STRENGTHOFMATERIALS–I

Subject Code: **CE304PC**

Regulations:R**22**-JNTUH

Class   :IIYearB.TechCEISemester

Departmentof CivilEngineering

BHARATINSTITUTEOFENGINEERINGANDTECHNOLOGY

Ibrahimpatnam-501510,Hyderabad

STRENGTHOFMATERIALS– I(CE304PC)
COURSEPLANNER

I. COURSEOVERVIEW:

CivilEngineers are required to designstructures like building, beams, dams, bridges, etc. The loads coming onto these structures, along with the self-weight, have to be safely transmittedtotheground.Astructuralengineermustbeabletodesignastructurein suchawaythatnone

of its members failduring load transfer process. This foundationalcourse in civilengineering is intended to introduce to concepts ofstress and strain due to external loading on a structural member, and their calculations. For this, the concept and calculations of (a) shear force diagrams and bending moment diagram for different type of beams, (b) bending and shear stresses in beams, (c) slope and deflection of beams using various methods are covered in depth. The important calculations of principal stresses and principal strains and theconsequent theoryof failures for prediction ofthe strength ofthe materials are also discussed. Through this course content engineers can design the structures for safety and serviceability

II. PREREQUISITE(S):

Level	Credits	Periods/Week	Prerequisites
UG	3	4	Engineering Mechanics

III. COURSEOBJECTIVES:

TheobjectiveoftheteacheristoimpartknowledgeandabilitiestothestudentstO:

i. **Relate**mechanicalpropertiesofamaterialwithits behaviourundervarious load types
ii. **Classify** thetypesofmaterialaccording tothemodesoffailureand stress-straincurves.
iii. **Apply**theconceptsofmechanicstofindthestressesat apoint ina materialofastructural member
iv. **Analyze**a loadedstructuralmemberfordeflectionsand failurestrength
v. **Evaluate**thestresses&strains inmaterialsanddeflections inbeammembers
vi. **Create**diagramsforshearforce,bendingmoment,stressdistribution,mohr'scircle, elastic curve
vii. **Design**simple beammembersofdifferent cross-sectionstowithstandthe loadsimposed on them.

IV. COURSEOUTCOMES:

Aftercompletingthiscoursethestudentmustdemonstratetheknowledgeandabilityto:
1. **Calculate**thestressandstraindeveloped inanystructuralmemberduetoappliedexternal load.
2. **Differentiate**thetypeofbeams, andthevarious loadingandsupportconditionuponthem.
3. **Apply**theformulaeforbeamsunderdifferent loadingcondition.
4. **Draw**shearforcediagramand bendingmomentdiagramfordifferenttypeofbeams.
5. **Derive**thepurebendingequation,andonitsbasisexplaintheexistence ofnormalstresses and shear stresses in the different layers of the beam.
6. **Explain**the importanceofandevaluatethesectionmodulusforvariousbeamcross-sections.
7. **Calculate**thenormalandtangentialstressesonaninclinedsectionofabarunderuniaxial, biaxial, pure shear and plain stress conditions.
8. **Evaluate**theprincipalstressandprincipalstrainat apointofastressed memberanddraw the Mohr's circle of stresses.
9. **Predict** failureofa materialusing varioustheoriesoffailure,andtheirrelative applications.
10. **Calculate**theslopeanddeflectioninbeamsbyusingmethodslikeDoubleintegration, Macaulay method, Moment-area method, Conjugate beam, etc.
11. Participateandsucceed incompetitiveexaminationlikeGATE,

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

ProgramOutcomes		Level	Proficiency assessedby
PO1	**Engineering knowledge**: Applytheknowledgeof mathematics, science, engineering fundamentals, andanengineeringspecializationtothesolutionof complex engineering problems.	H	Assignments, Exams
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusionsusingfirstprinciplesofmathematics, natural sciences, and engineering sciences.	H	Assignments, Exams
PO3	**Design/developmentofsolutions**:Designsolutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for thepublichealthandsafety,andthe cultural,	H	Assignments, Exams
PO4	**Conductinvestigationsofcomplexproblems**:Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the informationto providevalidconclusions.	S	Discussion
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelingtocomplexengineeringactivitieswithan understandingofthelimitations.	S	-
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal,health,safety, legalandculturalissuesand theconsequentresponsibilitiesrelevant tothe professional engineering practice.	H	Exams, Assignment, Discussions
PO7	**Environment andsustainability**:Understandthe impactoftheprofessionalengineeringsolutionsin societal and environmental contexts, and demonstratetheknowledgeof,andneedfor sustainable development.	S	Discussions
PO8	**Ethics**: Apply ethical principles and commit to professionalethicsandresponsibilitiesandnorms of the engineering practice.	S	Discussions
PO9	**Individualandteamwork**:Functioneffectivelyas anindividual,andasamemberorleaderindiverse teams, and in multidisciplinary settings.	S	Assignment, Discussions

PO10	**Communication**: Communicate effectively on complexengineeringactivitieswiththeengineering communityandwithsocietyat large,suchas,being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Discussions
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering andmanagementprinciplesandapplythesetoone's ownwork,asamemberandleader inateam,to manage projects and in multidisciplinary	S	-
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independentandlife-longlearninginthebroadest context of technological change.	S	Discuss

H -HighlyRelated

N–Not Applicable   S–Supportive

VI. HOWPROGRAMSPECIFICOUTCOMESAREASSESSED:

Programspecificoutcomes		Le vel	Proficiency Assessed By
PSO1	**UNDERSTANDING:**Graduateswillhavean abilityto understand, analyzeandsolveproblems usingbasicmathematicsandapplythetechniques related to irrigation, structural design, etc.	H	Lectures, Assignments Exams
PSO2	**ANALYTICALSKILLS:** Graduateswill have an abilityto designcivilstructures,usingconstruction components and to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safetymanufacturabilityandreliabilityandlearnto work with multidisciplinary teams.	H	Lectures, Assignments, Exams
PSO3	**BROADNESS:** Graduates will have an exposure to various fields of engineering necessary to understandtheimpactofotherdisciplinesoncivil engineering blueprints ina global, economic, and societal context and to have necessary focus for postgraduateeducationandresearchopportunities atgloballevel.	S	Lectures, Guest Lectures, Discussions, Industrial visits

VII. SYLLABUS:
UNIT– I
SimpleStressesandStrains: Elasticityandplasticity–Typesofstressesandstrains– Hooke'slaw–
stress–straindiagramformildsteel–Workingstress–Factorofsafety–

Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Elastic constants.

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

UNIT– II

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supportedand overhanging beams subjected to point loads, uniformly distributed load, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT– III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beamsections like rectangular, circular, triangular, I, T angle sections.

