT-IV

DIRECT AND BENDING STRESSES:

Stresses under the direct action of direct loading and bending moment, core of a section-determination of stresses in the case of chimneys, retaining walls and dams- conditions for stability -stresses due to direct loading and bending moment about both axis.

UNIT-V

UNSYMMETRICAL BENDING:

Introduction – Centroidal principal axes of section – Graphical method for locating principal axes –Moment of inertia referred to any set of rectangular axes- Stresses in beams subjected to unsymmetrical bending – principal axes- Resolution of bending moment into two rectangular axes through the centroid - Location of neutral axis-Deflection of beams under unsymmetrical bending .

BEAMS CURVED IN PLAN:

Introduction – Circular beams loaded uniformly and supported on symmetrically placed columns Semi circular beams simply supported on three equally spaced supports.

TEXT BOOKS:

1) A text book of Strength of materials by R.K Bansal-Laxmi Publications(P) ltd.,new Delhi
2) Strength of materials by Basavrajaiah and Mahadevappa, university Press
3) Strength of materials by Bhavikatti, Vikas Publications

REFERENCES

1) Mechanics of solid by ferdinandp Beer and others-tata Mc.grawhill Publications
2) Strength of materials by S.Ramakrishna and R.Narayan-Dhanpat Rai Publications.
3) Strength of materials by R.K.Rajput, S.Chand & Co, New Delhi
4) Strength of materials by A.R.basu, Dhanpat Rai & Co, Nai Sarah, New Delhi.
5) Strength of materials by L.S.Srinath et al.,Macmillian Idia Ltd

DEPARTMENT OF CIVIL ENGINEERING

II BTech (GR-18) - II Semester **AY: 2021-22** **SEC: A** **wef : 07-03-2022**

DAY/ HOUR	08:50-9:40	9:40-10:30	10:30-11:20	11:20-12:00	12:00-12:55	12:55-1:50	01:50-2:45
Monday	BEEE	SM II	SM II	Lunch Break	SA I	SA I	EAE
Tuesday	BEEE	HE	HE		CADLAB / FM & HM LAB		
Wednesday	SURVEY LAB/ FM & HM LAB				SA I	HE	BEEE
Thursday	SA I	SA I	BEEE		SM II	HE	HE
Friday	SURVEY LAB/ CAD LAB				SA I	SM II	SM II
Saturday	EAE	EAE	SM II		LIBRARY/ SPORTS/MENTORING		

ROOM NO	
Theory / Tutorial	4222
Lab	SURVEY LAB 4122/FM&HM LAB 4218/19, CAD Lab:4205
II Year Co-ordinator	
Mr.S.Venkatacharyulu	
Class Co-ordinator	
Mrs.I.Chandana	

CODE	Subject Name	CODE	Faculty Name
GR20A2016	Solid Mechanics – II	Dr.KS	Dr.K.Srikanth (Dr.K.S-1594)
GR20A2017	Basic Electrical and Electronics Engineering	Mr.PP	Mr.P.Praveen (Mr.PP-609)
GR20A2018	Structural Analysis – I	Mrs.KHL	Mrs.K.Hemalatha(Mrs.KHL-1177)
GR20A2004	Economics and Accounting for Engineers	Mrs.Y.G	Mrs.Y.Gayathri (Mrs.YG-257)
GR20A2019	Hydraulic Engineering	Dr.MD.H	Dr. Mohammed Hussain(Dr.Mohd.H-861)
GR20A2020	Surveying Lab	Mr.SPR/Mr.AP	Mr.Siva Prasad Raju (Mr.SPR-840)/Mr.A.Prakash (Mr.AP-1502)
GR20A2021	Computer Aided Design Lab	Mr.CVK/Mr.YKR	Mr.C.Vivek Kumar(Mr.CVK-1500)/Mr.Y.Kamala Raju (Mr.YKR-929)
GR20A2022	Fluid Mechanics and Hydraulic Machinery Lab	Mr.SVC/Mr.RR/ Mrs.OSDHB	Mr.S.Venkatacharyulu (Mr.SVC-814)/Mr.Rathod Ravinder (Mr.RR-1501)/Mrs.OSD Himabindu (972)

Almanac	
1st Spell of Instruction	07-03-2022 to 30-04-2022
1st Mid-term Examinations	02-05-2022 to 04-05-2022
2nd Spell of Instruction	05-05-2022 to 29-06-2022
2nd Mid-term Examinations	30-07-2022 to 02-07-2022
Preparation	04-07-2022 to 09-07-2022
End Semester Examinations/ (Theory/ Practicals) Regular/Supplementary	11-07-2022 to 30-07-2022

Time Table-Coordinator
Mr.Rathod Ravinder

HOD-CE
Dr.C.Lavanya

DAA

CODE	Subject	Faculty
GR20A2016	Solid Mechanics-II	Dr T Srinivas

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)
Department Of Civil Engineering

Vision

To become a pioneering centre in civil engineering through quality education, innovation, and entrepreneurship.

Mission

- To produce well qualified and talented engineers by imparting quality education.
- To enhance the skills of entrepreneurship, innovativeness, management and life-long learning in young engineers.
- To inculcate professional ethics and make socially responsible engineers.

Program Educational Objectives

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

Graduates of the Civil Engineering programme will be able to

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.

Program Specific Outcomes

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
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COURSE OBJECTIVES

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

On completion of this Subject/Course the student shall be able to:

S.No	Objectives
1	Knowledge of various stresses in thin and thick cylinders under pressures and show stress distribution diagrams
2	Introduce concept of torsion and bending in circular shafts and springs
3	Evaluate the bulking or failure load for axially loaded and eccentrically loaded columns and struts.
4	Knowledge of direct and bending stresses in concrete structures like retaining wall, chimney, dams and stability in dams.
5	Describe unsymmetrical bending in simply supported beams and to memorise beams incurved plan.

Signature of HOD Signature of faculty

Date: Date:

Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

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

COURSE OUTCOMES

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

On completion of this Subject/Course the student shall be able to:

S.No	Outcomes
1	Compute various stresses in thin and thick cylinders under pressure, show stressdistribution diagrams and define Lame's theorems.
2	Analyse the torsional strength of structural members and differentiate between closed and open coiled helical springs.
3	Determine the buckling failure load for axially loaded and eccentrically loaded columns.
4	Evaluate stresses in chimneys, retaining walls and dams and to check the stability of dams.
5	Evaluate the behaviour of members under unsymmetrical bending and locate shear centresfor the section and find stresses in circular and semi-circular beams.

Signature of HOD Signature of faculty

Date: Date:

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Civil Engineering

STUDENT ROLL LIST

B.Tech Civil Engg. II Yr-II Sem - GR 20 A.Y: 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	20241A0121	K.KONDAL
21	20241A0122	KAMMAMPATI UDAYKIRAN
22	20241A0123	KARNE SRITHAN
23	20241A0124	KUNCHALA VARUN KUMAR
24	20241A0125	KUNTA NITHIN REDDY
25	20241A0126	M PAVAN KALYAN
26	20241A0127	MERE MAHESH
27	20241A0128	MOHAMMED AHMED
28	20241A0129	MOTHUKURI LAXMAN
29	20241A0130	MOTTADI ADITYA TEJA
30	20241A0131	MULA SUSHMA SRI
31	20241A0132	NAYINI SWETHA

32	20241A0133	PAIDIPALLY BHARATH
33	20241A0134	P.SAI KIRAN REDDY
34	20241A0135	PASNOOR PAVAN PRATHAP REDDY
35	20241A0136	PATHLAVATH SHIVA NAYAK
36	20241A0137	PEDDIBOINA ANUSHA
37	20241A0138	POREDDY ABHINAV REDDY
38	20241A0139	PULLAGURA SANTHOSH
39	20241A0140	RACHALA BHARATH
40	20241A0141	RADHARAPU SHAJI KUMAR
41	20241A0142	RAMAVATH ROJA
42	20241A0143	RATHLAVATH SAIRAM NAYAK
43	20241A0144	RAVI TEJA PASUNUTHI
44	20241A0146	SADDI SHRIANK REDDY
45	20241A0147	SATHVIKA NARLA
46	20241A0148	SOKKULA KOUSHIKREDDY
47	20241A0149	SRIRAM PANDAVULA
48	20241A0150	T.BHARGAVI
49	20241A0151	T.BHUVANESHWARI
50	20241A0152	S.TEJA RETIESH REDDY
51	20241A0153	TEJAVATH KALYANI
52	20241A0154	TELLAPURAM PRUDHVI RAJ
53	20241A0155	THADEM ROHITH
54	20241A0156	THUMMALA RAJASHEKAR
55	20241A0157	UVSGR KAMESWARA SAI KARTHIK
56	20241A0158	SREERAM VATTEM
57	20241A0159	V VIKESH
58	20241A0160	VENNAM SRIKAR
59	21245A0101	GUMADAVELLI ARUN KUMAR
60	21245A0102	KADIRABAD SRIRAM
61	21245A0103	MANIKONDA NIKITHA
62	21245A0104	PARIDULA PRATHYUSHA
63	21245A0105	PATERU MOUNA

Gokaraju Rangaraju Institute of Engineering and Technology Department of Civil Engineering

GUIDELINES TO STUDY THE COURSE SUBJECT

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Guidelines to Students

Guidelines to study the Course: Solid Mechanics-II

The course helps the students to learn and understand the importance of different sturctures in civil engineering filed. One can learn to determine the various engineering properties of different structures like; retaining walls, dams, chimneys and elements like columns, struts, thin and thick cylinders. This course makes the students to understand about various properties of materials like timber, steel and concrete.

So the students should have the prerequisites

- knowledge of Engineering Mechanics
- knowledge on Mathematics

Where will this subject help?

- Useful in calculation of stresses, properties of elements of structures.
- This course let the students to work with various types of cylindres.
- This course let the students to determine the engineering properties of steel, wood, concrete.

BOOKS AND MATERIALS

Text Books	
1.	A text book of Strength of materials by R.K Bansal -Laxmi Publications(P) Ltd., new Delhi
2.	Strength of materials by Basavarajaiah and Mahadevappa, university Press
3.	Strength of materials by Bhavikatti, Vikas Publications

Suggested / Reference Books	
4.	Mechanics of solid by ferdinandp Beer and others-tata Mc.grawhill Publications

5	Strength of materials by R.K.Rajput, S.Chand & Co, New Delhi
6	Strength of materials by A.R.basu, Dhanpat Rai & Co, Nai Sarah, New Delhi.
7	Strength of materials by L.S.Srinath et al.,Macmillian Idia Ltd
8	Strength of materials by S.Ramakrishna and R.Narayan-Dhanpat Rai Publications.
Web Sites	
1	www. nptel.ac.in/courses/.../IIT.../strength%20of%20materials/homepage.htm
2	www. nptel.ac.in/courses/105105108/

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Civil Engineering

COURSE DESIGN AND DELIVERY SYSTEM (CDD)

- The Course syllabus is written into number of learning objectives and outcomes.
- These learning objectives and outcomes will be achieved through lectures, assessments, assignments, experiments in the laboratory, projects, seminars, presentations, etc.
- Every student will be given an assessment plan, criteria for assessment, scheme of evaluation and grading method.
- The Learning Process will be carried out through assessments of Knowledge, Skills and Attitude by various methods and the students will be given guidance to refer to the text books, 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, unit and lesson plans
- Understand different methods of teaching and learning
- Use appropriate teaching and learning aids
- Plan and deliver lectures effectively
- Provide feedback 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 Department of Civil Engineering

COURSE SCHEDULE

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

The Schedule for the whole Course / Subject is:

S. No.	Description	Duration (Date)		Total No. Of Periods
		From	To	
1.	**UNIT I:**	07/03/2022	26/03/2022	17
2.	**UNIT II:**	28/03/2022	19/04/2022	19
3.	**UNIT III:**	19/04/2022	14/05/2022	18
4.	**UNIT IV:**	17/05/2022	14/06/2022	23
5.	**UNIT V:**	14/06/2022	27/06/2022	11

1. Total No. of Instructional periods available for the course: **88** Hours / Periods

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DEPARTMENT OF CIVIL ENGINEERING

COURSE PLAN
(ACADEMIC YEAR: 2021-22)

Branch: Civil Engineering Class: II Year B.Tech – Section: A Semester: II

Subject: Solid Mechanics -II Faculty: Dr. T. Srinivas

LESSON No	Date	Unit No	No.of Periods	Topics	Objectives & Outcomes Nos.	References (Text Book, 2 by B S Basavarajaiah) Page Nos.: to
1	07/03/22	I	1	Introduction to Strength of Materials II	COB's - 1 CO's - 1	674-675
2	07/03/22		1	Thin Cylinders Derivation of Formula for Longitudinal and Circumferential Stresses(Hoop)	COB's - 1 CO's - 1	674-675
3	08/03/22		1	Problems solving	COB's - 1 CO's - 1	674-680
4	08/03/22		1	Problems solving	COB's - 1 CO's - 1	674-680
5	10/03/22		1	Changes in Dia. and Volume of Thin Cylinders Problems	COB's - 1 CO's - 1	674-680
6	12/03/22		1	Problems solving	COB's - 1 CO's - 1	674-680
7	14/03/22		1	Introduction Lame's Theory for Thick Cylinders Derivation of Lame's Formulae	COB's - 1 CO's - 1	674-680
8	14/03/22		1	Distribution of Hoop Radial Stresses across Thickness and problems	COB's - 1 CO's - 1	674-680
9	15/03/22		1	Problems solving	COB's - 1 CO's - 1	674-730

10	15/03/22		1	Problems solving	COB's - 1 CO's - 1	674-730
11	19/03/22		1	Design of Thick Cylinders problems	COB's - 1 CO's - 1	684-730
12	21/03/22		1	Problems solving	COB's - 1 CO's - 1	674-730
13	21/03/22		1	Problems solving	COB's - 1 CO's - 1	674-730
14	22/03/22		1	Difference in raddi derivation	COB's - 1 CO's - 1	674-730
15	22/03/22		1	Longitudinal and Volumetric Strains	COB's - 1 CO's - 1	674-730
16	24/03/22		1	Problems solving	COB's - 1 CO's - 1	674-730
17	26/03/22		1	Problems solving	COB's - 1 CO's - 1	674-730
18	28/03/22		1	Torsion of Circular Shafts: Theory of Pure Torsion-Derivation Equations: $T/J=f_s/R=C\Theta/L$ Assumptions Made in the Theory of Pure Torsion and problems	COB's –2 CO's - 2	425-426
19	28/03/22		1	Torsional Moment of Resistance and problems	COB's –2 CO's -2	425-426
20	29/03/22		1	Problems solving	COB's –2 CO's - 2	425-429
21	29/03/22		1	Problems solving	COB's –2 CO's - 2	425-429
22	31/03/22	**II**	1	Problems solving	COB's –2 CO's - 2	425-426
23	04/04/22		1	Power Transmitted by Shafts and problems	COB's –2 CO's - 2	425-429
24	04/04/22		1	Problems solving	COB's –2 CO's - 2	425-429
25	05/04/22		1	Problems solving	COB's –2 CO's - 2	425-426
26	05/04/22		1	Problems solving	COB's –2 CO's - 2	425-429
27	07/04/22		1	Power Transmitted by Shafts and problems Design of Shafts	COB's –2 CO's - 2	425-429

