Programme	**Bachelor of Technology in Mechanical Engineering**			Year of Regulation		**2018**
Department	**Mechanical Engineering**			Semester		**IV**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
ME 222	**Advanced strength of material**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	To introduce state of stress at a point, stresses on an arbitrary plane, principal stresses and principal strains.		CO1	Able to learn about the state of stress at a point, in a 3D solid elements, evaluate stress invariants, principal stresses and their directions.
	To develop the ability to compute the principal stresses and strains for a given state of stress and to draw Mohr's circle for given state of stress.		CO2	Able to derive the equilibrium equations in different coordinate systems. Also able to determine strain invariants, principal strains and their directions.
	To develop the capability to evaluate the stress strain relation for isotropic and orthotropic materials.		CO3	To be able to apply stress and strain transformation, in different coordinate systems such as rectangular, cylindrical coordinate system.
	To be able to obtain the shear centre for various geometries and solve pure bending related problems.		CO4	Able to develop constitutive relationships between stress and strain for linearly elastic solid, examine the properties of isotropic and anisotropic solids.
			CO5	Able to analyze pure bending and asymmetric bending of beams and shear centre for various geometries.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	**3**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**3**	**0**	**-**
2	CO2	**3**	**3**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**2**	**0**	**-**
3	CO3	**2**	**3**	**3**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**-**
4	CO4	**2**	**2**	**3**	**0**	**2**	**2**	**2**	**0**	**2**	**0**	**0**	**1**	**2**	**2**	**-**
5	CO5	**1**	**2**	**3**	**0**	**2**	**0**	**3**	**0**	**2**	**0**	**0**	**1**	**3**	**3**	**-**
6	CO6	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-**

SYLLABUS			
No.	Content	Hours	COs
I	**Introduction** Index notation, review of basic concepts and equations in mechanics, classification of materials equations related to the solid mechanics.	**03**	**CO1**
II	**Traction Stresses** Concept of traction, State of stress, Cauchy's stress theorem, Postulate of Cauchy stress tensor, Traction on arbitrary planes, Extreme normal and shear traction, Octahedral shear stress, Other stress measure - Engineering stress.	**08**	**CO1** **CO2**
III	**Equilibrium Equations** Derive equilibrium equations in Cartesian and cylindrical polar coordinates	**06**	**CO1** **CO2**
IV	**Analysis of Strain** Deformations, Change in length of a linear element, Rectangular strain components, The state of strain at a point, Change in direction of linear element, Cubical dilatation, Principal axes of strain and principal strains, Plane strains, in polar coordinates, Compatibility condition, Strain deviator and its Invariants.	**08**	**CO2** **CO3**
V	**Constitutive Relations** Restrictions on constitutive relations, General relationship between Cauchy stress and Cauchy Green strain for isotropic materials, General Hooke's law and its reduction for isotropic and orthotropic materials	**05**	**CO4**
VI	**Bending of Prismatic Straight Beams** Pure bending, bending due to uniform transverse loading and bending due to transverse sinusoidal loading of a beam, Asymmetrical bending of straight beams, Shear centre, Shear stresses in thin walled open sections	**06**	**CO5**
	Total Hours	**36**	

Essential Readings

1. L.S. Srinath, "Advanced Mechanics of Solids", TATA McGraw Hill, 3rd Edition, 2010.

2. A.R. Ragab, and S.E. Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press, 1st Edition 1988.

Supplementary Readings

1. M.H. Sadd, "Elasticity: Theory, Applications and Numerics", Academic Press, 2004.

2. S.P. Themoshenko, and J.N. Goodier, "Theory of Elasticity" McGraw Hill, 3rd Edition, 2010.