UNIT– IV

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

Conjugate Beam Method: Introduction – Concept of conjugate beam method. Difference between a real beam and a conjugate beam. Deflections of determinate beams with constant and different moments of inertia.

UNIT– V

Principal Stresses and Strains: Introduction – Stresses on an inclined section ofa bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane forbiaxialstresses –Two perpendicular normalstressesaccompanied bya stateofsimple shear – Mohr's circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of failure - Maximum Principal StressTheory, Maximum Principal Strain Theory, Maximum shear stress theory- Strain Energy and Shear Strain Energy Theory (Von Mises Theory).

SUGGESTEDBOOKS:

TEXTBOOKS:
1. MechanicsofMaterialsbyB. C.Punmia, A.K. JainandA. K. Jain,LaxmiPublications (P)Ltd,New Delhi.
2. StrengthofMaterials– APracticalApproachVol.1byD.S. PrakashRao, Universities Press, Hyderabad, India.
3. Mechanicsofmaterials byF. Beer, E.R.JohnstonandJ. Dewolf(IndianEdition–SI units), Tata McGraw Hill Publishing Co. Ltd., New Delhi

REFERENCESBOOKS:
1. MechanicsofMaterials(SIedition)byJ.M. GereandS.Timoshenko,CLEngineering, India
2. EngineeringMechanicsofSolidsbyE.G.Popov, PearsonEducation,NewDelhi,India

3. StrengthofMaterials byR. K. Bansal, LaxmiPublications(P)ltd., NewDelhi, India.
4. StrengthofMaterialsbyS.S.Bhavikatti,VikasPublishingHousePvt.Ltd.
5. StrengthofMaterialsbyR.KRajput,S.Chand&CompanyLtd.
6. StrengthofMaterialsbyR. S.Khurmi, S. ChandpublicationNewDelhi, India.
7. FundamentalsofSolidMechanicsbyM.L.Gambhir, PHILearningPvt.Ltd
8. StrengthofMaterials byR.Subramanian, OxfordUniversityPress.

NPTELWEBCOURSE:
   http://nptel.ac.in/courses/112107147/37
NPTELVIDEOCOURSE:
   http://nptel.ac.in/courses/112107147/37#

GATE SYLLABUS:
Bending moment and shear force in statically determinate beams. Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses, stress transformation, Mohr's circle. Simple bending theory, flexural and shear stresses, unsymmetrical bending, shear centre. Thin walled pressure vessels, uniform torsion, buckling of column, combined and direct bending stresses

IES SYLLABUS:
Analysisofdeterminatestructures-differentmethodsincludinggraphicalmethods.
VIII. COURSEPLAN:

Lecture No	Week	Unit	Topicstobecovered	Learning Objective	References
1.	1	1	UNIT-I Elasticity and plasticity – Typesofstressesandstrains–Hooke's law	Understandtheconceptof elasticity and plasticity, concept of stress and strain,conceptofHooke's law	T1:1.1-3,2.1-5
2.	1	1	Elasticity and plasticity – Typesofstressesandstrains–Hooke's law	Understandtheconceptof elasticity and plasticity, concept of stress and strain,conceptofHooke's law	T1:1.1-3,2.1-5
3.	1	1	Stress – strain diagram for mildsteel–Workingstress–Factor of safety	ExplainRelation between stress and strain for mild steel.Understandworking stressandfactorofsafety.	T1:2.4
4.	1	1	Stress – strain diagram for mildsteel–Workingstress–Factor of safety	ExplainRelation between stress and strain for mild steel.Understandworking stressandfactorofsafety.	T1:2.4
5.	2	1	Barsofvaryingsection	Understandtheconceptof	T1:2.6-

					barsforvaryingsection.	14
6.	2	1		Barsofvaryingsection	Understandtheconceptof barsforvaryingsection.	T1:2.6-14
7.	2	1		Composite bars – Temperaturestresses	Understandtheconceptof composite bars and temperature stresses.	T1: 2.15-20
8.	2	1		Composite bars – Temperaturestresses	Understandtheconceptof composite bars and temperature stresses.	T1: 2.15-20
9.	3	1		Lateralstrain,Poisson'sratio and volumetric strain – Elastic modulii and the relationshipbetweenthem	Explain lateral strain, Poisson'sratio,volumetric strain, elastic modulii and relationbetweenthem	T1:3.1-.3
10.	3	1		Lateralstrain,Poisson'sratio and volumetric strain – Elastic modulii and the relationshipbetweenthem	Explain lateral strain, Poisson'sratio,volumetric strain, elastic modulii and relationbetweenthem	T1:3.1-.3
11.	3	1		Elasticconstants.	Explain Bulk modulus, longitudinal strain, lateral strainandrelationbetween them	T1:3.5-14
12.	3	1		Elasticconstants.	Explain Bulk modulus, longitudinal strain, lateral strainandrelationbetween them	T1:3.5-14
13.	4	1		Strain Energy, Resilience – Gradual,sudden,impactand shock loadings – simple applications.	Explain resilience, proof resilience, modulus of resilience. Derive strain energyforvariousloadings andsimple	T1:6.1-5
14.	4	1		Strain Energy, Resilience – Gradual,sudden,impactand shock loadings – simple applications.	Explain resilience, proof resilience, modulus of resilience. Derive strain energyforvariousloadings and simple	T1:6.1-5
15.	4	2		**UNIT-II** **Definitionofbeam** –Types ofbeams–Conceptofshear force and bending moment	Define beam, types of beams.Explaintheconcept of shear force and bending moment	T1:9.1-5
16.	4	2		Definitionofbeam–Typesof beams – Concept of shear force and bending moment	Define beam, types of beams.Explaintheconcept of shear force and bending moment	T1:9.1-5
17.	5	2		S.FandB.Mdiagramsfor cantilever,subjectedtopoint	Deriveandevaluatethe shear-forceand bending	T1:9.6-7