				According to Theories of Failure.		
28	09/04/22		1	Problems solving	COB's –2 CO's - 2	425-429
29	11/04/22		1	Problems solving	COB's –2 CO's - 2	451-465
30	11/04/22		1	Problems solving	COB's –2 CO's - 2	482-483
31	12/04/22		1	Springs Introduction-Types of Springs – Deflection of Close and Open Coiled Helical Springs Under Axial Pull and Axial Couple	COB's –2 CO's - 2	482-514
32	12/04/22		1	Problems solving	COB's –2 CO's - 2	451-465
33	16/04/22		1	Problems solving	COB's –2 CO's - 2	482-483
34	18/04/22		1	Springs in Series and Parallel – Carriage or Leaf Springs	COB's –2 CO's - 2	482-514
35	18/04/22		1	Problems solving	COB's –2 CO's - 2	451-465
36	19/04/22		1	Problems solving	COB's –2 CO's - 2	482-483
37	19/04/22	**III**	1	Columns and Struts Introduction –Types of Columns Short, Medium and Long Columns – Axially Loaded Compression Members-Crushing Load	COB's –3 CO's - 3	601-603
38	21/04/22		1	Problems solving	COB's –3 CO's - 3	601-622
					COB's –3 CO's - 3	601-618
39	23/04/22		1	Problems solving	COB's –3 CO's - 3	601
40	25/04/22		1	Problems solving	COB's –3 CO's - 3	601
41	25/04/22		1	Euler's Theorem for Long Columns – Assumptions Derivation of Euler's Critical Load Formulae for Various End Conditions	COB's –3 CO's - 3	601-615

42	26/04/22		1	Problems solving	COB's –3 CO's - 3	601-610
43	26/04/22		1	Maximum B.M And Stress due To Transverse and Laterally Loading.	COB's –3 CO's - 3	601-628
44	28/04/22		1	Problems solving	COB's –3 CO's - 3	620-646
45	30/04/22		1	Maximum B.M And Stress due To Transverse and Laterally Loading.	COB's –3 CO's - 3	620-628
46	05/05/22		1	Problems solving	COB's –3 CO's - 3	620-628
47	07/05/22		1	Equivalent Length of a Column- Slenderness Ratio- Euler's Critical Stress Problems	COB's –3 CO's - 3	649-651
48	09/05/22		1	Limitations of Euler's Theory- Rankine's – Gordon Formula- Long Columns Subjected to Eccentric Loading –	COB's –3 CO's - 3	649-651
49	09/05/22		1	Problems solving	COB's –3 CO's - 3	652-671
50	10/05/22		1	Problems solving	COB's –3 CO's - 3	652-671
51	10/05/22		1	Secant Formula – Empirical Formulae – Straight Line Formula- Prof. Perry's Formula. Problems solving	COB's –3 CO's - 3	652-671
52	12/05/22		1	Problems solving	COB's –3 CO's - 3	652-671
53	14/05/22		1	Beam Columns Laterally Loaded Struts- Subjected to Uniformly Distributed and Concentrated Loads	COB's –3 CO's - 3	652-671
54	17/05/22		1	Problems solving	COB's –3 CO's - 3	652-671
55	17/05/22		1	Direct and Bending Stresses: Stresses under the Direct Action of Direct Loading and	COB's - 4 CO's - 4	Rk Bansal 413-468
		IV			COB's - 4 CO's - 4	Rk Bansal

				Bending Moment		413-468
56	19/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
57	21/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
58	23/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
59	23/05/22		1	Conditions for Stability - Stresses due to Direct Loading and Bending Moment about both Axis	COB's - 4 CO's - 4	Rk Bansal 413-468
60	24/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
61	24/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
62	26/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
63	28/05/22		1	Core of a Section- Determination of Stresses in the Case of Chimneys,	COB's - 4 CO's - 4	Rk Bansal 413-468
64	30/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
65	30/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
66	31/05/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
67	31/05/22		1	Analysis of Dams	COB's - 4 CO's - 4	413-468
68	02/06/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468

69	04/06/22		1	Problems solving	COB's - 4 CO's - 4	413-468
70	06/06/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
71	07/06/22		1	Problems solving	COB's - 4 CO's - 4	413-468
72	07/06/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
73	09/06/22		1	Problems solving	COB's - 4 CO's - 4	413-468
74	11/06/22		1	Analysis of Retaining walls	COB's - 4 CO's - 4	Rk Bansal 413-468
75	13/06/22		1	Problems solving	COB's - 4 CO's - 4	413-468
76	13/06/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
77	14/06/22		1	Problems solving	COB's - 4 CO's - 4	Rk Bansal 413-468
78	14/06/22	**V**	1	Unsymmetrical Bending: Introduction – Centroidal Principal Axes of Section	COB's - 5 CO's - 5	Rk Bansal 1051-1090
79	16/06/22		1	Problems	COB's - 5 CO's - 5	Rk Bansal 1051-1090
80	18/06/22		1	Graphical Method for Locating Principal Axes – Moment of Inertia Referred to any Set of Rectangular Axes-	COB's - 5 CO's - 5	Rk Bansal 1051-1090
81	20/06/22		1	Stresses in Beams Subjected to Unsymmetrical Bending	COB's - 5 CO's - 5	Rk Bansal 1051-1090
82	20/06/22		1	Principal Axes-Resolution of Bending Moment into Two Rectangular Axes Through the Centroid	COB's - 5 CO's - 5	Rk Bansal 1051-1090
83	21/06/22		1	Location of Neutral Axis-Deflection of Beams	COB's - 5 CO's - 5	Rk Bansal

				under Unsymmetrical Bending		1051-1090
84	21/06/22		1	Beams Curved in Plan: Introduction – Circular Beams Loaded Uniformly and Supported on Symmetrically Placed Columns	COB's - 5 CO's - 5	Rk Bansal 1051-1090
85	23/06/22		1	Problems solving	COB's - 5 CO's - 5	Rk Bansal 1051-1090
86	25/06/22		1	Semi Circular Beams Simply Supported on Three Equally Spaced Supports.	COB's - 5 CO's - 5	Rk Bansal 1051-1090
87	27/06/22		1	Problems solving	COB's - 5 CO's - 5	Rk Bansal 1051-1090
88	27/06/22		1	Problems solving	COB's - 5 CO's - 5	Rk Bansal 1051-1090

Gokaraju Rangaraju Institute of Engineering and Technology Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering **Unit No: 1**

Lesson No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References (Text Book, 2 by B S Basavarajaiah) Page Nos.: to
1	07/03/22	1	Introduction to Strength of Materials II	COB's - 1 CO's - 1	K1	674-675
2	07/03/22	1	Thin Cylinders Derivation of Formula for Longitudinal and Circumferential Stresses(Hoop)	COB's - 1 CO's - 1	K5	674-675
3	08/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-680
4	08/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-680
5	10/03/22	1	Changes in Dia. and Volume of Thin Cylinders Problems	COB's - 1 CO's - 1	K2	674-680
6	12/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-680
7	14/03/22	1	Introduction Lame's Theory for Thick Cylinders Derivation of Lame's Formulae	COB's - 1 CO's - 1	K5	674-680
8	14/03/22	1	Distribution of Hoop Radial Stresses across Thickness and problems	COB's - 1 CO's - 1	K3	674-680
9	15/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-730

10	15/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-730
11	19/03/22	1	Design of Thick Cylinders problems	COB's - 1 CO's - 1	K4	684-730
12	21/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-730
13	21/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-730
14	22/03/22	1	Difference in raddi derivation	COB's - 1 CO's - 1	K5	674-730
15	22/03/22	1	Longitudinal and Volumetric Strains	COB's - 1 CO's - 1	K3	674-730
16	24/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-730
17	26/03/22	1	Problems solving	COB's - 1 CO's - 1	K3	674-730

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Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS
UNIT PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering **Unit No: 2**

Lesson No.	Date	No. of Periods	Topics / Sub – Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References (Text Book, 2 by B S Basavarajaiah) Page Nos.: to
1.	28/03/22	1	Torsion of Circular Shafts: Theory of Pure Torsion- Derivation Equations: $T/J=f_s/R=C\Theta/L$ Assumptions Made in the Theory of Pure Torsion and problems	COB's –2 CO's - 2	K4	425-426
2.	28/03/22	1	Torsional Moment of Resistance and problems	COB's –2 CO's -2	K3	425-426
3.	29/03/22	1	Problems solving	COB's –2 CO's - 2	K3	425-429
4.	29/03/22	1	Problems solving	COB's –2 CO's - 2	K3	425-429
5.	31/03/22	1	Problems solving	COB's –2 CO's - 2	K3	425-426
6.	04/04/22	1	Power Transmitted by Shafts and problems	COB's –2 CO's - 2	K3	425-429
7.	04/04/22	1	Problems solving	COB's –2 CO's - 2	K3	425-429
8	05/04/22	1	Problems solving	COB's –2 CO's - 2	K3	425-426
9	05/04/22	1	Problems solving	COB's –2 CO's - 2	K3	425-429
10	07/04/22	1	Power Transmitted by Shafts and problems Design of Shafts	COB's –2 CO's - 2	K2	425-429

			According to Theories of Failure.			
11	09/04/22	1	Problems solving	COB's –2 CO's - 2	K3	425-429
12	11/04/22	1	Problems solving	COB's –2 CO's - 2	K3	451-465
13	11/04/22	1	Problems solving	COB's –2 CO's - 2	K3	482-483
14	12/04/22	1	Springs Introduction-Types of Springs – Deflection of Close and Open Coiled Helical Springs Under Axial Pull and Axial Couple	COB's –2 CO's - 2	K3	482-514
15	12/04/22	1	Problems solving	COB's –2 CO's - 2	K3	451-465
16	16/04/22	1	Problems solving	COB's –2 CO's - 2	K3	482-483
17	18/04/22	1	Springs in Series and Parallel – Carriage or Leaf Springs	COB's –2 CO's - 2	K3	482-514
18	18/04/22	1	Problems solving	COB's –2 CO's - 2	K3	451-465
19	19/04/22	1	Problems solving	COB's –2 CO's - 2	K3	482-483

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Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS
UNIT PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering **Unit No: 3**

Lesson No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References (GT lab Manual) Page Nos.:_to
1.	19/04/22	1	Columns and Struts Introduction –Types of Columns Short, Medium and Long Columns – Axially Loaded Compression Members-Crushing Load	COB's –3 CO's - 3	K2	601-603
2.	21/04/22	1	Problems solving	COB's –3 CO's - 3	K3	601-622
3.		1		COB's –3 CO's - 3	K3	601-618
4.	23/04/22	1	Problems solving	COB's –3 CO's - 3	K3	601
5.	25/04/22	1	Problems solving	COB's –3 CO's - 3	K3	601
6.	25/04/22	1	Euler's Theorem for Long Columns – Assumptions Derivation of Euler's Critical Load Formulae for Various End Conditions	COB's –3 CO's - 3	K5	601-615
7.	26/04/22	1	Problems solving	COB's –3 CO's - 3	K3	601-610
8.	26/04/22	1	Maximum B.M And Stress due To Transverse and Laterally Loading.	COB's –3 CO's - 3	K4	601-628
9.	28/04/22	1	Problems solving	COB's –3 CO's - 3	K3	620-646
10.	30/04/22	1	Maximum B.M And Stress due To Transverse and	COB's –3 CO's - 3	K4	620-628

			Laterally Loading.			
11.	05/05/22	1	Problems solving	COB's –3 CO's - 3	K3	620-628
12.	07/05/22	1	Equivalent Length of a Column- Slenderness Ratio- Euler's Critical Stress Problems	COB's –3 CO's - 3	K3	649-651
13.	09/05/22	1	Limitations of Euler's Theory- Rankine's – Gordon Formula- Long Columns Subjected to Eccentric Loading –	COB's –3 CO's - 3	K3	649-651
14	09/05/22	1	Problems solving	COB's –3 CO's - 3	K3	652-671
15	10/05/22	1	Problems solving	COB's –3 CO's - 3	K3	652-671
16	10/05/22	1	Secant Formula – Empirical Formulae – Straight Line Formula- Prof. Perry's Formula. Problems solving	COB's –3 CO's - 3	K3	652-671
17	12/05/22	1	Problems solving	COB's –3 CO's - 3	K3	652-671
18	14/05/22	1	Beam Columns Laterally Loaded Struts- Subjected to Uniformly Distributed and Concentrated Loads	COB's –3 CO's - 3	K3	652-671

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SCHEDULE OF INSTRUCTIONS

UNIT PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering **Unit No: 4**

Lesson No.	Date	No. of Periods	Topics / Sub – Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References (by Rk Bansal) Page Nos.: __to
1.	17/05/22	1	Direct and Bending Stresses: Stresses under the Direct Action of Direct Loading and Bending Moment	COB's - 4 CO's - 4	K2	Rk Bansal 413-468
2.	17/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
3.	19/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
4.	21/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
5.	23/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
6.	23/05/22	1	Conditions for Stability - Stresses due to Direct Loading and Bending Moment about both Axis	COB's - 4 CO's - 4	K2	Rk Bansal 413-468
7.	24/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468

8.	24/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
9.	26/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
10	28/05/22	1	Core of a Section-Determination of Stresses in the Case of Chimneys,	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
11	30/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
12	30/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
13	31/05/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
14	31/05/22	1	Analysis of Dams	COB's - 4 CO's - 4	K4	413-468
15	02/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
16	04/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	413-468
17	06/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
18	07/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	413-468
19	07/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468
20	09/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	413-468
21	11/06/22	1	Analysis of Retaining walls	COB's - 4 CO's - 4	K4	Rk Bansal 413-468
22	13/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	413-468
23	13/06/22	1	Problems solving	COB's - 4 CO's - 4	K3	Rk Bansal 413-468

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Department of Civil Engineering

SCHEDULE OF INSTRUCTIONS
UNIT PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering **Unit No: 5**

Lesson No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References (Rk Bansall) Page Nos.: __to
1.	14/06/22	1	Unsymmetrical Bending: Introduction – Centroidal Principal Axes of Section	COB's - 5 CO's - 5	K2	Rk Bansal 413-468
2.	16/06/22	1	Problems	COB's - 5 CO's - 5	K3	Rk Bansal 1051-1090
3.	18/06/22	1	Graphical Method for Locating Principal Axes –Moment of Inertia Referred to any Set of Rectangular Axes-	COB's - 5 CO's - 5	K4	1051-1090
4.	20/06/22	1	Stresses in Beams Subjected to Unsymmetrical Bending	COB's - 5 CO's - 5	K2	1051-1090
5.	20/06/22	1	Principal Axes-Resolution of Bending Moment into Two Rectangular Axes Through the Centroid	COB's - 5 CO's - 5	K2	1051-1090
6.	21/06/22	1	Location of Neutral Axis-Deflection of Beams under Unsymmetrical	COB's - 5 CO's - 5	K3	1051-1090

			Bending			
7.	21/06/22	1	Beams Curved in Plan: Introduction – Circular Beams Loaded Uniformly and Supported on Symmetrically Placed Columns	COB's - 5 CO's - 5	K2	1051-1090
8.	23/06/22	1	Problems solving	COB's - 5 CO's - 5	K3	1051-1090
9.	25/06/22	1	Semi Circular Beams Simply Supported on Three Equally Spaced Supports.	COB's - 5 CO's - 5	K2	1051-1090
10.	27/06/22	1	Problems solving	COB's - 5 CO's - 5	K3	1051-1060
11	27/06/22	1	Problems solving	COB's - 5 CO's - 5	K3	1051-1090

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 1…… Duration of Lesson: 1hr…….

