**Annexure ‘CD – 01’**

**FORMAT FOR COURSE CURRICULUM**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **L** | **T** | **P** | **S** | **SW/ FW** | **TOTAL CREDIT UNITS** |
| 3 | 0 | 2 | 0 | 0 | 4 |

**Course Title: Engineering Mechanics**

**Credit Units: 4**

**Course Level: UG**

**Course Code: ES101**

**Course Objectives:** Objective of this course is to provide the fundamental knowledge of static and dynamic behavior of rigid bodies under the influence of artificial or natural forces.

**Pre-requisites:** The Basic Concepts of Physics and Mathematics.

**Course Contents/Syllabus:**

|  |  |
| --- | --- |
|  | Weightage (%) |
| **Module I: Force system & Basics of Friction** | **30** |
| **Descriptors/Topics**   1. Fundamental of mechanics, Force & Force systems, Newton’s laws of motion. Principle of transmissibility of forces. Free body diagram & its application. 2. Concurrent-coplanar force systems, Laws of parallelogram, triangle and polygon, Resultant and Equilibrant of force, Equilibrium equations, Lami’s theorem and its application. 3. Non concurrent-coplanar force system, moment & couple, Varignon’s theorem and its applications. 4. Concept of limiting friction, Coulumb’s laws of dry friction. Simple block friction on any inclination, Simple ladder friction. |
| **Module II: Determinate Structure** | **30** |
| **Descriptors/Topics**   1. Beam & its type, different type of loading and support reactions. 2. Introduction to Shear Force & Bending Moment Diagrams (SFD & BMD) on point loaded simply supported beams. 3. Definition & Classification of plane truss, assumption in the truss analysis. 4. Analysis of plane trusses by the method of joints & method of section. |
| **Module III: Centroid & Moment of Inertia** | **30** |
| **Descriptors/Topics**   1. Determination of centroid by direct integration and by the method of composite bodies for wire/line & area. 2. Pappus-Guldinus theorems and its application. 3. Introduction to area moment of inertia, Parallel axis theorem, Perpendicular axis theorem, radius of gyration. 4. Determination of area moment of inertia of different geometrical shapes such as rectangle, triangle, circle and part of circle about an axis using direct integration method.   5 Determination of area moment of inertia of composite shape. |
| **Module IV: Introduction to Dynamic analysis:** | **10** |
| **Descriptors/Topics**   1. Concept of D’alembert principle and its various applications on motion of belt-pulley& blocks. |

**Course Learning Outcomes:** On successful completion of this course the student will be able to:

* ***State*** various principles of forces and its applications.
* ***Describe*** the conditions of equilibriums under influence of different forces.
* ***Demonstrate*** knowledge of basic determinate structures used in constructions.
* ***Analyze*** actions, reactions, internal forces in any connecting or individual rigid bodies.
* ***Formulate*** centroids of any combination or individual bodies.
* ***Estimate*** quantitative value of relative distribution of area about any reference point or axis.
* ***Evaluate*** dynamic behavior of bodies.

**Pedagogy for Course Delivery:** The course pedagogy will include lectures, e-contents, e-tutorials, numerical practice and experimental investigations.

**Lab/ Practical details:**

**List of Experiments**

1. To verify the law of Force Polygon.
2. To determine the reactions on simply supported beam using Parallel Force apparatus.
3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
4. To find the forces in the members of Jib Crane.
5. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.
6. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle
7. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of Worm Wheel
8. To verify force transmitted by members of given truss.
9. To verify the law of moments using Bell crank lever
10. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Differential Wheel and Axle

**Assessment/ Examination Scheme:**

|  |  |  |
| --- | --- | --- |
| **Theory L/T (%)** | **Lab/Practical/Studio (%)** | **Total (%)** |
| 75 | 25 | 100 |

**Theory Assessment (L&T):**

|  |  |  |
| --- | --- | --- |
|  | **End Term Examination** | |
| **Components** | **A** | **CT** | | **S/V/Q** | **HA** | **EE** |
| **Weightage (%)** | 5 | 15 | | 10 | 10 | 60 |

**Lab/ Practical/ Studio Assessment:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Continuous Assessment/Internal Assessment** | | | | **End Term Examination** | |
| **Components** | **A** | **PR** | **LR** | **V** | **PR** | **V** |
| **Weightage (%)** | 5 | 15 | 10 | 10 | 30 | 30 |

**Mapping Continuous Evaluation components/PSDA with CLOs**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bloom’s Level > | Knowledge | Comprehension | Application | Analysis | Synthesis | Evaluation | Evaluation |
| Course Learning Outcomes  Assessment type/PSDA | CLO1(***State*** various principles of forces and its applications) | CLO2 (***Describe*** the conditions of equilibriums under influence of different forces  ) | CLO3 (***Demonstrate*** knowledge of basic determinate structures used in constructions  ) | CLO4 (***Analyze*** actions, reactions, internal forces in any connecting or individual rigid bodies.  ) | CLO5 (***Formulate*** centroids of any combination or individual bodies.  ) | CLO6 (***Estimate*** quantitative value of relative distribution of area about any reference point or axis.  ) | CLO7 (***Evaluate*** dynamic behavior of bodies.) |
| Assignment |  |  |  |  |  |  |  |
| Quiz |  |  |  |  |  |  |  |
| Class Test |  |  |  |  |  |  |  |

**Text books:**

* S.S. Bhavikatti, Engineering Mechanics, New Age International Ltd **ISBN-13:** 978-8122433739
* Sadhu Singh, Engineering Mechanics, Umesh Publication ISBN-13 978-81-7409-260-1
* D.S Kumar , Engineering Mechanics, S.K. kataria and son ISBN: 978-93-5014-292-9
* Engineering Mechanics Lab Manual

**Reference books:**

* H. Shames & G. K. M. Rao, Engineering Mechanics, Pearson Education, 2006 **ISBN** 13: 9788177581232
* Timoshenko, Engineering Mechanics, McGraw Hill, **ISBN**: 9780070616806

**Other Reference materials:**

* <https://nptel.ac.in/courses/112/103/112103109/>
* <https://www.iitg.ac.in/rkbc/me101/Presentation/L01-03.pdf>
* <https://nptel.ac.in/courses/112/105/112105164/>
* <https://nptel.ac.in/courses/112/103/112103108/>