			loads, uniformly distributed load,uniformlyvaryingloads and combination of these loads– Pointofcontraflexure	moment for cantilever beamforvarioustypesof loading and solved problems	
18.	5	2	S.F and B.M diagrams for cantilever, subjected to point loads, uniformly distributed load,uniformlyvaryingloads and combination of these loads– Pointofcontraflexure	Derive and evaluate the shear-force and bending moment for cantilever beamforvarioustypesof loading and solved problems	T1:9.6-7
19.	5	2	S.F and B.M diagrams for cantilever, subjected to point loads, uniformly distributed load,uniformlyvaryingloads and combination of these loads– Pointofcontraflexure	Derive and evaluate the shear-force and bending moment for cantilever beamforvarioustypesof loading and solved problems	T1:9.6-7
20.	5	2	S.FandB.Mdiagramssimply supported subjected to point loads, uniformly distributed load,uniformlyvaryingloads and combination of these loads– Pointofcontraflexure	Derive and evaluate the shear-force and bending moment for simply supportedbeamforvarious typesofloadingandsolved problems	T1:9.6-7
21.	6	2	S.FandB.Mdiagramssimply supported subjected to point loads, uniformly distributed load,uniformlyvaryingloads and combination of these loads– Pointofcontraflexure	Derive and evaluate the shear-force and bending moment for simply supportedbeamforvarious typesofloadingandsolved problems	T1:9.6-7
22.	6	2	S.FandB.Mdiagramssimply supported subjected to point loads, uniformly distributed load,uniformlyvaryingloads and combination of these loads–Pointofcontraflexure	Derive and evaluate the shear-force and bending moment for simply supported beamforvarious typesofloadingandsolved problems	T1:9.6-7
23.	6	2	S.F and B.M diagrams for overhangingbeamssubjected to point loads, uniformly distributed load, uniformly varying loads and combinationoftheseloads– Point of contra flexure	Derive and evaluate the shear-force and bending moment for overhanging beamforvarioustypesof loading and solved problems	T1:9.6-7
24.	6	2	S.F and B.M diagrams for overhangingbeamssubjected to point loads, uniformly distributed load, uniformly varyingloads and	Derive and evaluate the shear-force and bending moment for overhanging beamforvarioustypesof loadingandsolved	T1:9.6-7

			combinationoftheseloads – Pointofcontraflexure	problems	
25.	7	2	S.F and B.M diagrams for overhangingbeamssubjected to point loads, uniformly distributed load, uniformly varying loads and combinationoftheseloads– Point of contra flexure	Derive and evaluate the shear-force and bending moment for overhanging beamforvarioustypesof loading and solved problems	T1:9.6-7
26.	7	2	RelationbetweenS.F.,B.M and rate of loading at a section of a beam.	Explain the relation between shear force and bendingmomentandrate ofloadingatasectionfor beams	T1:9.6-11
27.	7	3	**UNIT-III FLEXURALSTRESSES:** Theory of simple bending – Assumptions – Derivation of bendingequation:M/I=f/y= E/R	Explain the concept of simple bending with assumptionsandderivethe bending equation	T1: 10.1-5
28.	7	3	Theory of simple bending – Assumptions – Derivation of bendingequation:M/I=f/y= E/R	Explain the concept of simple bending with assumptionsandderivethe bendingequation	T1: 10.1-5
29.	8	3	Neutralaxis–Determination of bending stresses	Defineneutralaxisand determine the bending stresses for various conditions	T1: 10.5-7
30.	8	3	Neutralaxis–Determination of bending stresses	Defineneutralaxisand determine the bending stresses for various conditions	T1: 10.5-7
31.	8	3	Section modulus of rectangular and circular sections(SolidandHollow), I,T,AngleandChannel sections	Derivethesectionmodulus for rectangular, circular, I, T sections and solved problems	T1:10.7
32.	8	3	Section modulus of rectangular and circular sections(SolidandHollow), I,T,AngleandChannel sections	Derivethesectionmodulus for rectangular, circular, I, T sections and solved problems	T1:10.7
33.	9	3	Designofsimplebeam sections.	Solveproblemsfor design ofsimplebeams	T1:10.7
34.	9	3	Designofsimplebeam sections.	Solveproblemsfor design ofsimplebeams	T1:10.7

35.	9	3	SHEARSTRESSES: Derivationofformula–Shear stress distribution across various beam sections like rectangular, circular, triangular,I,Tanglesections.	Derive the formula for shear stress and evaluate theshearstressdistribution across various beam sections like rectangular, circular,triangular,I,T angle sections.	T1: 11.1-7
36.	9	3	Derivationofformula–Shear stress distribution across various beam sections like rectangular, circular, triangular,I,Tanglesections.	Derive the formula for shear stress and evaluate theshearstressdistribution across various beam sections like rectangular, circular, triangular, I, T anglesections.	T1: 11.1-7
37.	10	3	Derivationofformula–Shear stress distribution across various beam sections like rectangular, circular, triangular,I,Tanglesections.	Derive the formula for shear stress and evaluate theshearstressdistribution across various beam sections like rectangular, circular,triangular,I,T angle sections.	T1: 11.1-7
38.	10	3	Derivationofformula–Shear stress distribution across various beam sections like rectangular, circular, triangular,I,Tanglesections.	Derive the formula for shear stress and evaluate theshearstressdistribution across various beam sections like rectangular, circular, triangular, I, T anglesections.	T1: 11.1-7
39.	10	4	UNIT-IV PRINCIPALSTRESSES ANDSTRAINS:Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses	Define principal stresses and strains. Explain the stresses on a inclined sectionofabarunderaxial loading and explain the conceptofcompound stresses	T1:4.1
40.	10	4	Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicularnormalstresses accompanied by a state of simple shear - Mohr's circle of stresses, Principal stresses	Evaluate Normal and tangential stresses on an inclined plane for biaxial stresses and evaluate stresses for two perpendicular normal stressesaccompaniedbya stateofsimpleshear	T1:4.2-4.11
41.	11	4	Normal and tangential stressesonaninclinedplane forbiaxialstresses–Two	Evaluate Normal and tangentialstressesonan inclinedplanefor biaxial	T1:4.2-4.11

			perpendicularnormalstresses accompanied by a state of simple shear - Mohr's circle of stresses, Principal stresses	stresses and evaluate stresses for two perpendicular normal stressesaccompaniedbya state of simple shear	
42.	1 1	4	Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicularnormalstresses accompanied by a state of simple shear - Mohr's circle of stresses, Principal stresses	Evaluate Normal and tangential stresses on an inclined plane for biaxial stresses and evaluate stresses for two perpendicular normal stressesaccompaniedbya stateofsimpleshear	T1:4.2-4.11
43.	1 1	4	PrincipalStrains–Analytical and graphical solutions.	Explain the concept of Mohr's circle ofstresses and derive the principal stressesandstrainsusing analytical and graphical method.	T1:5.1-8
44.	1 1	4	PrincipalStrains–Analytical and graphical solutions.	Explain the concept of Mohr's circle ofstresses and derive the principal stressesandstrainsusing analytical and graphical method.	T1:5.1-8
45.	1 2	4	PrincipalStrains–Analytical and graphical solutions.	Explain the concept of Mohr's circle ofstresses and derive the principal stressesandstrainsusing analytical and graphical method.	T1:5.1-8
46.	1 2	4	Introduction – Various theoriesoffailure-Maximum Principal Stress Theory	Explain Maximum Principal Stress Theoryandevaluatefailurec riteria	T1:7.1-3
47.	1 2	4	Introduction–Various theoriesoffailure-Maximum Principal Stress Theory	ExplainMaximum Principal Stress Theoryandevaluatefailurec riteria	T1:7.1-3
48.	1 2	4	Maximum Principal Strain Theory, Strain Energy and ShearStrainEnergyTheory (Von Mises Theory).	Explain Maximum Principal Strain Theory, Strain Energy and Shear StrainEnergyTheory(Von Mises Theory) and evaluatefailurecriteria	T1:7.4-7
49.	1 3	4	MaximumPrincipalStrain Theory,StrainEnergyand	ExplainMaximum PrincipalStrainTheory,	T1:7.4-7