Lesson Title: Introduction to Strength of Materials II

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Discuss the importance of this course in civil engineering.

2. Explain basics of Engineering Mechanics.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Engineering constants
Relation between them

Assignment / Questions:

1. Explain elastic constants (COB: 1 & CO: 1)
2. Define proof stress (COB: 1 & CO: 1)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 2…… Duration of Lesson: 1hr…….

Lesson Title: Thin Cylinders Derivation of Formula for Longitudinal and Circumferential Stresses

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Derive formula for Circumferential stress.

2. Derive formula for Longitudinal stress.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics Derivation of Formula for Longitudinal and Circumferential Stresses

Assignment / Questions:

1. Explain the failure mechanisms of thin cylinder (COB: 1 & CO: 1)
2. Derive formula for Circumferential stress (COB: 1 & CO: 1)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 3…… Duration of Lesson: 1hr…….

Lesson Title: Problems solving on Longitudinal and Circumferential Stresses

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Solve the problems on Circumferential Stresses.

2. Solve the problems on Longitudinal Stresses.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Problems solving on Longitudinal and Circumferential Stresses

Assignment / Questions:

1. A cylindrical thin drum 800 mm in diameter and 5m long is made of 15 mm thick. Calculate the circuferential and longitudinal stresse. Take E as 200 GPa and and p as 3.5 N/mm2. (COB: 1 & CO: 1)
2. Derive formula for longitudinal stress (COB: 1 & CO: 1)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 4…… Duration of Lesson: 1hr…….

Lesson Title: Problems solving on Longitudinal and Circumferential Stresses

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Solve the problems on Circumferential Stresses.

2. Solve the problems on Longitudinal Stresses.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics Problems solving on Longitudinal and Circumferential Stresses

Assignment / Questions:

1. A cylindrical thin drum 1200 mm in diameter and 5m long is made of 35 mm thick. Calculate the circuferential and longitudinal stresse. Take E as 200 GPa and and p as 6.5 N/mm2. (COB: 1 & CO: 1)
2. Derive formula for shear stress (COB: 1 & CO: 1)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 5…… Duration of Lesson: 1hr…….

Lesson Title: Changes in Dimensions. and Volume of Thin Cylinders Problems

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Calculate the change in diameter of thin cylinder.
2. Calculate the change in length of thin cylinder.
3. Calculate the change in Volume of thin cylinder

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Diameter of thin cylinder
Length of thin cylinder
Volume of thin cylinder

Assignment / Questions:

1. A cylindrical thin drum 600 mm in diameter and 5m long is made of 15 mm thick. If the drum is subjected to an internal pressure of 3.5 MPa, determine its change in diameter and length. Take E as 200 GPa and poisson's ratio as 0.25. (COB: 1 & CO: 1)
2. What is the relation between longitudinal and circumferential stress?

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 7…… Duration of Lesson: 1hr…….

Lesson Title: Introduction Lame's Theory for Thick Cylinders an Derivation of Lame's Formulae

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1 Derive formula for pressure.

2. Derive formula for stress.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
About thick cylinders
Internal pressure
Stress across thickness of thick cylinder

Assignment / Questions:

1. Derive Lames's equations (COB: 1 & CO: 1)

2. Define thick cylinder(COB: 1 & CO: 1)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 14…… Duration of Lesson: 1hr …….

Lesson Title: Difference in raddi derivation

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Derive formula for difference in raddi.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Difference in raddi

Assignment / Questions:

1. Derive a formula for difference in raddi. (COB: 1 & CO: 1)
2. Explain the effect of difference in raddi on stresses. (COB: 1 & CO: 1)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 15…… Duration of Lesson: 1hr…….

Lesson Title: Longitudinal and Volumetric Strains

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Determine Longitudinal Strains
2. Determine Volumetric Strains

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Longitudinal Strains
Volumetric Strains

Assignment / Questions:

1. Explain effect of longitudinal Strains on poisons ratio. (COB: 1 & CO: 1)
2. Write the assumptions made in the Lame's theory. (COB: 1 & CO: 1)

Signature of faculty

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 18…… Duration of Lesson: 1hr…….

Lesson Title: Torsion of Circular Shafts: Theory of Pure Torsion-Derivation Equations: $T/J=f_s/R=C\Theta/L$ and Assumptions Made in the Theory of Pure Torsion

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Derivation Equations: $T/J=f_s/R=C\Theta/L$.

2. Explain assumptions Made in the Theory of Pure Torsion.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Assumptions Made in the Theory of Pure Torsion
Derivation Equations: $T/J=f_s/R=C\Theta/L$.

Assignment / Questions:

1. Derivation Equations: $T/J=f_s/R=C\Theta/L$. (COB: 2 & CO: 2)
2. Explain assumptions Made in the Theory of Pure Torsion. (COB: 2 & CO: 2)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 23…… Duration of Lesson: 1hr…….

Lesson Title: Power Transmitted by Shafts and problems

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Derive formula for Power Transmitted by shaft.

2. Solve the problems on Power Transmitted by shaft.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics Power Transmitted by shaft

Assignment / Questions:

1. Derive formula for Power Transmitted by shaft. (COB: 2 & CO: 2)
2. A solid shaft of 80 mm diameter is to be replaced by a hallow shaft of external diameter 100 mm. Determine the internal diameter of the hollow shaft if the same power is to be transmitted by both the shafts at the same angular velocity and shear stress. (COB: 2 & CO: 2)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 27…… Duration of Lesson: 1hr…….

Lesson Title: Design of Shafts According to Theories of Failure

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Discuss the different Theories of Failure of shafts.

2. Design the shafts.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Moment
Torsion

Assignment / Questions:

1. Discuss the different Theories of Failure of shafts. (COB: 2 & CO: 2)
2. A composite shaft consists of copper rod of 30 mm diameter enclosed in a steel tube of external diameter 40 mm and 5 mm thick. The shaft is required to transmit a torque of 0.5 KN- M. Determine the shearing stresses developed in the copper and steel, if both the shafts have equal lengths and welded to a plate at each end, so that their twists are equal. Take C_c as 40 GPa and C_s as 80 GPa.

(COB: 2 & CO: 2)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 31…… Duration of Lesson: 1hr…….

Lesson Title: Springs Introduction- Types of Springs – Deflection of Close and Open Coiled Helical Springs Under Axial Pull and Axial Couple

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Differentiate Close and Open Coiled Helical Springs

2. Derive formula for closely coiled helical spring.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Close Coiled Helical Springs
Open Coiled Helical Springs

Assignment / Questions:
1. Differentiate Close and Open Coiled Helical Springs (COB: 2 & CO: 2)
2. Derive formula for closely coiled helical spring subjected to axial load. (COB: 2 & CO: 2)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 34…… Duration of Lesson: 1hr…….

Lesson Title: Springs in Series and Parallel – Carriage or Leaf Springs

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Differentiate Springs in series and parallel

2. Solve the problems on springs, which are in series and parallel.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Springs in series.
Springs in parallel

Assignment / Questions:

1. Differentiate Springs in series and parallel. (COB: 2 & CO: 2)
2. Two closely coiled helical springs wound from the same wire. But with different core raddi having equal number of coils are compressed between rigid plates at their ends. Calculate the maximum shear stress induced in each spring, if the wire diameter is 10 mm and the load applied between the rigid plates is 500 N. The core radii of the springs 100 mm and 75 mm respectively (COB: 2 & CO: 2)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 37…… Duration of Lesson: 1hr…….

Lesson Title: Columns and Struts Introduction –Types of Columns Short, Medium and Long Columns – Axially Loaded Compression Members- Crushing Load

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Differentiate short and long columns

2. Explain the failure mechanism of columns.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Short columns
Long columns

Assignment / Questions:
1. Differentiate short and long columns. (COB: 3 & CO: 3)
2. Explain the failure mechanism of columns. (COB: 3 & CO: 3)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 41…… Duration of Lesson: 1hr…….

Lesson Title: Euler's Theorem for Long Columns – Assumptions Derivation of Euler's Critical Load Formulae for Various End Conditions

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Explain assumptions in Euler's theory.

2. Derive formula for both ends hinged.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Euler's theory
End conditions

Assignment / Questions:

1. Explain assumptions in Euler's theory. (COB: 3 & CO: 3)
2. Derive formula for both ends hinged. (COB: 3 & CO: 3)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 48…… Duration of Lesson: 1hr…….

Lesson Title: Limitations of Euler's Theory- Rankine's –Johnson Gordon Formula- Long Columns Subjected to Eccentric Loading

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Derive formula of Rankine's theory

2. Derive formula of Johnson Gordon Formula.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Rankine's theory
Johnson Gordon Formula

Assignment / Questions:

1. Derive formula of Rankine's theory. (COB: 3 & CO: 3)
2. Derive formula of Johnson Gordon Formula. (COB: 3 & CO: 3)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 53…… Duration of Lesson: 1hr…….

Lesson Title: Beam Columns Laterally Loaded Struts- Subjected to Uniformly Distributed and Concentrated Loads

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Derive formula of Laterally Loaded Struts- Subjected to Concentrated Loads

2. Derive formula of Laterally Loaded Struts- Subjected to Uniformly Distributed Loads

.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Beam column with point load
Beam column with udl load

Assignment / Questions:

1. Derive formula of Laterally Loaded Struts- Subjected to Concentrated Loads. (COB: 3 & CO: 3)
2. Derive formula of Laterally Loaded Struts- Subjected to Uniformly Distributed Loads (COB: 3 & CO: 3)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 55…… Duration of Lesson: 1hr…….

Lesson Title: Direct and Bending Stresses: Stresses under the Direct Action of Direct Loading and Bending Moment

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Differentiate Direct and Bending Stresses

2.Calculate Stresses under the Direct Action of Direct Loading and Bending Moment

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Direct and Bending Stresses
Stresses under the Direct Action of Direct Loading and Bending Moment

Assignment / Questions:

1. Differentiate Direct and Bending Stresses. (COB: 4 & CO: 4)
2. A column of circular c/s is subjected to a load of 120 kN, the load is parallel to the axis but eccentric by an amount of 2.5mm. The external and internal diameter of column of 60 mm and 50 mm respectively, if both the ends of the column are hinged and column is 2.1 m long, then determine the maximum stress in the column and take E as 200 GN/m^2. (COB: 4 & CO: 4)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 59…… Duration of Lesson: 1hr…….

Lesson Title: Conditions for Stability -Stresses due to Direct Loading and Bending Moment about both Axis

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Apply the conditions for stability of dams

2. Calculate the problems for stability of dams

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
To avoid tension
To avoid Overturning
To avoid sliding
To avoid crushing

Assignment / Questions:

1. Check the conditions for stability of dam. (COB: 4 & CO: 4)
2. Concrete dam has its upstream face vertical and a top width of 3 m. Its downstream face has a uniform batter. It stores water to a depth of 15 m with a free board of 2 m. The weights of water and concrete may be taken as 10 KN/m^3 and 25 KN/m^3. Calculate the minimum dam width at the bottom for no tension in concrete, neglect uplift. (COB: 4 & CO: 4)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 63…… Duration of Lesson: 1hr…….

Lesson Title: Core of a Section- Determination of Stresses in the Case of Chimneys,

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Determination of Stresses in the Case of Chimneys

2. Determination the problems of Stresses in the Case of Chimneys.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Chimneys

Assignment / Questions:

1. A masonry chimney 24 m high, of uniform circular section, 3.5 m external diameter and 2 m internal diameter is subjected to a horizontal wind pressure of 1 KN/m^2 of projected area. Find the maximum and minimum stress intensities at the base, if the specific weight of masonry is 22 KN/m^3

(COB: 4 & CO: 4)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 78…… Duration of Lesson: 1hr…….

Lesson Title: Unsymmetrical Bending: Introduction – Centroidal Principal Axes of Section

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Explain Unsymmetrical Bending

2. Explain Principal Axes of Section

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Unsymmetrical Bending
Principal Axes

Assignment / Questions:
1. Explain Unsymmetrical Bending. (COB: 4 & CO: 4)
2. Discuss about deflection of a beam under unsymmetrical bending. (COB: 4 & CO: 4)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 81…… Duration of Lesson: 1hr…….

Lesson Title: Stresses in Beams Subjected to Unsymmetrical Bending

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Determine Stresses in Unsymmetrical Bending

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Stresses in Unsymmetrical Bending

Assignment / Questions:

1. An equal angle section of 80X80X10 mm is used as a simply supported beam over a span of 2.4 m. It carries a load of 400 N along the line YG, where G is the centroid of the section. Calculate the deflection of the beam at the mid section and its direction with the load line.(COB: 4 & CO: 4)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 83…… Duration of Lesson: 1hr…….

Lesson Title: Location of Neutral Axis-Deflection of Beams under Unsymmetrical Bending

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Locate the Neutral Axis under Unsymmetrical Bending

2. Determine the deflection of Beams under Unsymmetrical Bending.

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Neutral Axis
deflection of Beams under Unsymmetrical Bending.

Assignment / Questions:

1. An equal angle section of 100X100X10 mm is used as a simply supported beam over a span of 3.4 m. It carries a load of 500 N along the line YG, where G is the centroid of the section. Calculate the deflection of the beam at the mid section and its direction with the load line. (COB: 4 & CO: 4)

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LESSON PLAN

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Lesson No: 84…… Duration of Lesson: 1hr…….

Lesson Title: Beams Curved in Plan: Introduction – Circular Beams Loaded Uniformly and Supported on Symmetrically Placed Columns

INSTRUCTIONAL/LESSON OBJECTIVES:

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

1. Determine BM of Beams Curved in Plan
2. Determine TM of Beams Curved in Plan

TEACHING AIDS: White board and Marker pens

TEACHING POINTS :

Sub topics
Bending Moment
Torsion

Assignment / Questions:

1. A curved beam semi-circular in plan, 5m radius and supported on three equally spaced supports. The beam carries a UDL of 20kN/m of the circular length. Analyze the beam and plot the twisting moment diagram. (COB: 4 & CO: 4)

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Department of Civil Engineering

COURSE COMPLETION STATUS

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Units	**Remarks**	**Objective Achieved**	**Outcome Achieved**
Unit I	22-03-2022 Unit covered on time	1	1
Unit II	16-04-2022 Unit covered on time	2	2
Unit III	09-05-2022 Unit covered on time	3	3
Unit IV	14-06-2022 Unit covered on time	4	4
Unit V	27-06-2022 Unit covered on time	5	5

Signature of HOD Signature of faculty

Date: Date:

Gokaraju Rangaraju Institute of Engineering and Technology Department of Civil Engineering
EVALUATION STRATEGY

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Designation: Professor /Assistant Professor

1. TARGET:
   a) Percentage for pass: 80%
   b) Percentage of class:

First class with distinction	30
First class	10
Pass class	10
Total strength (No's)	50/63

2. COURSE PLAN & CONTENT DELIVERY

- 64 classes held for detailed demonstration of each topic and for analysis of problems in the class.

3. METHOD OF EVALUATION

3.1 ☐ Mid Examinations (Mid-I, Mid-II)

3.2 ☐ Assignments

3.3 ☐ Quiz

3.4 ☐ Semester/End Examination

4. List out any new topic(s) or any innovation you would like to introduce in teaching the subjects in this Semester.

Introducing Flipped classroom and Think-pair-share activities via moodle online course.

