

**Purbanchal University**  
Faculty of Engineering, Biratnagar, Nepal  
*Syllabus*

**Level:** Bachelor

**Program:** Bachelor in Civil Engineering

**Subject:** STRENGTH OF MATERIALS

**Subject Code:** BCI----

**Year:** II

**Semester:** III

Teaching Schedule Hours/Week					Examination Schedule					Total Marks	
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	40	25	125
3	3	3	2/2	7	3 Hrs.	60	-	-			

**Note:** L: Lecture T: Tutorial P: Practical

### Course Objective:

The purpose of the course is to provide basic knowledge to calculate stresses and deformations of objects under external loadings, to give knowledge of strength of materials on engineering applications and design problems.

### Course Content:

#### 1. Direct Stresses and Strains

(11 Hours)

- 1.1 Stresses and strains - normal stress-strain, shear stress-strain, Hook's law, Poisson's ratio, modulus of elasticity, modulus of rigidity, bulk modulus and their relationship
- 1.2 Stress-strain diagrams for ductile and brittle material.
- 1.3 Factor of safety and stress concentration
- 1.4 Elongation of bars: varying cross-sections, tapered section
- 1.5 Principle of superposition
- 1.6 Compound bars subjected to axial tension and compression
- 1.7 Thermal stresses: single bar, compound / composite bars

#### 2. Shear force and bending moment

(5 Hours)

- 2.1 Revision of previous works (Type of support, load, determinate, indeterminate structure)
- 2.2 The concept of superposition of internal forces
- 2.3 Maximum bending moments and shearing forces and their positions for statically determinate frames.



3. **Moment of Inertia** (4 Hours)
- 3.1 Moment of inertia of standard and built-up sections
  - 3.2 Polar moment of inertia
  - 3.3 Radius of gyration
  - 3.4 Principal moment of inertia
4. **Principal Stresses** (5 Hours)
- 4.1 Introduction
  - 4.2 Stresses on an inclined plane subjected to two mutually perpendicular normal stresses
  - 4.3 Stresses on an inclined plane subjected to two mutually perpendicular normal and shear stresses
  - 4.4 Principal stresses and principal strains
  - 4.5 Mohr's circle diagram for stress
5. **Theory of Flexure** (6 Hours)
- 5.1 Coplanar and pure bending, assumptions, derivation of bending equation.
  - 5.2 Introduction to elastic and plastic bending
  - 5.3 Radius of curvature, flexural stiffness
  - 5.4 Analysis of beams of symmetric cross-section
  - 5.5 Shear stress variation in rectangular and thin walled I beam
  - 5.6 Analysis of composite beams
  - 5.7 Concept of deflection in beams (simply supported beam)
6. **Torsion** (3 Hours)
- 6.1 Introduction
  - 6.2 Assumptions and derivation of torsional equation
  - 6.3 Calculation of torsional moments in series and parallel combination of shafts
  - 6.4 Calculation of torsional stresses
7. **Thin-Walled Pressure Vessels** (3 Hours)
- 7.1 Definition and characteristics of thin-walled vessels
  - 7.2 Types of stresses in thin-walled vessels
  - 7.3 Calculation of stresses and strains in thin-walled vessels
8. **Compound Stresses Failure Theories** (5 Hours)
- 8.1 Introduction
  - 8.2 Load acting eccentrically to one and both axes
  - 8.3 Condition for no tension in the section
  - 8.4 Introduction to failure theories
9. **Introduction to Buckling** (3 Hours)
- 9.1 Definition of buckling



## 9.2 Buckling of columns

## 9.3 Effective length

### **Laboratories:**

1. Tensile test of steel
2. Simple bending test on steel or timber beam
3. Torsion test on simple shaft
4. Test on column behavior and buckling



## References:

1. B.C. Punmia. *Strength of Materials – Mechanics of Structures*, Standard Publication Distributors, New Delhi
2. E. P. Popov. *Mechanics of Materials*, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 1989
3. G.B.Motra. *A text book of strength of materials*, Heritage Publishers & Distributors Pvt. Ltd
4. G. H. Ryder. *Strength of Materials*, 3rd Edition, Macmillan, ELBS, 1985
5. R. K Bansal. *A text book of strength of materials*, Laxmi publication, New Delhi
6. R. K. Rajput. *Strength of Materials (Mechanics of Solids)*, S. Chand, New Delhi
7. S. P. Timoshenko & D. H. Young. *Elements of Strength of Materials*, 5th Edition, East-West Press Pvt. Ltd., 1987
8. S. S. Vavikatti. *Strength of Materials*, Vikas Publication, New Delhi

*\*Latest edition will be preferable.*

## Evaluation Scheme: Marks Division

Question Type	No. of Questions	Marks	Total Marks
Short	4	2	8
Medium	7	4	28
Long	3	8	24
Total			60