			ShearStrainEnergyTheory (Von Mises Theory).	Strain Energy and Shear StrainEnergyTheory(Von Mises Theory) and evaluatefailurecriteria	
50.	1 3	5	Bending into a circular arc – slope,deflectionandradiusof curvature – Differential equationfortheelasticlineof a beam	Derive relation between slope,deflectionandradius ofcurvature and derive the differentialequationforthe elastic line of a beam	T1: 12.1-3
51.	1 3	5	Bending into a circular arc – slope,deflectionandradiusof curvature – Differential equationfortheelastic lineof abeam	Derive relation between slope,deflectionandradius ofcurvature and derive the differentialequationforthe elastic lineofabeam	T1: 12.1-3
52.	1 3	5	Bending into a circular arc – slope,deflectionandradiusof curvature – Differential equationfortheelasticlineof a beam	Derive relation between slope,deflectionandradius ofcurvature and derive the differentialequationforthe elastic line of a beam	T1: 12.1-3
53.	1 4	5	Double integration and Macaulay's methods – Determination of slope and deflectionforcantileverand simply supported beams subjected to point loads, U.D.L, Uniformly varying load	Determine slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, Uniformly varying load using Double integrationandMacaulay's methods	T1: 12.4-11
54.	1 4	5	Double integration and Macaulay's methods – Determination of slope and deflectionforcantileverand simply supported beams subjected to point loads, U.D.L, Uniformly varying load	Determine slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, Uniformly varying load using Double integrationandMacaulay's methods	T1: 12.4-11
55.	1 4	5	Double integration and Macaulay's methods – Determination of slope and deflectionforcantileverand simply supported beams subjected to point loads, U.D.L,Uniformlyvarying load	Determine slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, Uniformly varying load using Double integrationandMacaulay's methods	T1: 12.4-11
56.	1 4	5	Doubleintegrationand Macaulay'smethods– Determinationofslope and	Determine slope and deflectionforcantilever andsimplysupported	T1: 12.4-11

			deflectionforcantileverand simply supported beams subjected to point loads, U.D.L,Uniformlyvarying load	beams subjected to point loads, U.D.L, Uniformly varying load using Double integrationandMacaulay's methods	
57.	1 5	5	Mohr'stheorems–Moment areamethod–applicationto simple cases including overhangingbeams.	Explain mohr's theorem andmomentareamethod and apply it to simple beams.	T1: 13.1-9
58.	1 5	5	Mohr'stheorems–Moment areamethod–applicationto simple cases including overhangingbeams.	Explain mohr's theorem andmomentareamethod and apply it to simple beams.	T1: 13.1-9
59.	1 5	5	Mohr'stheorems–Moment areamethod–applicationto simple cases including overhangingbeams.	Explain mohr's theorem andmomentareamethod and apply it to simple beams.	T1: 13.1-9
60.	1 5	5	Mohr'stheorems–Moment areamethod–applicationto simplecasesincluding overhanging beams.	Explain mohr's theorem andmomentareamethod andapplyittosimple beams.	T1: 13.1-9
61.	1 6	5	ConjugateBeamMethod: Introduction–Conceptof conjugate beam method. Differencebetweenareal beamand aconjugatebeam.	Explain conjugate beam methodanddifferentiate betweenrealbeamanda conjugate beam.	T1: 14.1-8
62.	1 6	5	ConjugateBeamMethod: Introduction–Conceptof conjugate beam method. Difference between a real beamand aconjugatebeam.	Explain conjugate beam methodanddifferentiate betweenrealbeamanda conjugate beam.	T1: 14.1-8
63.	1 6	5	ConjugateBeamMethod: Introduction–Conceptof conjugate beam method. Difference between a real beamand aconjugatebeam.	Explain conjugate beam methodanddifferentiate betweenrealbeamanda conjugate beam.	T1: 14.1-8
64.	1 6	5	ConjugateBeamMethod: Introduction–Conceptof conjugate beam method. Differencebetweenareal beamand aconjugatebeam.	Explain conjugate beam methodanddifferentiate betweenrealbeamanda conjugate beam.	T1: 14.1-8

IX. MAPPINGCOURSEOUTCOMESLEADINGTOTHEACHIEVEMENTOFPROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

CourseO bjectives	ProgramOutcomes	ProgramSpecific Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PS O2	PS O3
I	H	H	H	S	S	S	S	S	S	S	S	S	H	H	S
II	H	H	H	S	S	S	S	S	S	S	S	S	H	H	S
III	H	H	H	S	S	S	S	S	S	S	S	S	H	H	S
IV	H	H	H	S	S	S	S	S	S	S	S	S	H	H	S
V	H	H	H	S	S	S	S	S	S	S	S	S	H	H	S
VI	H	H	H	S	S	S	S	S	S	S	S	S	H	H	S
VII	H	H	H	S	S	S	S	S	S	S	S	S	H	H	S

X. QUESTIONBANK:(JNTUH)
DESCRIPTIVEQUESTIONS:(WITHBLOOMSPHRASES)
UNIT-I
SHORTANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Distinguishbetweentheterms(a)Elasticity and (b) Plasticity with examples.	Remembering	1
2	Definethefollowingpropertiesof engineering materials: (a) Ductility(b) Brittleness(c)Malleability	Remembering	1
3	Definethefollowingpropertiesof engineering materials: (a)Toughness(b)Hardness(c) Strength	Remembering	1
4	DefineStressatapointinamaterial,and mentionitsunits.	Remembering	1
5	Distinguishbetweendifferent typesof stressusingillustrations	Remembering	1
6	DefineStraininamaterialandgiveits units	Remembering	1
7	StateHooke'slawandgiveitsequation	Remembering	1
8	Distinguishbetweendifferenttypesof strain	Remembering	1
9	Definemodulusofelasticityandgiveits units.	Remembering	1
10	Drawstress-straindiagramformildsteel indicatingallcriticalpoints	Understanding	1
11	Definelongitudinalstrainandlateralstrain.	Remembering	1
12	DefinePoisson'sratio anditsrangeof values	Remembering	1