Signature of HOD
Date:

Signature of faculty
Date:

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Mappings of CO's, COB's Vs PO's, POB's

Course Objectives - Course Outcomes Relationship Matrix

Assessment:

1. Assignment 2. Internal Examination 3. External Examination
4. Practical Projects 5. Viva

Assessments \ Course Outcomes	1	2	3	4	5
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X
4					
5					

Assessments \ Course Objectives	1	2	3	4	5
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X
4					
5					

Course Objectives (COB's) - Course Outcomes (CO's) Relationship Matrix

Course Objectives \ Course Outcomes	1	2	3	4	5
1	X				
2		X			
3			X		
4				X	
5					X

Course Outcomes - Program Outcomes relations (Contributions: High, Medium and Low)

Course Code	Course Title	Course Outcomes	Programme Outcomes												PSO's	
			a	b	c	d	e	f	g	h	i	j	k	l	1	2
GR20 A2016	Solid Mechanics-II	1. Compute various stresses in thin and thick cylinders under pressure, show stress distribution diagrams and define Lame's theorems.	H	M		H		M		M	M	M		M		M
		2. Analyse the torsional strength of structural members and differentiate between closed and open coiled helical springs	H	M		H		M		M	M	M		M	M	
		3 Determine the buckling failure load for axially loaded and eccentrically loaded columns	H	M		H		M		M	M	M		M	M	
		4. Evaluate stresses in chimneys, retaining walls and dams and also check the stability of dams	H	M		H		M		M	M	M		M	M	
		5. Evaluate the behaviour of members under unsymmetrical bending and locate shear centres for the section and find stresses in circular and semi-circular beams	H	M		H		M		M	M	M		M		M

Course Objectives - Program Outcomes (PO's) and PSOs Relationship Matrix

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

Course Outcomes - Program Outcomes relations (PO's) and PSOs Relationship Matrix

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

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TUTORIAL SHEET - 1

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Designation: Professor

This Tutorial corresponds to Unit No.1

Q1. Explain the failure mechanisms of thin cylinder. (COBs: 1 & Cos: 1)

Q2. A cylindrical thin drum 400 mm in diameter and 4m long is made of 10 mm thick. If the drum is subjected to an internal pressure of 2.5 MPa, determine its change in diameter and length. Take E as 200 GPa and poisson's ratio as 0.25.

Q3. Write the assumptions made in the Lame's theory.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the Objectives/Outcomes to which these Questions / Problems / Exercises are related.

Objective Nos.: 1

Outcome Nos.: 1

Signature of HOD Signature of faculty

Date: Date:

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TUTORIAL SHEET - 2

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Designation: Professor

This Tutorial corresponds to Unit No.2

Q1. A quarter-elliptic leaf spring 600 mm long is subjected to a point load of 15 KN. If the bending stress and deflection is not to exceed 350 MPa and 60 mm respectively, find the suitable size and number of plates required by taking the width as 7 times the thickness. Take E as 200 GPa.

Q2. A composite shaft consists of copper rod of 50 mm diameter enclosed in a steel tube of external diameter 60 mm and 5 mm thick. The shaft is required to transmit a torque of 1.5 KN-M. Determine the shearing stresses developed in the copper and steel, if both the shafts have equal lengths and welded to a plate at each end, so that their twists are equal. Take C_c as 40 GPa and C_s as 80 GPa.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the Objectives/Outcomes to which these Questions / Problems / Exercises are related.

Objective No.: 2

Outcome No.: 2

Signature of HOD Signature of faculty

Date: Date:

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

TUTORIAL SHEET - 3

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Designation: Professor

This Tutorial corresponds to Unit No.3

Q1. A column of circular c/s is subjected to a load of 150 kN, the load is parallel to the axis but eccentric by an amount of 3.5mm. The external and internal diameter of column of 80 mm and 50 mm respectively, if both the ends of the column are hinged and column is 2.3 m long, then determine the maximum stress in the column and take E as 200 GN/m^2.

Q2. What is beam column? and give some examples.

Q3. Derive the crippling load of a column subjected to a axial compressive load when one end is fixed and other end is hinged.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the Objectives/Outcomes to which these Questions / Problems / Exercises are related.

Objective No.: 3

Outcome No.: 3

Signature of HOD Signature of faculty

Date: Date:

Gokaraju Rangaraju Institute of Engineering and Technology
(Autonomous)

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TUTORIAL SHEET - 4

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Designation: Professor

This Tutorial corresponds to Unit No.4

Q1. Concrete dam has its upstream face vertical and a top width of 2 m. Its downstream face has a uniform batter. It stores water to a depth of 18 m with a free board of 3 m. The weights of water and concrete may be taken as 10 KN/m^3 and 25 KN/m^3. Calculate the minimum dam width at the bottom for no tension in concrete, neglect uplift.

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Q2. A masonry chimney 30 m high, of uniform circular section, 4.5 m external diameter and 2.5 m internal diameter is subjected to a horizontal wind pressure of 2 KN/m^2 of projected area. Find the maximum and minimum stress intensities at the base, if the specific weight of masonry is 25 KN/m^3

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the Objectives/Outcomes to which these Questions / Problems / Exercises are related.

Objective No.: 4

Outcome No.: 4

Signature of HOD Signature of faculty

Date: Date:

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

TUTORIAL SHEET - 5

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Designation: Professor

This Tutorial corresponds to Unit No.5

Q1. A curved beam semi-circular in plan, 8m radius and supported on three equally spaced supports. The beam carries a UDL of 30kN/m of the circular length. Analyze the beam and plot the twisting moment diagram.

Q2 An equal angle section of 100X100X10 mm is used as a simply supported beam over a span of 3.2 m. It carries a load of 600 N along the line YG, where G is the centroid of the section. Calculate the deflection of the beam at the mid section and its direction with the load line

Q3. Discuss the deflection of a beam under unsymmetrical bending.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the Objectives/Outcomes to which these Questions / Problems / Exercises are related.

Objective No.: 5

Outcome No.: 5

Signature of HOD Signature of faculty

Date: Date:

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Civil Engineering

II B.Tech. II Semester, I Assignment (AY: 2021-22)

Solid Mechanics-II (Sub Code: GR20A2016)

I. Answer all Questions

2. Explain the failure mechanisms of thin cylinder. (COBs: 1 & COs: 1)
2. A cylindrical thin drum 600 mm in diameter and 5m long is made of 15 mm thick. If the drum is subjected to an internal pressure of 3.5 MPa, determine its change in diameter and length. Take E as 200 GPa and poisson's ratio as 0.25. (COBs: 1 & COs: 1)
3. A thick spherical shell of 200mm internal diameter is subjected to an internal fluid pressure of 7 N/mm^2. If the permissible tensile stress in the shell material is 8 N/mm^2, find the necessary thickness of shell. (COBs: 1 & COs: 1)
4. Write the assumptions made in the Lame's theory. (COBs: 1 & COs: 1)
5. A cylindrical shell is a 4m long, and is having 1m internal diameter and 20mm thickness. Calculate the maximum intensity of shear stress induced and also the change in a dimensions of the shell if it is subjected to an internal fluid pressure of 1.75 N/mm2 and $E=2X10^5$ and poisons ratio is 0.3. (COBs: 1 & COs: 1)

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Civil Engineering

II B.Tech. II Semester, II Assignment (AY: 2021-22)

Solid Mechanics-II (Sub Code: GR20A2016)

I. Answer all Questions

1. Derive the torsion equation $T/J = f_s/R = C\Theta/L$ (COBs: 2 & Cos: 2)

2. A solid shaft of 80 mm diameter is to be replaced by a hallow shaft of external diameter 100 mm. Determine the internal diameter of the hollow shaft if the same power is to be transmitted by both the shafts at the same angular velocity and shear stress. (COBs: 2 & COs: 2)
3. A composite shaft consists of copper rod of 30 mm diameter enclosed in a steel tube of external diameter 40 mm and 5 mm thick. The shaft is required to transmit a torque of 0.5 KN- M. Determine the shearing stresses developed in the copper and steel, if both the shafts have equal lengths and welded to a plate at each end, so that their twists are equal. Take C_c as 40 GPa and C_s as 80 GPa. (COBs: 2 & COs: 2)

4. A Closely coiled helical spring is of 40 mm mean diameter and wire diameter of 5mm subjected to a load of 500 N having 15 no. of turns and take Modulus of Rigidity is 45GPa. Calculate Maximum deflection and stiffness of the spring. (COBs: 2 & COs: 2)
5. Two closely coiled helical springs wound from the same wire. But with different core raddi having equal number of coils are compressed between rigid plates at their ends. Calculate the maximum shear stress induced in each spring, if the wire diameter is 10 mm and the load applied between the rigid plates is 500 N. The core radii of the springs 100 mm and 75 mm respectively. (COBs: 2 & COs: 2)
6. Determine the diameter of solid shaft which will transfer 450kw at 250rpm.The angle of twist must not exceed one degree per meter length and maximum torsional shear stress is to be limited to 45 N/mm^2 Assume G=85 N/mm^2. (COBs: 2 & COs: 2)

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Civil Engineering

II B.Tech. II Semester, III Assignment (AY: 2021-22)

Solid Mechanics-II (Sub Code: GR20A2016)

I. Answer all Questions

1. Derive the crippling load of a column subjected to an axial compressive load when one end is fixed and other end is free. (COBs: 3 & COs: 3)

2 A column of circular c/s is subjected to a load of 120 kN, the load is parallel to the axis but eccentric by an amount of 2.5mm. The external and internal diameter of column of 60 mm and 50 mm respectively, if both the ends of the column are hinged and column is 2.1 m long,then determine the maximum stress in the column and take E as 200 GN/m^2. (COBs: 3 & COs: 3)

3. A Simply supported beam of length 5m is subjected to a UDL of 35kN/m over the whole span and deflects 15mm at centre. Determine the crippling loads, when this beam is used as a column for both ends are hinged. (COBs: 3 & COs: 3)

4. What is beam column? and give some examples. (COBs: 3 & COs: 3)

5. a) Differentiate between short and long column. (COBs: 3 & COs: 3)

b) Explain the mode of failures of short and long columns with neat sketches. (COBs: 3 & COs: 3)

Gokaraju Rangaraju Institute of Engineering and Technology

Department of Civil Engineering

II B.Tech. II Semester, IV Assignment (AY: 2021-22)

Solid Mechanics-II (Sub Code: GR20A2016)

I. Answer all Questions

1.Concrete dam has its upstream face vertical and a top width of 3 m. Its downstream face has a uniform batter. It stores water to a depth of 15 m with a free board of 2 m. The weights of water and concrete may be taken as 10 KN/m^3 and 25 KN/m^3. Calculate the minimum dam width at the bottom for no tension in concrete, neglect uplift. (COBs: 4 & COs: 4)

2.A masonry chimney 24 m high, of uniform circular section, 3.5 m external diameter and 2 m internal diameter is subjected to a horizontal wind pressure of 1 KN/m^2 of projected area. Find the maximum and minimum stress intensities at the base, if the specific weight of masonry is 22 KN/m^3(COBs: 4 & COs: 4)

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Gokaraju Rangaraju Institute of Engineering and Technology

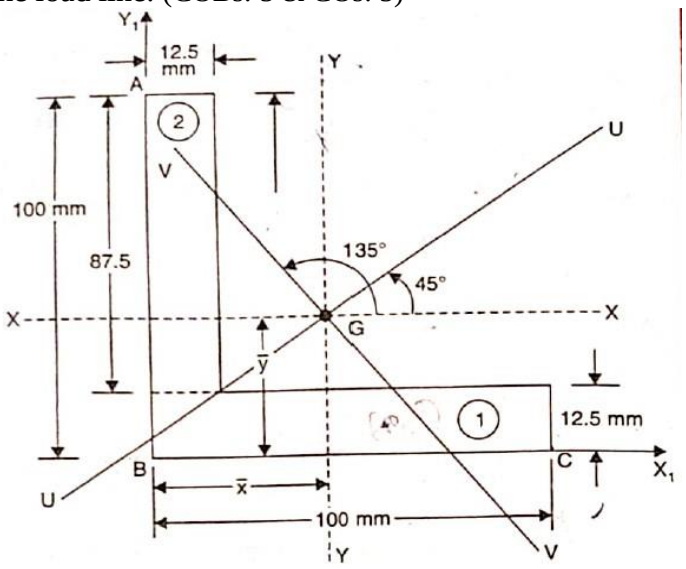
Department of Civil Engineering

II B.Tech. II Semester, Final Assignment (AY: 2021-22)

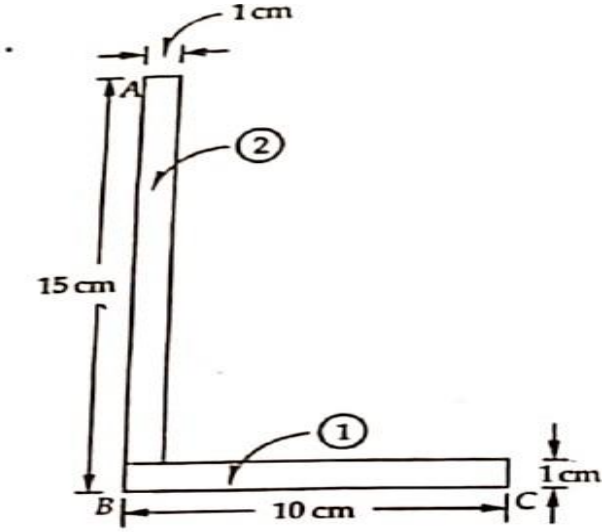
Solid Mechanics-II (Sub Code: GR20A2016)

I. Answer all Questions

1. An equal angle section of 100X100X12.5 mm is used as a simply supported beam over a span of 2.4 m. It carries a load of 400 N along the line YG as shown in figure, where G is the centroid of the section. Calculate the deflection of the beam at the mid section and its direction with the load line. (COBs: 5 & COs: 5)



2. Discuss about deflection of a beam under unsymmetrical bending. (COBs: 5 & COs: 5)
3. For the unequal angle section as shown in figure, determine the location of principal axes and principal moments of inertia. (COBs: 5 & COs: 5)



4. A curved beam semi-circular in plan, 5m radius and supported on three equally spaced supports. The beam carries a UDL of 20kN/m of the circular length. Analyze the beam and plot the twisting moment diagram.
5.

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RUBRIC TEMPLATE

Academic Year : 2021-2022 **Semester** : **II**

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

Course/Subject : Solid Mechanics-II **Course Code** : GR20A2016

Name of the Faculty: Dr. T Srinivas **Designation:** Professor

Dept.: Civil Engineering

Objective: To analyze the different elements such as cylinders, springs, columns, dams and chimneys with different materials.
Student Outcome: To analyze the different elements such as cylinders, springs, columns, dams and chimneys with different materials.

