FISAT
FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY
AUTONOMOUS
Focus on Excellence

Semester 1
Engineering Mechanics

Course Code	Teaching hours per week				Credits	Exam hours	Course type	CIE Marks	ESE Marks
	L	T	P	R					
26NNVES104	3	1	0	0	3	2.5	Theory	40	60

1. **Preamble**: This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. The course develops the ability to analyze static and dynamic systems through concepts such as force equilibrium, friction, centroids, moments of inertia, structural analysis, and motion. It provides the theoretical and analytical tools required for solving engineering problems related to structures, machines, and mechanical systems. This course forms the backbone of Structural Engineering and acts as a prerequisite to mechanics of solids, structural analysis and fluid mechanics.

2. **Prerequisites:** Nil

Module Number	Syllabus Description	Contact Hours
1	**Introduction to statics**: Composition and resolution of forces, Parallelogram law of forces, Principle of transmissibility of forces, Lami's theorem **Equilibrium conditions** : Forces in 2D and 3D for concurrent and non concurrent co-planar forces, Moment of a force, couple, Varignon's theorem, free body diagram **Forces in space**-Introduction-Resultant of force-Equilibrium of force in space.	9
2	**Friction**: Laws of friction-Equilibrium of force systems involving frictional forces-Problems related to connected bodies-Ladder friction-wedge friction. **Centroid and moment of inertia**:Parallel axis theorem and perpendicular axis theorem. Polar moment of inertia, radius of gyration, mass moment of inertia-ring and disc (Concept only)	9
3	**Analysis of structures:** Support reactions of beams (point load, UDL and UVL only), Introduction to plane trusses, analysis of plane trusses by method of joints and method of sections	9
4	**Introduction to dynamics**:Rectilinear translation-Equations of motion in kinematics and kinetics-D'Alembert's Principle-motion on	9

	horizontal and inclined surfaces, motion of connected bodies, Simple harmonic motion, free and forced vibration, degree of freedom	
	Total hours	36

3. Course Assessment Method

Continuous Internal Evaluation Marks (CIE)

Attendance	Assignment/ Microproject	Internal Examination- 1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

Part A	Part B	Total
8x3 =24marks • 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks	**4x9 = 36 marks** • Each question carries 9 marks. • Two questions will be given from each module,out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions.	60

4. Course Outcomes

At the end of the course students should be able to:

Course Outcomes		Blooms Taxonomy Level
CO1	Apply statics principles to analyze force systems and equilibrium in 2D and 3D.	K3
CO2	Solve engineering problems involving moments, couples, and frictional forces.	K3
CO3	Determine centroids and moments of inertia of engineering sections.	K3
CO4	Analyze beams and plane trusses to determine support reactions and member forces.	K4

CO5	Apply dynamics principles to solve problems involving motion and vibrations.	K3

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

5. Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-

6. Text Books

Sl No	Title of Book	Name of Author/s	Publisher	Edition and Year
1	Engineering Mechanics (in SI units)	S. Timoshenko, D.H. Young, J.V.Rao, Sukumar Pati,	Tata McGraw Hill	5th Edition , 2017
2	Engineering Mechanics: Statics and Dynamics	N.H. Dubey	Tata McGraw Hill	2014
3	Textbook of Engineering Mechanics	R.K Bansal	Laxmi Publications Pvt Ltd	4th Edition 2016
4	Engineering Mechanics: Combined Statics and Dynamics	Russell C. Hibbeler	Pearson Education	14th Edition 2015
5	Engineering Mechanics - Statics and Dynamics	Shames, I. H.	Prentice Hall of India.	4th Edition 2008

7. Reference Books

Sl No	Title of Book	Name of Author/s	Publisher	Edition and Year
1	Engineering Mechanics	Basudeb Bhattacharya	Oxford University Press, India	2, 2015
2	Engineering Mechanics-Statics and Dynamics	Irving Shames,G.K.M. Rao	Pearson	4, 2009

3	Engineering Mechanics	K.L.Kumar, Veenu Kumar	Tata McGraw Hill	4, 2010
4	Engineering Mechanics	S.S. Bhavikkatti	New Sage International	4, 2008
5	Engineering Mechanics Statics	J. L. Meriam, L. G.	Wiley	9th Edition 2020

8. Video Links or any other Reference Materials

Sl No	Details Like Weblink, Publication Details	Module
1	Engineering Mechanics-Introduction https://nptel.ac.in/courses/112106286	1,2,3,4
2	Engineering Mechanics-Equilibrium http://www.digimat.in/nptel/courses/video/122104015/L02.html	1
3	Engineering Mechanics-Statics and Dynamics https://nptel.ac.in/courses/112106180	1,2,3,4
4	Analysis of trusses https://www.youtube.com/watch?v=lheoBL2QaqU&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=7	3

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Model Question Paper

Register No…… Name: ……..