LONGANSWERQUESTIONS

S. No	Question	Blooms Taxonomy Level	Programm eOut come
1.	Explainwithillustrationsandstress-strain diagrams, the phenomenon of strain-hardening.	Understanding	1
2.	Explainwithillustrationsandstress-strain diagrams, thephenomenonofnecking.	Understanding	1
3.	Defineandexplaintheterms:slipand creep.	Understanding	1
4.	Explaintheoff-setmethodoflocatingthe yield point for a material on its stress-straincurve.	Understanding	1
5.	Explaintheconceptoffatiguefailure. Defineendurancelimitandfatiguelimit.	Understanding	1
6.	Atensiletest wasconductedonamildsteel bar. The following data was obtained from the test:Diameter of steel bar = 2.5 cm; Gauge length of the bar = 24 cm;Diameter ofthe bar at rupture = 2.35 cm; Gauge length at rupture = 24.92mmDetermine(a) percentage elongation(b)percentagedecreaseinarea	Applying	1,2
7.	A tensile test was conducted on a mild steel bar. The following data was obtained fromthetest:Diameterofsteelbar=3cm; Gauge length of the bar = 20cmLoad at elastic limit = 250kN; Extension at load of 150kN = 0.21mmMaximum load = 380kN; Determine: (a) Young's modulus (b)Yieldstrength(c) Ultimate Strength (d)Strainattheelasticlimit	Applying	1,2
8.	Derivetheconstitutiverelationshipbetween stressandstrainforthreedimensional stress systems.	Applying	1,2
9.	Arodwhoseendsarefixedtorigidsupports, is heated so that rise in temperature is To C. Derive the expression for thermal strainandthermalstressessetupinthe body if α is co-efficient of thermal expansion.	Applying	1,2
10.	Derivetheexpressionforvolumetricstrain ofabodyintermsofitslinearstrainsin orthogonaldirections.	Applying	1,2

UNIT-II
SHORTANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Whatarethedifferent typesofbeams?	Remembering	2
2	Differentiatebetweenasimplysupported beamand a cantilever.	Remembering	2
3	Differentiatebetweenafixedbeamanda cantilever.	Remembering	2
4	Showbyproperdiagram, positiveand negativeshearforcesatasectionofa beam.	Remembering	2
5	Drawshearforcediagramsforacantilever of length L carrying a point load W at the freeend.	Applying	2,4
6	Drawshearforcediagramsforacantilever of length L carrying a point load W at the mid-span.	Applying	2,4
7	Draw shear force diagram for a cantilever oflengthLcarryingauniformlydistributed load of w per unit length over its entire span.	Applying	2,4
8	Drawshearforcediagramsforasimply supportedbeamoflengthLcarryinga point load W at its mid-span.	Applying	2,4
9	Draw shear force diagram for a simply supported beam of length L carrying a uniformlydistributedloadofw perunit lengthoveritsentirespan.	Applying	2,4
10	Explainwhat informationweobtainfrom shearforcediagramandbendingmoment diagram.	Understanding	2,4

LONGANSWERQUESTIONS

S. No	Question	Blooms Taxonomy Level	Programme Out come
1	Derivetherelationbetweenrateofloading,shear forceand bending moment for abeamcarrying a uniformly distributed load of w per unit length overwholespan.	Understanding	2,3,4
2	Derivetheshearforceandbendingmoment	Understan	2,3,4

S.No	Question	Blooms Taxonomy Level	Programme Out come
	diagramsforacantileverbeamcarryinga uniformlydistributed loadofwperunit runover half its span staring from the free-end.	ding	
3	Drawthe shear force diagrams for a cantilever beam of length 12 m carrying a uniformly distributedloadof12kNm-1overhalfitsspan staringfromthefree-end.	Applying	2,3,4
4	Draw the bending moment diagrams for a cantilever beam of length 12 m carrying a uniformlydistributed loadof12kNm-1overhalf itsspanstaringfromthefree-end.	Applying	2,3,4
5	Derive the shear force and bending moment diagrams for a cantilever beam carrying a uniformlyvaryingloadfromzeroatfreeendtow perunitlengthatthefixedend.	Applying	2,3,4
6	Draw the shear force and bending moment diagrams for a cantilever beam of length 4 m if two anti-clockwise moments of 15 kNm and 10 kNmareappliedatthe mid-spanandthefreeend, respectively.	Applying	2,3,4
7	Draw the shear force and bending moment diagrams for a cantilever beamoflength7 mwith auniformlyvaryingloadfromzeroatfixed-endto 10 kN/mat4mfromthefixedend.	Applying	2,3,4
8	Draw the shear force and bending moment diagrams for a simply supported beam of length 12mwithaneccentricpoint loadatadistance'3 m'fromtheleft endandat adistanceof'4m' from the right end.	Applying	2,3,4
9	Derive the shear force and bending moment diagrams for a simply supported beam with an eccentricpointloadatadistance'a'fromleftend andatadistance'b'fromrightend.	Applying	2,3,4
10	Derive the shear force and bending moment diagramsforasimplysupportedbeamcarryinga uniformlydistributed loadof *w*per unit runover wholespan.	Applying	2,3,4

UNIT-III
SHORTANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Define bendingstressinabeamwitha diagram.	Understanding	5
2	Definepurebending andshowanexample byafigure.	Understanding	5

3	Defineneutralaxisandwhereis itlocated inabeam.	Understanding	5
4	Whataretheassumptions madeintheoryof simplebending?	Remembering	5
5	Writethebendingequation,definingallthe terms inthe equation	Remembering	5
6	Explaintheterms:momentofresistance andsection modulus	Remembering	5,6
7	Explaintheroleofsection modulusin definingthestrengthofasection.	Understanding	5,6
8	Writethesectionmodulusforasolid rectangularsection.	Applying	5,6
9	Writethesectionmodulusforahollow rectangular section.	Applying	5,6
10	Writethesectionmodulus forasolid circularsection.	Applying	5,6