			Beginning	**Developing**	**Reflecting Development**	**Accomplished**	**Exemplary**	**Score**
S.No	**Name of the Student**	**Performance Criteria**	**1**	**2**	**3**	**4**	**5**	
1	22245A0105	The level of knowledge on basic requirements for analysis	Low level of knowledge on basic rquirements of analysis	Able to discuss the basic requirements of analysis	Ability to explain the basic requirements of analysis	Full knowledge on basic requirements of analysis	Analysing and implementing the knowledge of requirements of design	5
		The level of knowledge on analysis of different elements.	Low level of knowledge on analysis of different elements..	Able to discuss on analysis of different elements..	Ability to explain analysis of different elements..	Full knowledge on analysis of different elements. .	Analysing and application of knowledge on analysis of different elements.	5
		The level of knowledge in understanding different	Low level of knowledge in understanding different	Ability to discuss in understanding different materials.	Ability to explain in understanding different materials.	Full knowledge in understanding different	Analysing and implementing the knowledge in	5

		materials.	materials.			materials.	understanding different materials.	
							Average Score	5

			Beginning	**Developing**	**Reflecting Development**	**Accomplished**	**Exemplary**	**Score**
S.No	**Name of the Student**	**Performance Criteria**	**1**	**2**	**3**	**4**	**5**	
1	212401A0127	The level of knowledge on basic requirements for analysis	Low level of knowledge on basic rquirements of analysis	Able to discuss the basic requirements of analysis	Ability to explain the basic requirements of analysis	Full knowledge on basic requirements of analysis	Analysing and implementing the knowledge of requirements of design	5
		The level of knowledge on analysis of different elements.	Low level of knowledge on analysis of different elements..	Able to discuss on analysis of different elements..	Ability to explain analysis of different elements..	Full knowledge on analysis of different elements..	Analysing and application of knowledge on analysis of different elements.	4
		The level of knowledge in understanding different materials.	Low level of knowledge in understanding different materials.	Ability to discuss in understanding different materials.	Ability to explain in understanding different materials.	Full knowledge in understanding different materials.	Analysing and implementing the knowledge in understanding different materials.	4
							Average Score	4.33
			Beginning	**Developing**	**Reflecting Development**	**Accomplished**	**Exemplary**	**Score**
S.No	**Name of the Student**	**Performance Criteria**	**1**	**2**	**3**	**4**	**5**	

1	212410A0102	The level of knowledge on basic requirements for analysis	Low level of knowledge on basic rquirements of analysis	Able to discuss the basic requirements of analysis	Ability to explain the basic requirements of analysis	Full knowledge on basic requirements of analysis	Analysing and implementing the knowledge of requirements of design	4
		The level of knowledge on analysis of different elements.	Low level of knowledge on analysis of different elements..	Able to discuss on analysis of different elements..	Ability to explain analysis of different elements..	Full knowledge on analysis of different elements..	Analysing and application of knowledge on analysis of different elements.	3
		The level of knowledge in understanding different materials.	Low level of knowledge in understanding different materials.	Ability to discuss in understanding different materials.	Ability to explain in understanding different materials.	Full knowledge in understanding different materials.	Analysing and implementing the knowledge in understanding different materials.	2
							Average Score	3

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering (AY: 2021-22)
II B.Tech. II Semester, Objective Question Paper for Mid-I
Solid Mechanics-II (Sub Code: GR20A2016)

Name:_____ Hall Ticket No. | | | | | | **A** | | | | |

Answer All Questions. **All Questions Carry Equal Marks.**
Time: 10 Min. **Date of Exam: 04-05-2022 (AN)** **Marks: (10 X 0.5 = 5)**

I. Choose the correct alternative:

Question No.	Questions	Blooms Levels*	Course Outcome
1	A cylinder is said to be thin if it's thickness is [ ] a. <D/20 b. <D/30 c. >D/30 d. >D/20 mm	BL1	CO1
2	In a thin cylindrical shell of diameter (d), thickness (t) and subjected to an internal pressure (p), the longitudinal stress in the shell is [ ] a. pd/8t b. pd/4t c. pd/6t d. pd/2t	BL1	CO1
3	When a thin cylinder is subjected to an internal pressure, the cylinder tends to split into two troughs, what stress will be developed [ ] a. Longitudinal stress b. Hoop stress c. Shear stress d. Bending stress	BL2	CO1
4	In Thick cylindrical shell the radial pressure exists at [ ] a. Internal surface b. External surface c. Common joint d.All the above	BL2	CO1
5	The shear stress is maximum [ ] a. at the center of a section b. at a distance R/3 from center c. on the surface of a section d. at a distance r/2 from center	BL4	CO2
6	Torsional rigidity means, the product of [ ] a. EI b. EJ c. CJ d. CE	BL2	CO2
7	When a shaft subjected torsion, what stress will be developed [ ] a. Bending stress b. Shear stress c. Direct stress d. All the above	BL2	CO2
8	If a shaft is rotating at (N) rpm with an applied torque T in KN-m, the power in kW being transmitted by the shaft is [ ] a. $2\pi NT/600$ b. $2\pi NT/60$ c. $2\pi NT/4500$ d. $2\pi NT/450$	BL2	CO2
9	If ratio of effective length to least lateral dimension is greater than 12 then it is called [ ] a. Short Column b. Strut c. Pedestal d. Long Column	BL2	CO3
10	If a column is subjected to an axial loading then it is subjected [ ] a. Bending stress only b. Direct stress only c. a and b d. shear stress only	BL4	CO3

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering (AY: 2021-22)
II B.Tech. II Semester, Subjective Question Paper for Mid-I
Solid Mechanics-II (Sub Code: GR20A2016)

Time: 80 Minutes **Date of Exam: 04-05-2022 (AN)** **Max Marks: (3 X 5 = 15)**

Answer All Questions:

Question No.	Unit	Blooms Levels*	Course Outcome
1	A thick spherical shell of 200mm internal diameter is subjected to an internal fluid pressure of 7 N/mm2. If the permissible tensile stress in the shell material is 8 N/mm2, find the necessary thickness of shell.	BL4	CO1
	OR		
2	A cylindrical shell is a 4m long, and is having 1m internal diameter and 20mm thickness. Calculate the maximum intensity of shear stress induced and also the change in a dimensions of the shell if it is subjected to an internal fluid pressure of 1.75 N/mm2 and $E=2X10^5$ and poisons ratio is 0.3.	BL5	CO1
3	Derive the torsion equation $T/J= f_s /R=C\Theta/L$	BL3	CO2
	OR		
4	A Closely coiled helical spring is of 40 mm mean diameter and wire diameter of 5mm subjected to a load of 500 N having 15 no. of turns and take Modulus of Rigidity is 45GPa. What is Maximum deflection and stiffness of the spring.	BL1	CO2
5	Derive the crippling load of a column subjected to an axial compressive load when one end is fixed and other end is free..	BL3	CO3
	OR		
6	a) Differentiate between short and long column. b) Explain the mode of failures of short and long columns with neat sketches.	BL1 BL2	CO3 CO3

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering (AY: 2021-22)
II B.Tech. II Semester, Objective Question Paper for Mid-II
Solid Mechanics-II (Sub Code: GR20A2016)

Name:_____ Hall Ticket No. | | | | | | **A** | | | | |

Answer All Questions. **All Questions Carry Equal Marks.**
Time: 10 Min. **Date of Exam: 30-06-2022 (AN)** **Marks: (10 X 0.5 = 5)**

I. Choose the correct alternative:

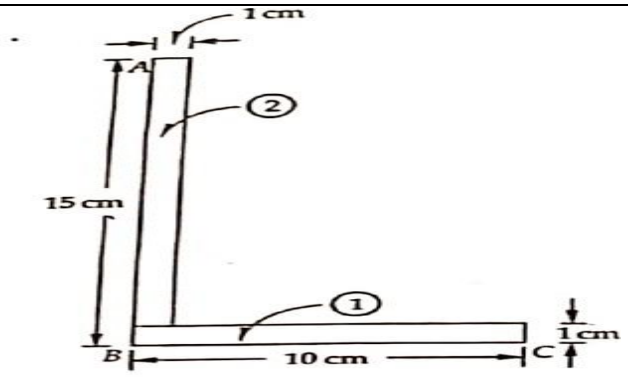
Question No.	Questions
1	A column of length 'L' buckles at load 'P1', which is hinged at both the ends. And other column of same length and same cross section, but fixed at both ends buckles at load P2.Then P2/P1 is a) 1 b) 4 c)16 d) 8 ( )
2	If the reservoir is full then , the forces acting on the dam are ( ) a) Weight of the dam b) Resultant force c) Force acting due to water d) All
3	A beam which is subjected to lateral load in addition to axial load is called ( ) a) Long column b. Short column c. Beam column d. Strut
4	In case of circular column of diameter (d), then the limiting value of eccentricity is a. d/8 b) d/3 c)d/4 d) d/6 ( )
5	The position of neutral axis (NA) in unsymmetrical bending is calculated by using () a. $\tan\beta = Ivv/Iuu*\tan\Theta$ b. $\tan\beta = Iuu/Ivv*\tan\Theta$ c. $\tan\beta = Ivv/Ivv*\tan\Theta$ d. $\tan\beta = Iuu/Iuu*\tan\Theta$
6	Principal axes are the axes about which the product of inertia is ( ) a) Maximum b) Negative c)Minimum d)Zero
7	The wind coefficient value (k) for a masonry chimney of square cross section is ( ) a. 0.5 b. 1.0 c. 0.67 d. 1.5
8	When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as () a. passive earth pressure b. swelling pressure c. pore pressure d. active earth pressure
9	The moment of inertia about principal axis is called ( ) a. Product of inertia b. principal moment of inertia c. shear stress d. bending stress
10	At the base of a chimney, what stresses will be developed () a. Bending stress only b. Direct stress only c. a and b d. shear stress only

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering (AY: 2021-22)
II B.Tech. II Semester, Subjective Question Paper for Mid-II
Solid Mechanics-II (Sub Code: GR20A2016)

Time: 80 Minutes **Date of Exam: 30-06-2022 (AN)** **Max Marks: (3 X 5 = 15)**

Answer All Questions:

Question No.	Unit	Blooms Levels*	Course Outcome
1	A steel strut of 60 mm x 60 mm in cross section and 2.2 m long carries an axial load of 150 kN and also a lateral load W at the centre, normal to one of its faces. If the strut is hinged at both of its ends, find the maximum value of the lateral load, if the permissible compressive stress is 160 N/mm^2. Take $E=200kN/mm^2$.	BL3	CO3
	OR		
2	A masonry retaining wall of trapezoidal section with a vertical face on the earth side is 2 m wide at the top, 5 m wide at the bottom and 8 m high. It retains sand over the entire height with an angle of surcharge 22°. Determine the distribution of pressure at the base of the wall. Take weight of sand and that of masonry as $18kN/m^3$ and $24kN/m^3$ respectively. It has an angle of repose of 30°.	BL3	CO4
3	A masonry trapezoidal dam 6 m high, 3m wide at its top and 6 m wide at its bottom retains water on its vertical face. Determine the maximum and minimum stresses at the base (i) when reservoir is full (ii) when reservoir is empty. Take weight of water and that of masonry as $10kN/m^3$ and $24kN/m^3$ respectively.	BL5	CO4
	OR		
4	A masonry chimney 20 m high, of uniform circular section, 3.6 m external diameter and 2.1 m internal diameter is subjected to a horizontal wind pressure of 1.2 KN/m^2 of projected area. Find the maximum and minimum stress intensities at the base, if the specific weight of masonry is 24 KN/m^3.	BL3	CO4
5	For the unequal angle section as shown in figure, determine the location of principal axes and principal moments of inertia.	BL3	CO5

			
OR			
6	Discuss the deflection of a beam under unsymmetrical bending.	BL1	CO5

II B.Tech II Semester Regular Examinations, July 2022

MODEL PAPER

Solid Mechanics- II

(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.	Discuss theories of failures in case of thin cylinders	**[2]**	**CO1**	**BL2**
b.	List out the assumptions made in Lame's theory of thick cylinders.	**[2]**	**CO1**	**BL1**
c.	Define torque and give the expression for shear stress.	**[2]**	**CO2**	**BL1**
d.	List out the types of springs.	**[2]**	**CO2**	**BL1**
e.	Explain assumption in Euler's theory.	**[2]**	**CO3**	**BL2**
f.	Define beam column with example.	**[2]**	**CO3**	**BL2**
g.	Explain the wind coefficient (k) for different shapes of Chimneys.	**[2]**	**CO4**	**BL2**
h.	Discuss stability of the dam in view of tension at the base.	**[2]**	**CO4**	**BL2**
i.	Explain concept of unsymmetrical bending with neat sketch.	**[2]**	**CO5**	**BL2**
j.	Define product of inertia.	**[2]**	**CO5**	**BL1**

PART – B
(Answer ALL questions. All questions carry equal marks)
5 * 10 = 50 Marks

2.	A cylindrical shell is 4m long, having 1m internal diameter and 20mm thickness. Calculate the maximum intensity of shear stress induced and also the change in dimensions of the shell, if it is subjected to an internal fluid pressure of 1.75 N/mm2. Take $E=2X10^5$ MPa and poisons ratio 0.3.	**[10]**	**CO1**	**BL3**
	OR			
3.	A thick spherical shell of 250mm internal diameter is subjected to an internal fluid pressure of 8 N/mm^2. If the permissible tensile stress in the shell material is 12 N/mm^2, find the necessary thickness of a shell?	**[10]**	**CO1**	**BL3**
4.	A solid shaft of 80 mm diameter is to be replaced by a hallow shaft of external diameter 100 mm. Determine the internal diameter of the hollow shaft if the same power is to be transmitted by both the shafts at the same angular velocity and shear stress..	**[10]**	**CO2**	**BL3**
	OR			

5.	A Closely coiled helical spring is of 60 mm mean diameter and wire diameter of 6mm subjected to a load of 600 N, having 12 no. of turns with Modulus of Rigidity as 45GPa. Calculate the Maximum deflection and stiffness of the spring.	**[10]**	**CO2**	**BL3**
6.	A column of 2.1 m long and in circular c/s is subjected to a load of 120 kN, the load is parallel to the axis but eccentric by an amount of 2.5mm. The external and internal diameter of the column is 60 mm and 50 mm respectively. Determine the maximum stress in the column, if both the ends of the column are hinged, take E as 200 GN/m^2.	**[10]**	**CO3**	**BL3**
	OR			
7.	A Simply supported beam of length 6m is subjected to a UDL of 30kN/m over the whole span and deflects by 20mm at the centre of a beam. Determine the crippling load, when this beam is used as a column for both ends as hinged.	**[10]**	**CO3**	**BL3**
8.	Concrete dam has its upstream face vertical and a top width of 3 m. Its downstream face has a uniform batter. It stores water to a depth of 15 m with a free board of 2 m. The weights of water and concrete may be taken as 10 kN/m^3 and 25 kN/m^3 respectively. Calculate the minimum dam width at the bottom for no tension in the concrete, neglect uplift.	**[10]**	**CO4**	**BL5**
	OR			
9.	A masonry chimney 24 m high, of uniform circular section, 3.5 m external diameter and 2 m internal diameter is subjected to a horizontal wind pressure of 1 KN/m^2 of projected area. Find the maximum and minimum stress intensities at the base, if the specific weight of masonry is 22 KN/m^3.	**[10]**	**CO4**	**BL3**
10.	a. Define principal axis and Principal moment of inertia. b. Discuss the deflection of a beam under unsymmetrical bending.	**[4]** **[6]**	**CO5** **CO5**	**BL1** **BL2**
	OR			
11.	A curved beam semi-circular in plan, 5m radius and supported on three equally spaced supports. The beam carries a UDL of 20kN/m of the circular length. Analyze the beam and plot the twisting moment diagramDiscuss the limit state design of serviceability for deflection.	**[10]**	**CO5**	**BL4**