LONGANSWERQUESTIONS

S. No	Question	Blooms Taxonomy Level	Programme Out come
1	Derivethebendingequationfor abeam.	Understanding	5
2	For a given stress, compare the moments of resistanceofabeamofasquaresection, whenplaced (i)withitstwosideshorizontaland(ii)withits diagonal horizontal. Which is more suitable?	Understanding	5,6
3	Three beams have the same length, the same allowablestressandthesamebendingmoment.The cross-section of the beams are a square, a rectangle with depth twice the width and a circle. If all the three beams have the same flexural resistance capacity, then find the ratio of the weights of the beams.Whichbeamismosteconomical?	Understanding	5,6
4	Arectangularbeam60 mmwideand150 mmdeepis simply supported over a span of 6 m. If the beam is subjected to central point load of 12 kN, find the maximumbendingstressinducedinthebeam section.	Applying	5,6
5	A rectangular beam 300 mm deep is simply supported over a span of 4 m. What uniformly distributed load the beam may carry, ifthe bending stressisnottoexceed120MPa.TakeI=225x106 mm4 .	Applying	5,6
6	Acantileverbeamisrectangularinsectionhaving80	Applying	5,6

	mm width and 120 mm depth. If the cantilever is subjectedto apoint loadof6kNatthefreeeendand thebendingstress isnottoexceed40MPa,findthe spanofthecantileverbeam.		
7	A hollow square section with outer and inner dimensions of 50 mmand 40 mm respectively, is used as a cantilever of span 1 m. How much concentrated load can be applied at the free end, if themaximumbendingstressisnotexceed35MPa?	Applying	5,6
8	A cast iron water pipe of 500 mm inside diameter and 20 mm thick is supported over a span of 10 m. Findthemaximumstressinthepipemetal,whenthe pipe isrunningfull.Takedensityofcastironas70.6 kN/m3,and thatofwateras9.8kN/m3.	Applying	5,6
9	Two wooden planks 150 mm x 50 mm each are connected to form a T-section of a beam. If a momentof6.4kNmisappliedaroundthehorizontal neutralaxis, findthebendingstressesat boththe extreme fibres of the cross-section.	Applying	5,6
10	Provethatmaximumshearstressinacircularsection ofbeamis4/3 timestheaverageshearstress.	Applying	5,6

UNIT-IV
SHORTANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Defineprincipalplanesandprincipal stresses	Understanding	7,8
2	Whyisitimportanttodetermineprincipal stressesandplanes?	Understanding	7,8
3	Whatarethemethodsusedtodeterminethe stressesonobliquesection?	Remembering	7,8
4	Drawtherepresentationofbiaxialstateof stressatapointinamaterial.	Understanding	7,8
5	Drawtherepresentationofthestateofpure shearstressatapointinamaterial.	Understanding	7,8
6	Explaintheconditionofplanestress.	Understanding	7,8
7	Write the expression for normal and tangentialstressesonaninclinedplanefor amaterialelementsubjectedtocombined biaxial and shear stress.	Understanding	7,8
8	Give the expression for principal stresses forthecaseofcombinedbi-axialandshear stress (plan stress condition).	Understanding	7,8

S.No	Question	Blooms Taxonomy Level	Programme Out come
9	Givetheexpressionformaximumshear stressforthecaseofcombinedbi-axialand shear stress (plan stress condition).	Understanding	7,8
10	ExplainMohr'scircleofstressesusingan example.	Understanding	7,8

LONGANSWERQUESTIONS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Derive an expression for the major and minorprincipalstressesonanobliqueplane, whenthebodyissubjectedtodirectstresses intwomutuallyperpendiculardirections accompanied by a shear stress.	Applying	7,8
2	Defineandexplainhetheoriesoffailure: (i) Maximumprincipalstresstheory (ii) Maximumprincipalstraintheory	Understanding	7,8,9
3	Defineandexplainhetheoriesoffailure: (i) Maximumshear stresstheory (ii) Maximumshearstrainenergytheory	Understanding	7,8,9
4	Abodyissubjectedtodirectstressesintwo mutually perpendicular principal tensile stresses accompanied by a simple shear stress. Draw the Mohr's circle of stresses and explain how you will obtain the principalstressesandstrains.	Applying	7,8
5	A bodyissubjectedto direct stresses intwo mutuallyperpendiculardirections.Howwill you determine graphically the resultant stresses on an oblique plane when (i) the stressesareunequalandunlike;(ii)the stresses are unequal and like.	Applying	7,8
6	In a two dimensional stress system, the direct stresses on two mutually perpendicular planes are 100 MN/mm2. Theseplanesalso carryashear stressof25 MN/mm2. If the factor of safetyon elastic limit is2.5,thenfind:(i)thevalueofstress whenshearstrainenergyisminimum;(ii) elasticlimitofmaterialinsimpletension.	Applying	7,8
7	Determinethediameterofaboltwhich is subjectedto anaxialpullof18 kNtogether witha transverseshearforceof9 kN,when	Applying	7,8,9

S.No	Question	Blooms Taxonomy Level	Programme Out come
	theelasticlimit intensionis350N/mm2, factor of safety = 3 and μ = 0.3 using (i) Maximumprincipalstresstheory (ii) Maximumprincipalstraintheory (iii) Maximumshearstress theory (iv) Maximumstrainenergytheorem (v) Maximumshear strainenergytheory		
8	A bolt is under an axial thrust of 10 kN together with a transverse shear force of 4 kN.Calculatethediameterofboltaccording to (i) Maximumprincipalstresstheory (ii) Maximumshearstress theory (iii) Maximumstrainenergytheorem Takeelasticlimit insimpletension=225 N/mm2, factor of safety = 3, μ = 0.3.	Applying	7,8,9
10	Theprincipalstressesatapointinaelastic material are 30 N/mm2 (tensile), 120 N/mm2 (tensile) and 50 N/mm2 (compressive). If the elastic limit in simpletension is 250 N/mm2 and μ = 0.3, then determine whether the failure of material will occur or not according to (iii) Maximumprincipalstresstheory (iv) Maximumprincipalstraintheory (v) Maximumshear stresstheory (vi) Maximumstrainenergytheorem (vii) Maximumshearstrainenergytheory	Applying	7,8,9

UNIT-V
SHORTANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Definedeflectionand slopeofabeam.	Remembering	10
2	Writethedifferentialequationforthebeam	Remembering	10
3	Listthedifferentmethodsforfindingslope anddeflectionofabeam.	Remembering	10

4	Explain the concept of double-integration method to obtain the deflections of a beam	Understanding	10
5	Give the relation between the load, shear force and bending moment at a section of a beam.	Remembering	10
6	What is Macaulay's method? How is it different from the general double integration method?	Understanding	10
7	What is meant by flexural rigidity? Give its expression.	Remembering	10
8	Give the slope and deflection of a cantilever beam, with flexural rigidity EI, and length L, carrying a point load W at its free end?	Remembering	10
9	Give the slope and deflection of a simply supported beam, with flexural rigidity EI, and length L, carrying a point load W at its mid-span?	Remembering	10
10	State and explain the first theorem of Mohr.	Understanding	10

LONG ANSWER QUESTIONS

S.No	Question	Blooms Taxonomy Level	Programme Out come
1	Derive an expression for slope and deflection of a beam subjected to uniform bending moment.	Applying	10
2	Prove that the relation where M is the bending moment and E is modulus of elasticity and I is moment of inertia of the beam section.	Applying	10
3	Prove that the deflection at centre of a simply supported beam, carrying a point load at centre, is given by	Applying	10
4	Derive the slope at supports and deflection at centre for a simply supported beam carrying uniformly distributed load of *w* per unit length over the entire span.	Applying	10
5	Use Moment-Area method to find the slope and deflection of a simply supported beam carrying a point load at the centre.	Applying	10
6	Use Moment-Area method to find the slope and deflection of a simply supported beam carrying a uniformly distributed load over the entire span.	Applying	10
7	Derive slope and deflection of a cantilever	Applying	10

	carryinguniformlydistributedloadover whole lengthusingMacaulay'smethod.		
8	Deriveslopeanddeflectionofacantilever carrying uniformlydistributed loadover a length 'a' from the fixed end by double integrationmethod.	Applying	10
9	Deriveslopeanddeflectionofacantilever carrying uniformlydistributed loadover a length'a' fromthe fixed end byMoment-Area method.	Applying	10
10	Derive slope and deflection relations for a cantilevercarryingagraduallyvaryingload fromzeroat thefreeend to$w$permetrerun atthefixedend.	Applying	10

XI. OBJECTIVE QUESTIONS:
JNTUH UNIT 1

1. Amaterialobey'sHooke'slawup to
   (a)Plastic limit (b)Elastic limit (c)Yieldpoint(d)Limit ofproportionality
2. Theintensityofstresswhich causesunitstrainis called
   (a)Unitstress(b) Modulusofrigidity(c) Bulkmodulus(d) Modulusofelasticity
3. Withinelasticlimitstressis
   (a) Inverselyproportionaltostrain(b)Directlyproportionaltostrain
   (c)Squarerootofstrain(d) Equaltostrain
4. Abarwhensubjected to anaxialpullP
   (a) Decrease inlengthandwidthand increaseinthickness
   (b) Decreaseinlengthandincreaseinwidthand thickness
   (c) IncreaseinlengthanddecreaseinWidthand thickness
   (d) Increaseinlength, widthandthickness.
5. Poissons'sratioistheratioof
   (a) Stressandstrain(b) Modulesofelasticityandstrain
   (c)Lateralstrainandlongitudinalstrain(d)Noneofthese
6. Ifallthedimensionsofaprismaticbar aredoubled,thenthe maximumstressproducedin it under its own weight will
   a)decreaseb)   remainunchanged   c)increasetotwotimes   d)increasetofourtimes
7. Theelongationofaconicalbarunderitsownweightisequalto
   a) thatofaprismaticbarofsamelength
   b) onehalfthat ofaprismaticbarofsamelength
   c) onethird thatofaprismaticbarofsamelength
   d) onefourththatofaprismaticbarofsamelength
8. Ifamaterialhas identicalproperties inalldirections,itissaidtobe
   a) homogeneous   b) isotropic   c) elastic   d) orthotropic
9. Two bars ofdifferent materials are ofthe same size and are subjected to same tensile forces. Ifthebarshaveunit elongations intheratioof4:7,thentheratio ofmoduliof elasticity of the two materials is
   a) 7:4   b) 4:7   c) 4:17   d) 16:49

10. Ifacomposite barofsteeland copperisheated,thenthecopperbarwillbe under
   a) tension   b) compression c) shear   d) torsion

UNIT2

1. Theshapeofcantileverfor uniformlydistributedloadwillbe
   (a)Straightline(b)Parabolic(c)Parabolic(d) Elliptical
2. Apointofcontraflexureoccursina
   (a)Simplysupported beam(b)Fixedbeam(c) Cantilever(d) Noneoftheabove
3. Shear forcediagramforacantileverbeamcarrying auniformlydistributed loadoverits length is a
   (a)Triangle(b)Rectangle(c)Hyperbola(d)Parabola
4. Maximumbendingmomentinabeamoccurswhere
   a) deflectioniszero b)shearforceismaximum
   c)shearforceis minimumd)   shearforcechangessign
5. Rateofchangeofbendingmomentisequalto
   a) shearforce   b) deflection   c) slope   d) rateofloading
6. Thediagramshowingthevariationofaxialload alongthe span iscalled
   a) shearforcediagram   b) bendingmomentdiagram
   c) thrust diagram   d) influencelinediagram
7. Thevariationofthebending moment intheportionofabeamcarrying linearlyvarying load is a)
   linear   b) parabolic   c) cubic   d) constant
8. Themaximumbendingmomentduetoamovingloadonafixedendedbeamoccurs
   a) atasupport   b) alwaysatthemidspan
   c) undertheloadonly   d) noneoftheabove

UNIT3

1. InI-section,thebending momentisresistedmainlyby
   (a) Flangesonly(b)Webonly(c)Bothbyflangesandweb(d)None oftheabove
2. The'planesectionremainsplane'assumptioninbendingtheoryimplies:
   (a) strainprofile islinear(b)stressprofile islinear
   (c)bothstrainandstressprofilesarelinear(d)sheardeformationsare neglected
3. Beamsofuniformstrengtharebetter ascomapredtobeamsofuniformcrosssectionas they are Economical
   (a) Forshortspans(b)Forlargespans
   c)Forheavyweightbeams(d)Forlightweightbeams
4. Thesquarerootoftheratioofmoment ofinertiaofthecrosssectiontoitscrosssectional area is called
   a)Secondmomentofareab)Slenderness ratio
   c)Sectionmodulusd)Radiusofgyration
5. InT-section
   (a) Bothflange and webresistsinthe ratioofthetheirareasofcross-section
   (b) Onlyflangesresistsshear(c)Mostofthe shearisresisted byweb only
   (d) None ofthese
6. Shearstress inarectangularbeamexhibitsa
   (a)Parabolicvariation(b)Linear variation(c) Cubicvariation(d) Noneofthe above
7. Abeamofrectangular cross-sectionis100 mmwideand200 mmdeep. Ifthesectionis subjected to a shear force of 20 kN, then the maximum shear stress in the section is
   a)1N/mm2   b)1.125 N/mm2   c)1.33 N/mm2   d)1.5N/mm2