*****

GR20 2021-22 B.Tech CE 220, Section: A GR20A2016 Solid Mechanics - II Sessional Marks

S.No	Roll No	MID-I Marks	MID-II Marks	Tutorial Marks	Assessment Marks	Sessional Marks
1	20241A0101	7	5	5	3	14
2	20241A0102	0	3	2	2	6
3	20241A0103	1	2	2	2	6
4	20241A0104	7	12	3	5	18
5	20241A0105	2	5	2	2	8
6	20241A0106	3	5	2	2	8
7	20241A0107	2	2	2	3	7
8	20241A0108	AB	2	2	2	5
9	20241A0109	2	4	2	2	7
10	20241A0110	3	7	2	3	10
11	20241A0111	2	3	2	2	7
12	20241A0112	11	18	3	5	23
13	20241A0113	4	5	3	4	12
14	20241A0114	4	2	2	2	7
15	20241A0115	7	14	3	5	19
16	20241A0116	9	10	5	3	18
17	20241A0117	19	17	3	5	26
18	20241A0118	9	15	3	5	20
19	20241A0119	14	14	3	5	22
20	20241A0121	13	11	2	2	16
21	20241A0122	14	16	5	5	25
22	20241A0123	10	16	2	3	18
23	20241A0124	AB	10	2	3	10
24	20241A0125	14	15	2	3	20
25	20241A0126	3	8	2	2	10
26	20241A0127	15	12	5	5	24
27	20241A0128	AB	7	2	3	9
28	20241A0129	17	16	5	5	27
29	20241A0130	2	3	2	2	7
30	20241A0131	9	15	2	3	17
31	20241A0132	13	13	2	3	18
32	20241A0133	3	6	2	2	9
33	20241A0134	17	14	2	2	20
34	20241A0135	6	2	2	2	8
35	20241A0136	17	19	5	5	28
36	20241A0137	20	20	5	5	30
37	20241A0138	6	6	2	2	10
38	20241A0139	4	7	2	2	10
39	20241A0140	16	16	3	5	24
40	20241A0141	0	4	2	2	6
41	20241A0142	11	16	5	5	24
42	20241A0143	11	15	5	4	22
43	20241A0144	20	20	5	4	29
44	20241A0146	2	7	2	2	9
45	20241A0147	11	12	3	5	20
46	20241A0148	2	4	2	3	8
47	20241A0149	13	12	5	5	23
48	20241A0150	19	20	5	5	30
49	20241A0151	12	6	3	5	17
50	20241A0152	4	5	2	2	9
51	20241A0153	11	13	5	5	22

52	20241A0154	19	18	5	5	29
53	20241A0155	14	17	5	5	26
54	20241A0156	14	10	2	2	16
55	20241A0157	11	10	2	3	16
56	20241A0158	14	19	5	5	27
57	20241A0159	4	10	2	2	11
58	20241A0160	6	9	2	2	12
59	21245A0101	16	18	5	5	27
60	21245A0102	20	20	5	5	30
61	21245A0103	17	20	5	5	29
62	21245A0104	17	19	5	4	27
63	21245A0105	20	20	5	5	30

P. Mouna

4.5/5

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering (AY: 2021-22)
II B.Tech. II Semester, Objective Question Paper for Mid-II
Solid Mechanics-II (Sub Code: GR20A2016)

Name: P. MOUNA Hall Ticket No. 21245A0105

Answer All Questions. **All Questions Carry Equal Marks.**
Time: 10 Min. **Date of Exam: 30-06-2022 (AN)** **Marks: (10 X 0.5 = 5)**

I. Choose the correct alternative:

Question No	Questions
1	A column of length 'L' buckles at load 'P1', which is hinged at both the ends. And other column of same length and same cross section, but fixed at both ends buckles at load P2. Then P2/P1 is a) 1 b) 4 c)16 d) 8 (b)
2	If the reservoir is full then , the forces acting on the dam are (d) a) Weight of the dam b) Resultant force c) Force acting due to water d) All
3	A beam which is subjected to lateral load in addition to axial load is called (c) a) Long column b. Short column c. Beam column d. Strut
4	In case of circular column of diameter (d), then the limiting value of eccentricity is a. d/8 b) d/3 c)d/4 d) d/6 (b)
5	The position of neutral axis (NA) in unsymmetrical bending is calculated by using (b) a. $\tan\beta = I_{vv}/I_{uu}*\tan\theta$ b. $\tan\beta = I_{uu}/I_{vv}*\tan\theta$ c. $\tan\beta = I_{vv}/I_{vv}*\tan\theta$ d. $\tan\beta = I_{uu}/I_{uu}*\tan\theta$
6	Principal axes are the axes about which the product of inertia is (d) a) Maximum b) Negative c)Minimum d)Zero
7	The wind coefficient value (k) for a masonry chimney of square cross section is (b) a. 0.5 b. 1.0 c. 0.67 d. 1.5
8	When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as (d) a. passive earth pressure b. swelling pressure c. pore pressure d. active earth pressure
9	The moment of inertia about principal axis is called (b) a. Product of inertia b. principal moment of inertia c. shear stress d. bending stress
10	At the base of a chimney, what stresses will be developed (c) a. Bending stress only b. Direct stress only c. a and b d. shear stress only

Institute of Engineering & Technology
(Autonomous College Affiliated to JNTUH)
Bachupally, Kukatpally, Hyderabad - 500090

(12 Pages)

I | II **MID TERM EXAMINATION**

No. 139722

H.T. No. 2 1 2 4 5 A 0 1 0 5

Name of the Examination II B.Tech II Sem Mid-II Examination

Course SM-II Branch Civil Engineering Date 30-6-22.

Signature of the Invigilator

Q.NO.	1		2		3		4		5		6		TOTAL
	a	b	a	b	a	b	a	b	a	b	a	b	
MARKS	5				5		5		5				15

15

START WRITING FROM HERE

Axial load, $P = 150\,KN = 150\times10^3\,N$

Length, $L = 2.2\,m = 2200\,mm$

$f_{max} = 160\,N/mm^2$

$E = 200\times10^3\,N/mm^2$

Cross sectional Area, $A = 60\times60 = 3600\,mm^2$

Lateral load = W

f_{max} = Direct stress + Bending stress

$= f_0 + f_b$

$f_0 = \frac{P}{A} = \frac{150\times10^3}{3600} = 41.67\ N/mm^2$

$f_b = \frac{M_{max}}{Z}$ (∵ For Max. Lateral Load, calculate Mmax)

$$M_{max} = \frac{-W}{2}\left[\sqrt{\frac{EI}{P}} \tan \frac{l}{2}\sqrt{\frac{P}{EI}}\right]$$

$$\frac{l}{2}\sqrt{\frac{P}{EI}} = \frac{2200}{2}\sqrt{\frac{150\times10^3}{200\times10^3\times I}}$$

$$I = \frac{a^4}{12} = \frac{60^4}{12} = 1.08\times10^6 mm^4$$

$$\frac{l}{2}\sqrt{\frac{P}{EI}} = \frac{2200}{2}\sqrt{\frac{150\times10^3}{200\times10^3\times1.08\times10^6}}$$

$$= 0.92 rad = \frac{0.92\times180}{\pi} = 52.71^\circ$$

$$M_{max} = \frac{-W}{2}\left[\sqrt{\frac{200\times10^3\times1.08\times10^6}{150\times10^3}} \tan(52.71^\circ)\right]$$

$$= -787.89W$$

$$Z = \frac{I}{y} = \frac{1.08\times10^6}{\frac{60}{2}} = 36000 mm^3$$

$$f_b = \frac{-787.89W}{36000}$$

$$f_{max} = 41.67 - \frac{787.89W}{36000}$$

$$160 - 41.67 = \frac{-787.89W}{36000}$$

$$118.33 = \frac{-787.89W}{36000}$$

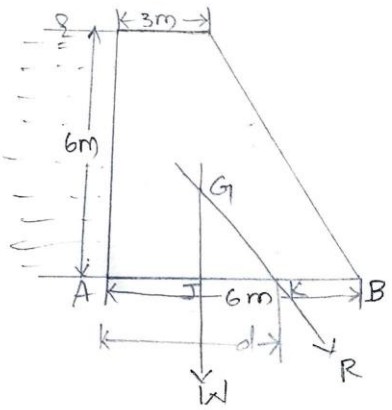
$W = -5406.693\ N$

$W = -5.406\ KN$ ('−' indicates the direction).

3. $a = 3m,\ b = 6m,\ H = h = 6m$

$\omega = 10\ KN/m^3,\ \rho = 24\ KN/m^3$

Extra



$$f_{max} = \frac{W}{b}\left[1 + \frac{6e}{b}\right]$$

$$f_{min} = \frac{W}{b}\left[1 - \frac{6e}{b}\right]$$

(ii) When reservoir is full

$$P = \frac{\omega h^2}{2} = \frac{10 \times 6^2}{2} = 180\ KN/m$$

$$W = \rho \times \left(\frac{a+b}{2}\right) \times H = 24 \times \left(\frac{3+6}{2}\right) \times 6 = 648\ KN/m$$

$d = AJ + JK$

$$AJ = \frac{a^2 + ab + b^2}{3(a+b)} = \frac{3^2 + (3\times6) + 6^2}{3(3+6)} = 2.33m$$

$$JK = \frac{P}{W} \times \frac{h}{3} = \frac{180}{648} \times \frac{6}{3} = 0.56m$$

$d = 2.33 + 0.56 = 2.9m$

$e = d - \frac{b}{2}$

$= 2.9 - \frac{6}{2} = -0.1$

$$f_{max}_{(A)} = \frac{648}{6}\left[1 + \frac{6(-0.1)}{6}\right] = 97.2\ N/mm^2$$

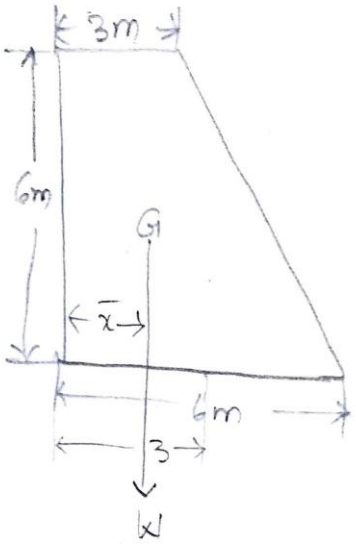
$$f_{max}_{(B)} = \frac{648}{6}\left[1 - \frac{6(-0.1)}{6}\right] = 118.8\ N/mm^2$$

(ii) When the reservoir is empty

$$e = \frac{b}{2} - \bar{x}$$

$$= \frac{6}{2} - 2.34$$

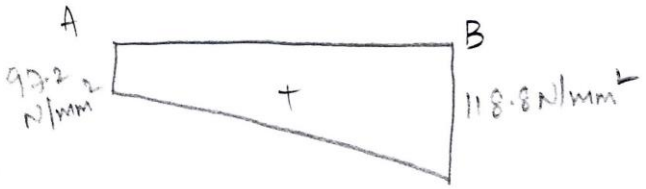
$$= 0.66m$$



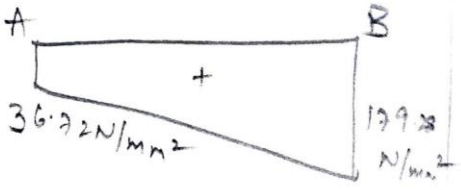
$$f_{max}_{(B)} = \frac{648}{6}\left[1 + \frac{6(0.66)}{6}\right]$$

$$= 179.28\ N/mm^2$$

$$f_{min}_{(A)} = 36.72\ N/mm^2$$



When Reservoir is full



When Reservoir is empty.

5.

$a_1 = 100 \times 10 = 1000 mm^2$

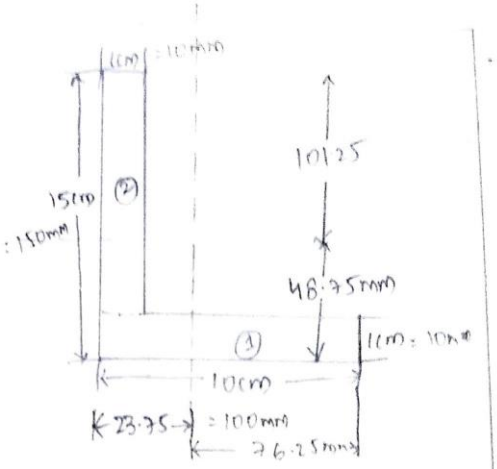
$x_1 = \frac{100}{2} = 50mm$

$y_1 = \frac{10}{2} = 5mm$

$a_2 = 140 \times 10 = 1400 mm^2$

$x_2 = \frac{10}{2} = 5mm$

$y_2 = 10 + \frac{140}{2} = 80mm$



$$\bar{x} = \frac{a_1 x_1 + a_2 x_2}{a_1 + a_2} = \frac{(1000 \times 50) + (1400 \times 5)}{1000 + 1400} = 23.75mm$$

$$\bar{y} = \frac{a_1 y_1 + a_2 y_2}{a_1 + a_2} = \frac{(1000 \times 5) + (1400 \times 80)}{1000 \times 1400} = 48.75mm$$

$$I_{xx} = I_{xx_1} + I_{xx_2}$$

$$I_{xx_1} = \frac{bd^3}{12} + a_1 (\bar{y} - y_1)^2$$

$$= \frac{100 \times 10^3}{12} + 1000 (43.75)^2 = 1.92 \times 10^6 mm^4$$

$$I_{xx_2} = \frac{bd^3}{12} + a_2 (\bar{y} - y_2)^2$$

$$I_{xx_2} = \frac{10 \times 140^3}{12} + 1400 (31.25)^2 = 3.65 \times 10^6 mm^4$$

$$I_{xx} = 5.57 \times 10^6 mm^4$$

$$I_{yy} = I_{yy_1} + I_{yy_2}$$

$$I_{yy_1} = \frac{db^3}{12} + a_1 (\bar{x} - x_1)^2$$

$$= \frac{10 \times 100^3}{12} + 1000 (23.75 - 50)^2 = 1.52 \times 10^6 mm^4$$

$$I_{yy_2} = \frac{db^3}{12} + A(\bar{x} - x_2)^2$$

$$= \frac{140 \times 10^3}{12} + 1400(23.75-5)^2$$

$$= 503.85 \times 10^3 \text{ mm}^4$$

$$I_{yy} = 1.52 \times 10^6 + 503.85 \times 10^3 = 2.02 \times 10^6$$

$$I_{UU} = \frac{I_{xx} + I_{yy}}{2} + \sqrt{\left(\frac{I_{xx} - I_{yy}}{2}\right)^2 + (I_{xy})^2}$$

$$I_{VV} = \frac{I_{xx} + I_{yy}}{2} - \sqrt{\left(\frac{I_{xx} - I_{yy}}{2}\right)^2 + (I_{xy})^2}$$

$$I_{xy} = \underset{G_1}{(x\ y\ A)} + \underset{G_2}{(x\ y\ A)} = (26.25 \times -43.75 \times 1000) + (-18.75 \times 31.25 \times 1400)$$

$$= -1.968 \times 10^6$$

$G_1 \rightarrow x = +26.25\text{mm}(50-23.75)$

$y = -48.75+5 = -43.75\text{mm}$

$A = 1000\text{mm}^2$

$G_2 \rightarrow x = -23.75+5 = -18.75\text{mm}$

$y = 101.25 - 70 = 31.25\text{mm}$

$A = 1400\text{mm}^2$

$$I_{UU} = \frac{5.57 \times 10^6 + 2.02 \times 10^6}{2} + \sqrt{\left(\frac{5.57 \times 10^6 - 2.02 \times 10^6}{2}\right)^2 + (-1.968 \times 10^6)^2}$$

$= 1.005 \times 10^{13}\text{ mm}^4$ ~~$= 6.445 \times 10^6\text{ mm}^4$~~

$$I_{vv} = \frac{5.59\times10^6 + 2.02\times10^6}{2} - \sqrt{\left(\frac{5.59\times10^6 - 2.02\times10^6}{2}\right)^2 - (-1.968\times10^6)^2}$$

$$= 1.144\times10^6$$

$$\tan 2\theta = \frac{2I_{xy}}{I_{yy} - I_{xx}}$$

$$= \frac{2(-1.968\times10^6)}{(2.02\times10^6) - (5.59\times10^6)} = 1.108$$

$$2\theta = \tan^{-1}(1.108) = 47.93^\circ$$

$$\theta_1 = 23.96^\circ$$

$$\theta_2 = 113.96^\circ$$

---

4. $w = 24\,KN/m^3$, $P = 1.2\,KN/m^2$

5. $f_{max} = f_0 + f_b$

$f_{min} = f_0 - f_b$

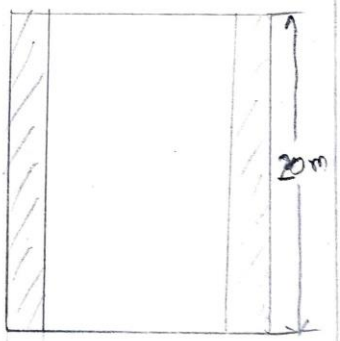
$$f_0 = \frac{W}{A}$$

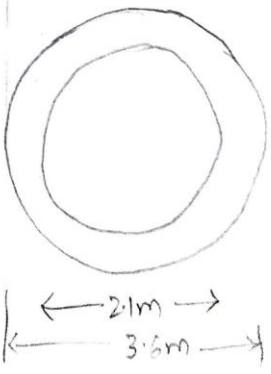
$$W = w \times A \times H$$

$$= 24 \times \frac{\pi}{4}(3.6^2 - 2.1^2) \times 20$$

$$= 3.223\times10^3\ KN/m$$

$$A = \frac{\pi}{4}(3.6^2 - 2.1^2) = 6.915\,mm^2$$





$$f_0 = \frac{3.223 \times 10^3}{6.715} = 480\ N/mm^2$$

$$f_b = \frac{M}{Z}$$

$$M = P \times \frac{h}{2}$$

$$P = K \times p \times A_p$$

$$= \frac{2}{3} \times 1.2 \times 3.6 \times 20 = 57.6$$

$$M = 57.6 \times \frac{20}{2} = 576\ N\text{-}mm$$

$$I = \frac{\pi}{64}\left(3.6^4 - 2.1^4\right) = 7.29\ mm^4$$

$$Z = \frac{I}{y} = \frac{7.29}{\frac{3.6}{2}} = 4.05\ mm^3$$

$$f_b = \frac{576}{4.05} = 142.22\ N/mm^2$$

$$f_{max} = 622.22\ N/mm^2$$

$$f_{min} = 337.78\ N/mm^2$$

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Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering (AY: 2021-22)
II B.Tech. II Semester, Objective Question Paper for Mid-II
Solid Mechanics-II (Sub Code: GR20A2016)

Name: M. Mahesh Hall Ticket No. 2 0 2 4 1 A 0 1 2 7

Answer All Questions. **All Questions Carry Equal Marks.**
Time: 10 Min. **Date of Exam: 30-06-2022 (AN)** **Marks: (10 X 0.5 = 5)**

I. Choose the correct alternative:

Question No.	Questions
1	A column of length 'L' buckles at load 'P1', which is hinged at both the ends. And other column of same length and same cross section, but fixed at both ends buckles at load P2.Then P2/P1 is a) 1 b)4 c)16 d) 8 (B)
2	If the reservoir is full then , the forces acting on the dam are (D) a) Weight of the dam b) Resultant force c) Force acting due to water d) All
3	A beam which is subjected to lateral load in addition to axial load is called (C) a) Long column b. Short column c. Beam column d. Strut
4	In case of circular column of diameter (d), then the limiting value of eccentricity is a. d/8 b) d/3 c)d/4 d) d/6 (D)
5	The position of neutral axis (NA) in unsymmetrical bending is calculated by using (A) a. $\tan\beta = I_{vv}/I_{uu}*\tan\theta$ b. $\tan\beta = I_{uu}/I_{vv}*\tan\theta$ c. $\tan\beta = I_{vv}/I_{vv}*\tan\theta$ d. $\tan\beta = I_{uu}/I_{uu}*\tan\theta$
6	Principal axes are the axes about which the product of inertia is (D) a) Maximum b) Negative c)Minimum d)Zero
7	The wind coefficient value (k) for a masonry chimney of square cross section is (C) a. 0.5 b. 1.0 c. 0.67 d. 1.5
8	When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as (D) a. passive earth pressure b. swelling pressure c. pore pressure d. active earth pressure
9	The moment of inertia about principal axis is called (B) a. Product of inertia b. principal moment of inertia c. shear stress d. bending stress
10	At the base of a chimney, what stresses will be developed (B) a. Bending stress only b. Direct stress only c. a and b d. shear stress only

Gokaraju Rangaraju Institute of Engineering & Technology

(Autonomous College Affiliated to JNTUH) (12 Pages)

Bachupally, Kukatpally, Hyderabad - 500090

I	II	MID TERM EXAMINATION

No. 417933 H.T.No. 2 0 2 4 1 A 0 1 2 1

Name of the Examination II-B.Tech I-Sem Mid II Examination

Course B.Tech Branch Civil Engineering Date 30/06/2022

Signature of the Invigilator

Q.NO	1		2		3		4		5		6		TOTAL
	a	b	a	b	a	b	a	b	a	b	a	b	
MARKS													

M. Mahesh

START WRITING FROM HERE

1 Given

$L = 2.2\ m$

dimension of strut : $60 \times 60\ mm$

$P = 150\ kN$

W = lateral load

Hinged at both ends

Stress $= 160\ N/mm^2$

~~$M_{max} = \frac{W}{2}\left(\sqrt{\frac{EI}{P}}\ \tan\frac{L}{2}\sqrt{\frac{P}{EI}}\right)$~~

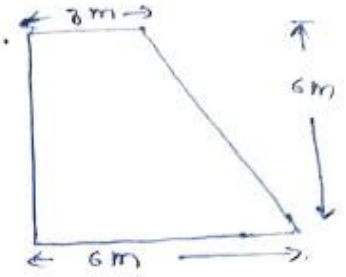
$\therefore f_{max} = \frac{P}{A} + \frac{M}{Z}$

$M_{max} = \frac{W}{L}\left(\sqrt{\frac{EI}{P}}\right)\tan \frac{1}{2}\sqrt{\frac{P}{EI}}$

3. Given,

(4)

$a = 3$
$b = 6$
$H = 6$
$h = 6$
$w = 10$
$g = 24$



full

$\rightarrow d = AJ + JK$

$\Rightarrow AJ = \frac{a^2+ab+b^2}{3(a+b)} = \frac{3^2+3(6)+6^2}{3(3+6)}$

$= \frac{9+18+36}{3(9)} = \frac{63}{27} = 2.33$

$\rightarrow JK = \frac{P}{w} \times \frac{h}{3} =$

$= \frac{1800}{648} \times \frac{6}{3} = \frac{5.555}{0.555}$

$\rightarrow P = \frac{wh^2}{2} = \frac{10 \times 6^2}{2}$

$= \frac{360}{2} = 180$

$\Rightarrow W = g\left(\frac{a+b}{2}\right)H$

$= 24\left(\frac{3+6}{2}\right)6$

$= 24\left(\frac{9}{2}\right)6$

$= 648$

$d = AJ + JK = 2.33 + 0.55$

$= 2.88$

$e = d - b/2 \Rightarrow 2.88 - 6/2 = 2.88 - 3$

$= -0.12$

$\rightarrow f_{max} = \frac{w}{b}\left(1 + \frac{6e}{b}\right) = \frac{648}{6}\left(1 + \frac{6(0.12)}{6}\right)$

$= 120.96$

$\rightarrow f_{min} = \frac{w}{b}\left(1 - \frac{6e}{b}\right) = \frac{648}{6}\left(1 - \frac{6(0.12)}{6}\right)$

$= 95.04$

When reservoir is empty:

$h = 0$

$$AJ = \frac{3^2 + 6^2 + 3(6)}{3(3+6)} = \frac{9+36+18}{3(9)} = \frac{63}{27} = 2.33$$

$$Jk = \frac{p}{\omega} \times \frac{h}{3} = \frac{0}{648} \times \frac{0}{3}$$

$$= 0$$

$$d = AJ + Jk = 2.33$$

$\rightarrow p = \frac{\omega h}{2} = 0$

$\omega = 9\left(\frac{a+b}{2}\right)$ #

$= 648$

$$e = d - b/2 = 2.33 - 6/2 = 2.33 - 3 = -0.67$$

$$\rightarrow f_{max} = \frac{\omega}{b}\left(1 + \frac{6e}{b}\right) = \frac{648}{6}\left(1 + \frac{6(0.67)}{6}\right)$$

$$= 180.36$$

$$\rightarrow f_{min} = \frac{648}{6}\left(1 - \frac{6e}{b}\right) = \frac{648}{6}\left(1 - \frac{6(0.67)}{6}\right)$$

$$= 35.64$$

5. Sec①

$a_1 = 10 \times 1 = 10 \text{ cm}^2$

$x_1 = 10/2 = 5 \text{ cm}$

$y_1 = 1/2 = 0.5 \text{ cm}$

$a_2 = 14 \times 1 = 14 \text{ cm}^2$

$x_2 = 1/2 = 0.5 \text{ cm}$

$y_2 = 1 + \frac{14}{2} = 1 + 7.5 = 8.5$

$$\bar{x} = \frac{a_1x_1 + a_2x_2}{a_1 + a_2} = \frac{10(5) + 14(0.5)}{10 + 14} = 2.375$$

$$\bar{y} = \frac{a_1y_1 + a_2y_2}{a_1 + a_2} = \frac{10(0.5) + 14(8.5)}{10 + 14} = 5.166$$

$$I_{xx} = \frac{bd^3}{12} + a_1h_1^2 + \left(\frac{bd^3}{12} + a_2h_2^2\right)$$

$$= \frac{10(1)^3}{12} + 10(5.166 - 0.5)^2 + \left(\frac{1(14)^3}{12} + 14(5.166 - 8.5)^2\right)$$

$$= 602.833$$

$$I_{yy} = \frac{db^3}{12} + a_1h_1^2 + \frac{db^3}{12} + a_2h_2^2$$

$$= \frac{1(10)^3}{12} + 10(2.375 - 5)^2 + \frac{14(1)^3}{12} + 14(2.375 - 0.5)^2$$

$$= 202.625$$

G_1: $x = 5 - 2.375 = 2.625$

$y = -14 + 5.166 = -8.834$

$C.G_2 \rightarrow x_2 = 2.375 - 5 = -2.625$

$y_2 = 14 - 5.166 = 8.834.$

$= (10)(2.65)(-8.834) + 14(-2.625)(8.834)$

$= 558.7505$

$$I_{xy} = \frac{I_{xx}+I_{yy}}{2} + \frac{I_{yy}-I_{xx}}{2} + 558.7505$$

$$\theta = \tan^{-1}\left(\frac{I_{xx}+I_{yy}}{I_{yy}}\right)$$

$\rightarrow \theta =$

$$I_{UU} = \frac{I_{xx}+I_{yy}}{2} + \sqrt{\left(\frac{I_{xx}-I_{yy}}{2}\right)^2 + \left(\frac{I_{yy}}{\sin\theta}\right)^2 + \left(\frac{I_{xx}}{\cos\theta}\right)^2}$$

$\rightarrow \theta = 63°$

$$I_{UU} = \frac{I_{xx}+I_{yy}}{2} + \sqrt{\left(\frac{I_{xx}-I_{yy}}{2}\right)^2 + \left(\frac{I_{yy}}{\sin\theta}\right)^2 + \left(\frac{I_{xy}}{\cos\theta}\right)^2}$$

$= 1764.695$

$I_{VV} = 1726.179$

Jabby..

1/5

Gokaraju Rangaraju Institute of Engineering and Technology
Department of Civil Engineering (AY: 2021-22)
II B.Tech. II Semester, Objective Question Paper for Mid-II
Solid Mechanics-II (Sub Code: GR20A2016)

Name: Abhiram . Hall Ticket No. 202141A0102

Answer All Questions. **All Questions Carry Equal Marks.**
Time: 10 Min. **Date of Exam: 30-06-2022 (AN)** **Marks: (10 X 0.5 = 5)**

I. Choose the correct alternative:

Question No.	Questions
1	A column of length 'L' buckles at load 'P1', which is hinged at both the ends. And other column of same length and same cross section, but fixed at both ends buckles at load P2.Then P2/P1 is a) 1 b) 4 c)16 d) 8 (a)
2	If the reservoir is full then , the forces acting on the dam are (d) a) Weight of the dam b) Resultant force c) Force acting due to water d) All
3	A beam which is subjected to lateral load in addition to axial load is called (c) a) Long column b. Short column c. Beam column d. Strut
4	In case of circular column of diameter (d), then the limiting value of eccentricity is a. d/8 b) d/3 c)d/4 d) d/6 (b)
5	The position of neutral axis (NA) in unsymmetrical bending is calculated by using (a) a. $\tan\beta = Ivv/Iuu*\tan\Theta$ b. $\tan\beta = Iuu/Ivv*\tan\Theta$ c. $\tan\beta = Ivv/Ivv*\tan\Theta$ d. $\tan\beta = Iuu/Iuu*\tan\Theta$
6	Principal axes are the axes about which the product of inertia is (a) a) Maximum b) Negative c)Minimum d)Zero
7	The wind coefficient value (k) for a masonry chimney of square cross section is (d) a. 0.5 b. 1.0 c. 0.67 d. 1.5
8	When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as (b) a. passive earth pressure b. swelling pressure c. pore pressure d. active earth pressure
9	The moment of inertia about principal axis is called (c) a. Product of inertia b. principal moment of inertia c. shear stress d. bending stress
10	At the base of a chimney, what stresses will be developed (d) a. Bending stress only b. Direct stress only c. a and b d. shear stress only

Gokaraju Rangaraju Institute of Engineering & Technology

(Autonomous College Affiliated to JNTUH)

Bachupally, Kukatpally, Hyderabad - 500090

(12 Pages)

I	II	MID TERM EXAMINATION

No. 407908

H.T. No. 2024 1A 0102

Name of the Examination Solid Mechanics - II.

Course II B.TECH II Sem mid-2 Branch Civil Date 30/6/22.