8. Aprismaticbar whensubjectedtopurebendingassumestheshapeof
   a) catenary   b) cubicparabolac)   quadraticparabola   d)   arcofacircle

UNIT4

1. Slopeanddeflectionat apoint ina loadedcantileverbeamcarryingseveralloadscanbe found out by the
   (a)Principleofleastwork(b)Momentareamethod
   (c)Double integrationmethod(d)Macualay's method
2. Ifthedepthofarectangularbeamis halvedthedeflectionforabeamcarryinga midpoint load shall be
   (a)Halved(b)Doubled(c) Fourtimes(d)Eighttimes
3. AcantileveroflengthL,carriesapoint loadWatthe freeend.Thedownwarddeflectionat the free end is given by_____.
4. AcantileveroflengthL,carriesapoint loadWatthe freeend.Theslopeatthefreeend is given by

   _____.
5. AcantileveroflengthL,carriesaudlwperunit lengthoverthewhole length.The downward deflection at the free end is given by_____.

UNIT5

1. Principalplanesareplaneshaving
   (a) Maximumshearstress(b)No shear stress
   (c) Minimumshear stress(d) Noneoftheabove
2. Attheprincipalplanes
   (a) Normalstress is maximumorminimumandtheshearstressiszero
   (b) Tensileandcompressivestressesarezero
   (c) Tensilestress iszeroandtheshearstressis maximum.
   (d) Nostressacts
3. Mohr'scirclecanbeusedtodeterminefollowingstressoninclinedsurface
   (a) Principalstress(b)Normalstress
   (c)Tangentialstress(d)Maximumshearstress(e)Allofthe above
4. TheradiusofMohr'scirclefortwoequalunlikeprincipalstressesofmagnitudepis
   a) p   b) p/2   c)   zero   d)   noneofthese
5. Shearstressonprincipalplanesis
   a)zero   b)   maximum   c)   minimum   d)noneofthese
6. Themajorandminorprincipalstressesat apoint are3MPaand -3MParespectively.The maximum shear stress at the point is   a) Zero   b)3MPa   c)6MPa   d)9MPa
7. Theplanewhich havenoshear stressareknownas_____.
8. The stresses acting onprincipalplanes are knownas _____.
9. Whena member issubjectedtoasimpleshearstress,thenthenormalstressonanoblique plane is given as _____.
10. Whena member issubjectedto asimpleshearstress,thenthetangentialstressonan oblique plane is given as _____.

XII. GATE QUESTIONS:

1. Theshapeofcantileverfor uniformlydistributedloadwillbe
   (a)Straightline(b)Parabolic(c)Parabolic(d) Elliptical
2. Apointofcontraflexureoccursina
   (a)Simplysupportedbeam(b) Fixedbeam
   (c)Cantilever(d)Noneofthe above

3. Shear forcediagramforacantileverbeamcarrying auniformlydistributed loadoverits length is a

(a)Triangle(b)Rectangle(c)Hyperbola(d)Parabola

4. Maximumbendingmomentinabeamoccurswhere
   a) deflectioniszero
   b) shearforceis maximum
   c) shearforceisminimum
   d) shearforcechangessign

5. Rateofchangeofbendingmomentisequalto
   a) shearforce   b) deflection   c) slope   d) rateofloading

6. Thediagramshowingthevariationofaxialload alongthe span iscalled
   a) shearforcediagram
   b) bendingmomentdiagram
   c) thrust diagram
   d) influencelinediagram

7. Thevariationofthebending moment intheportionofabeamcarrying linearlyvarying load is a)
      linear   b) parabolic   c) cubic   d) constant

8. Themaximumbendingmomentduetoamovingloadonafixedendedbeamoccurs
   a) atasupport
   b) alwaysatthemidspan
   c) undertheloadonly
   d) noneoftheabove

9. AcantileverbeamABoflength1carriesaconcentratedloadWat its midspanC. Ifthe free end B is supported on a rigid prop, then there is a point of contraflexure
   a) betweenAand C
   b) betweenCandB
   c) onebetween AandCandotherbetweenCandB
   d) nowhereinthebeam

10. Aprismaticbeamfixedat bothendscarriesauniformlydistributedload. Theratio of bending moment at the supports to the bending moment at mid-span is
    a) 0.5   b) 1.0   c) 1.5   d) 2.0

    A beam of overall length 1 with equal overhangs on both sides carries a uniformly distributedloadovertheentirelength.Tohavenumericallyequalbendingmomentsat

XIII. WEBSITES:
1. http://www.asce.org
2. http://www.icivilengineer.com
3. http://www.construction-guide.in

XIV. EXPERTDETAILS:
- Prof.SATISHC.SHARMADepartmentofMechanical&IndustrialEngineering Indian Institute of Technology Roorkee
- Prof.M.S.Sivakumar Department of Applied Mechanics , IIT Madras. email: mssiva@iitm.ac.in
- Prof.S.K. Bhattacharyya,DepartmentofCivilEngineering,IITKharagpur.
- Dr. SatishCSharma (IITR)
- LSRamachandra&SKBarai(IITKGP)

XV. JOURNALS:

0970-1141	ThesisDigestoncivilEngineering	1987
0973-8061	InternationalEngineeringandTechnologyJournal ofCivilandStructure	2007
0975-5314	Internationaljournalofcivilengineering	2009
0975-6744	Journalofinformationknowledgeand research in civilengineering	2009
0976-6308	Internationaljournalofcivilengineeringand technology	2010

2249-426X	InternationalJournalofCivilEngineeringand Applications	2011
2249-8753	RecentTrendsinCivilEngineeringand Technology	2011
2277-5986	World ResearchJournalofCivilEngineering	2011
2277-7032	InternationalJournalofStructuralandCivil Engineering	2012
2278-9987	InternationalJournalofCivilEngineering(IJCE)	2012
2319-6009	InternationalJournalofStructuralandCivil EngineeringResearch	2012
2320-723X	International Journal of Advanced Research in Civil,Structural,EnvironmentalandInfrastructure EngineeringandDeveloping	2013

XVI. LISTOFTOPICSFORSTUDENTSEMINARS:

1. Stressesand strain
2. Typesofbeam
3. Bendingstressandshearstress
4. Mohr'scircle
5. Principlestressesandstrain
6. Slopeand Deflectionofbeam
7. ConceptofBending Equation
8. ImportantroleofStrengthofMaterials

XVII. CASESTUDIES / SMALL PROJECTS:

1.The lengthofabroad -gaugerailwaysleepersuchthatit hasthe minimumbending moment.