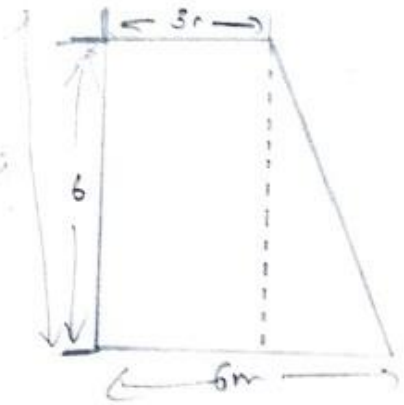
Signature of the Invigilator

Q.NO.	1		2		3		4		5		6		TOTAL
	a	b	a	b	a	b	a	b	a	b	a	b	
MARKS			0		2		0		0				2

2/15

START WRITING FROM HERE

③ Given.



$a = 3$

$h = 6$

$H = 9$

$w = 10 KN/m^3$

$c = 24 KN/m^3$.

$d = AJ + x$.

$$AJ = \frac{a^2 + ab + b^2}{3(a+b)}$$

$$x = \frac{P}{W} \cdot \frac{h}{3}$$

$$P = \frac{w h^2}{3}$$

$$W = \int \left(\frac{a+b}{3}\right) H.$$

$$AJ = \frac{3^2 + 3b + b^2}{3(a+b)}$$

$$\Rightarrow \frac{9^2 + 3b + b^2}{3(a+b)}.$$

$$P = \frac{wh^2}{3}$$

$$= \frac{10(6)^2}{3}$$

$$= \frac{10 \times 36}{3}$$

$$= \frac{360}{3}$$

$$= 120\ KN/m^3.$$

$$W = P\left(\frac{a+b}{3}\right) M.$$

$$= \left(\frac{3+b}{3}\right) 9.$$

$$= \frac{27+9b}{3}$$

$$= 9 + 9b$$

$$x = \frac{120}{9+9b} \times \frac{9}{3}$$

$$= \frac{120 \times 9}{3 \times 3(a+b)} = \frac{120 \times \frac{9}{3}}{9+9b}$$

$$= \frac{1080}{3 \times 3(a+b)} = \frac{120 \times 9}{3+3b+3}$$

$$= \frac{1080}{9+3b}$$

$$d = AJ + x.$$

$$= \frac{9^2 + 3b + b^2}{3(a+b)} + \frac{1080}{9+3b+3}$$

$$= \frac{9^2 + 3b + b^2 + 3240}{3(a+b)}.$$

$$\frac{b}{6} = \frac{9^2 + 3b + b^2 + 3240}{3(a+b)}.$$

$$\frac{b}{6} = \frac{9^2 + 3240}{3(a+b)} - \frac{b}{2}.$$

$$d = 8.02\ m$$

(5) Given.

$a_1 = 15$.

$a_2 = 10$

$b_1 = 14$

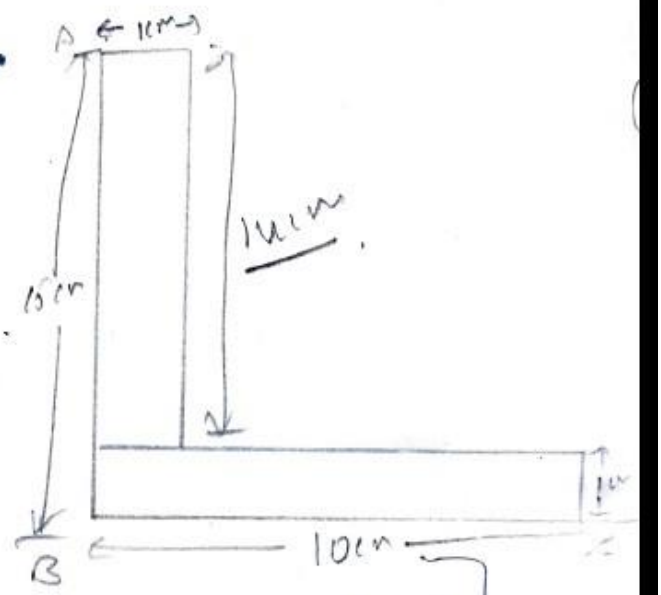
$b_2 = 9$.

$x_1 = 29$

$x_2 = \frac{15}{14}$.

$y_1 = 19$.

$y_2 = \frac{10}{9}$.



$$\bar{x} = \frac{\left[\left(\frac{b_1 y_1}{2} + \frac{b_2 y_2}{2}\right) x_2 + \left(\frac{a_1 y_1}{2} + \frac{a_2 y_2}{2}\right)\right]}{}$$

$$\bar{y} = \frac{\left[\left(\frac{b_2 y_2}{2} + \frac{b_1 y_1}{2}\right) - \left(\frac{a_1 y_1}{2} + \frac{a_2 y_2}{2}\right)\right]}{}$$

(c) Given

$b = 20m$.

$H = 3.6m$.

$d = 2.1m$.

$w = 1.2 KN/m^2$.

$e = 24 KN/m^3$

(2) A masonry retaining wall of trapezoidal section with a vertical face on the earth side is 2m wide at the top; 5m wide at the bottom and 8m high. It remains sand over the entire height with an angle of surcharge 22°. Determine the distribution of pressure at the base of the wall. Take weight of the sand and that of masonry as $18 KN/m^3$ and $24 KN/m^3$ respectively. It has an angle of repose of 30°

CODE: GR20A2016 | GR 20 | SET - 4

II B.Tech II Semester Regular Examinations, July/August 2022

SOLID MECHANICS- II
(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.	A cast iron pipe of 750 mm diameter is used to carry water under a head of 60 m. Determine the thickness of the pipe if the permissible stress is to be 20 MPa. Consider the unit weight of water is 10 kN/m^3.	[2]	CO1	BL3
b.	What are the assumptions made in Lame's theory?	[2]	CO1	BL1
c.	Why hollow circular shafts are preferred when compared to solid circular shafts?	[2]	CO2	BL1
d.	What do you mean by close coiled helical spring? List out the stresses induced in the helical compression spring due to axial load.	[2]	CO2	BL1
e.	What are the classifications of columns?	[2]	CO3	BL1
f.	Define the term slenderness ratio and describe with mathematical expression, how it limits the use of Euler's formula for crippling load.	[2]	CO3	BL1
g.	What do you mean by direct stress and bending stress?	[2]	CO4	BL2
h.	Discuss stability of the dam in view of tension at the base.	[2]	CO4	BL2
i.	Explain concept of unsymmetrical bending with neat sketch.	[2]	CO5	BL2
j.	State the parallel Axes and Principal Moment of inertia	[2]	CO5	BL2

PART – B
(Answer ALL questions. All questions carry equal marks)

5 * 10 = 50 Marks

2.	A thin steel cylindrical shell of thickness 10 mm, 1.5 m diameter and 4.5 m long is carrying a fluid at a pressure of 3.5 N/mm^2. Determine the change in diameter, length and volume of the cylinder. Assume E=2x10^5 N/mm^2 and Poisson's ratio=0.25.	[10]	CO1	BL3

OR

3.	A thick cylinder has an internal diameter of 120 mm and an external diameter of 240mm. It is subjected to an internal pressure of 80 N/mm^2 and an external pressure of 20N/mm^2. Find the maximum value of the hoop stress, and the radial pressure at a radial distance of 115 mm. Plot the distribution of radial and hoop stresses across the thickness.	[10]	CO1	BL3

4. (a) A steel shaft of diameter 120 mm is subjected to a torque of 5 kN-m and a bending moment of 3 kN-m. Determine the magnitude and direction of the principal stresses and determine the maximum shear stress. [10] CO2 BL4

(b) A close-coiled helical spring having 24 turns is made of 8 mm diameter wire. The mean diameter of the spring is 80 mm and it carries a load of 250 N. Determine the shear stress developed, the deflection and the stiffness of the spring. Take G = 85 GPa. CO2 BL3

OR

5. A solid circular steel shaft is required to transmit 45 kW at 200 rpm. Determine the diameter of the shaft, if the maximum shear stress is not to exceed 60 N/mm^2 in shaft. The solid shaft is now replaced by a hollow steel shaft with the internal diameter equal to 75% of the external diameter. Determine the external diameter of the shaft if it is required to transmit the same power at same rpm and the maximum shear stress produced is also the same. Determine the % saving of the material by using hollow shaft in place of solid shaft. [10] BL4 CO2

6. A cast iron column of a hollow circular section with an external diameter of 250 mm and a wall thickness of 50 mm is subjected to an axial compressive load. The column is 7 m long with both ends hinged. Taking factor of safety as 8, determine the safe value of 'P'. Rankine's constants are, $f_c = 560\ N/mm^2$ and a=1/1600. [10] BL5 CO3

OR

7. Derive an expression for Euler's critical load of a column with one end fixed and the other end free from first principles. [10] CO3 BL4

8. A masonry retaining wall of trapezoidal section is 8 m high and retains earth which is level up to the top. The width at the top is 1.5 m and exposed face is vertical. Determine the minimum width of the wall at the bottom in order the tension may not be induced at the base. Masonry and earth has densities 2300 kg/m^3 and 1600 kg/m^3 respectively. The angle of repose of the soil is 30^0. [10] BL4 CO4

OR

9. A chimney of uniform cros section is 45 m high with external diameter 4 m and the internal diameter is 2.5 m. The chimney is subjected to horizontal wind pressure of 2 kN/m^2. The self-weight of the chimney is 2500 kN. Determine the maximum and minimum stresses. [10] CO4 BL3

10. A simply supported T- beam, 2.5m carries a central concentrated load inclined at 30° to the Y-axis. If the maximum compressive and tensile stresses are not exceeds75MPa respectively. Find the maximum load the beam can carry. [10] CO5 BL5

OR

11. A beam, semi-circular in plan of radius equal to 5 m, is simply supported on three equally spaced supports. The beam is subjected to uniformly distributed load of 20kN/m of curved length. Draw the bending moment diagram and indicate location and magnitude of maximum bending moment. [10] CO5 BL4

*****

Assignment Sample

ASSIGNMENT-1 SOLID MECHANICS - II

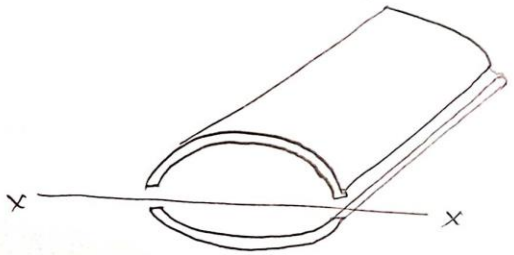
P. Mouna
21245A0105
CIVIL II YEAR

1. Explain the failure mechanisms of thin cylinder.

If the stresses exceeds the permissible stresses the cylinder is likely to fail in the following two ways.

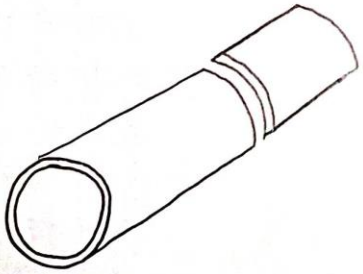
a) It may split-up into two troughs

The bursting will take place if the force due to fluid pressure is more than the resisting force due to circumferential stress set up in the Material



b) It may split-up into two cylinders.

The bursting will take place if the force due to fluid pressure acting on the ends of the cylinder is more than the resisting force due to longitudinal stress (σ_2) developed in the material



2. A cylindrical thin drum 600mm in diameter and 5m long is made of 15mm thick. If the drum is subjected to an internal pressure of 3.5MPa. Determine its change in diameter and length. Take E as 200GPa and poisson's ratio as 0.25.

$d = 600mm$

$l = 5000mm$

$t = 15mm$

$P = 3.5\ N/mm^2$

$E = 200 \times 10^3\ N/mm^2$

$\frac{1}{m} = 0.25$

$$\delta d = \frac{Pd^2}{2tE}\left[1 - \frac{1}{2m}\right]$$

$$= \frac{3.5 \times 600^2}{2 \times 15 \times 200 \times 10^3}\left[1 - \frac{0.25}{2}\right] = 0.184mm$$

$$\delta l = \frac{Pdl}{2tE}\left[\frac{1}{2} - \frac{1}{m}\right]$$

$$= \frac{3.5 \times 600 \times 5000}{2 \times 15 \times 200 \times 10^3}\left[\frac{1}{2} - 0.25\right]$$

$$= 0.437mm$$

3. A thick spherical shell of 200mm internal diameter is subjected to an internal fluid pressure of $7 N/mm^2$. If the permissible tensile stress in the shell Material is $8 N/mm^2$, find the necessary thickness of shell.

$d = 200mm$

Internal radius, $r_1 = \frac{200}{2} = 100mm$

fluid pressure, $p_x = 7 N/mm^2$

permissible stress, $f_x = 8 N/mm^2$

$$P_x = \frac{2b}{x^3} - a \quad \text{and} \quad f_x = \frac{b}{x^3} + a$$

At $x = 100mm$, $f_x = 8 N/mm^2$

$$8 = \frac{b}{100^3} + a = \frac{b}{1000000} + a \rightarrow (1)$$

At $x = 100mm$, $P_x = 7 N/mm^2$

$$7 = \frac{2b}{100^3} - a = \frac{2b}{1000000} - a \rightarrow (2)$$

From (1) & (2) by adding

$$15 = \frac{3b}{1000000}$$

$$b = \frac{1000000 \times 15}{3} = 5000000.$$

b in eq ①

$$8 = \frac{5000000}{1000000} + a = 5 + a$$

$$a = 3.$$

then $\therefore P_x = \frac{2 \times 5000000}{x^3} - 3$

$x = r_1$, $P_x = 0$

$$0 = \frac{2 \times 5000000}{r_1^3} - 3$$

$$r_1^3 = \frac{10000000}{3}$$

$$r_1 = \left(\frac{10^7}{3}\right)^{1/3} = 149.3\text{mm}$$

$\therefore$ Thickness of the shell, $t = r_1 - r_2 = 149.3 - 100 = 49.3\text{mm}$

4. Write the assumptions made in the Lame's Theory.

The problems of thick cylinders are solved on the basis of following assumptions.

a) The Material of the shell / cylinder is homogeneous and isotropic

b) The plane sections of the cylinder perpendicular to the longitudinal axis remains plane under the effect of internal pressure.

5. A cylindrical shell is 4m long, and is having 1m internal diameter and 20mm thickness. Calculate the maximum intensity of shear stress induced and also the change in a dimensions of the shell if it is subjected to an internal fluid pressure of $1.75 N/mm^2$ and $E = 2 \times 10^5$ and poison's ratio is 0.3.

length = 4000mm

internal diameter = 1000mm

thickness, t = 20mm

internal fluid pressure, $p = 1.75 N/mm^2$

$E = 2 \times 10^5 N/mm^2$

$\frac{1}{m} = 0.3$

$$\gamma_{max} = \frac{Pd}{8t} = \frac{1.75 \times 1000}{8 \times 20} = 10.937 N/mm^2$$

$$\delta d = \frac{Pd^2}{2tE}\left[1 - \frac{1}{2m}\right]$$

$$= \frac{1.75 \times 1000^2}{2 \times 20 \times 2 \times 10^5}\left[1 - \frac{0.3}{2}\right] = 0.185mm$$

$$\delta l = \frac{PdL}{2tE}\left[\frac{1}{2} - \frac{1}{m}\right]$$

$$= \frac{1.75 \times 1000 \times 4000}{2 \times 20 \times 2 \times 10^5}\left[\frac{1}{2} - 0.3\right] = 0.175mm$$