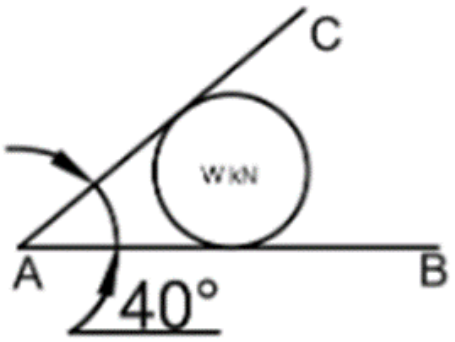
FEDERAL INSTITUTE OF SCIENCE AND TECHNOLOGY (FISAT)
(Autonomous)
FIRST SEMESTER BTECH DEGREE EXAMINATION, <MONTH &YEAR>

Course Code : 26NNVES104
Course Name : Engineering Mechanics

Total Marks : 60 Duration : 2.5 hours

PART - A

	(Answer all questions. Each question carries 3 marks)	CO	Marks
1	State and prove Varignon's theorem of moments.	CO1	(3)
2	Explain the concept of a free body diagram. Draw the free body diagram of the ball shown in the figure.	CO1	(3)



3	List any five laws of dry friction.	CO2	(3)
4	State and explain perpendicular axis theorem	CO3	(3)
5	What are the assumptions in truss analysis?	CO4	(3)
6	A simply supported beam AB of span 8m carries concentrated load of 2kN, 4kN and 5 kN at 3m, 4m and 5m from support A. Find the reactions at the support?	CO4	(3)

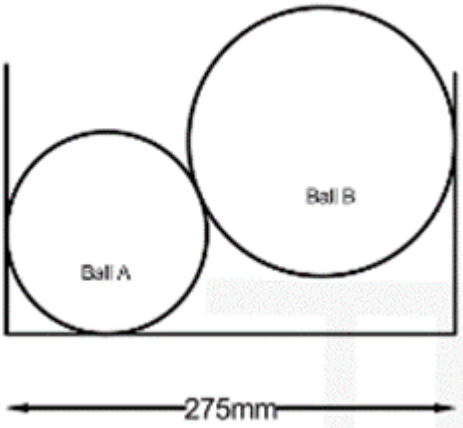
7	Explain D'Alembert's principle	CO5	(3)
8	Distinguish between free vibration and forced vibration?	CO5	(3)

PART - B

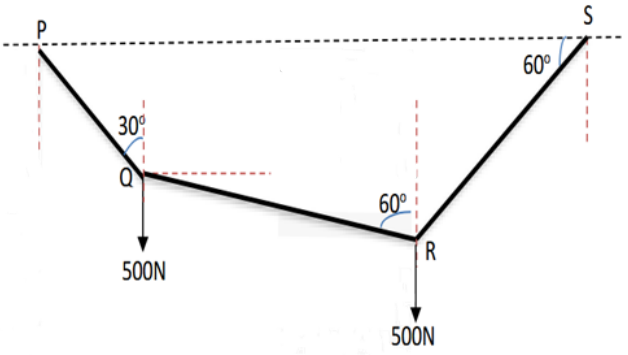
(Answer one full question from each module. Each question carries 9 marks)

Module 1

9	Two balls A and B of diameters 150mm and 200mm respectively are placed in a trough of 275mm wide as shown in the figure. The weight of ball A is 200 kN and that of ball B is 250kN. Find the reactions at all points of contact	CO1	(9)



10	A string PQRS is attached to two fixed points P and S has 2 equal weights of 500N attached to it at Q and R. The weights rest with the portions PQ and RS, inclined at angles of 30° and 60° respectively to the vertical as shown in Fig. 1. Find the tension in the portions PQ, QR and RS of the string, if the inclination of the portion QR with the vertical is120°.	CO1	(9)



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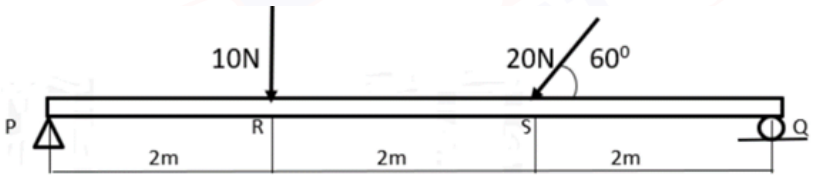
Module 2

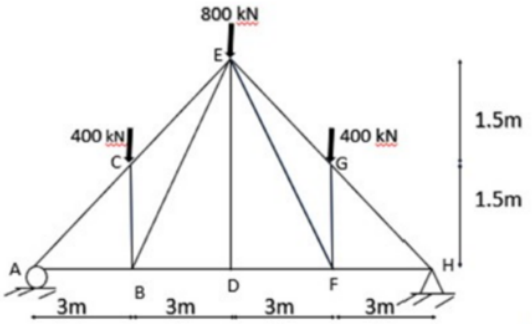
11	A ladder 6m long and weighing 320 N is placed against a vertical wall at an inclination of 40o with the wall. The coefficient of friction between the wall and the ladder is 0.3 and that between the floor and the ladder is 0.25. What is the minimum horizontal force P applied at the lower end of the ladder when a man weighing 700 N standing at a distance of 4.70m along the ladder from the lower end?	CO2	(9)
12	A **400 N** block rests on a rough plane inclined at **40°**. The coefficient of static friction is **0.50**. Determine: 1. The normal reaction. 2. The limiting friction. 3. Whether the block is in equilibrium.	CO2	(9)

Module 3

13	A beam 6m long is loaded as shown in Fig. . Calculate the reactions at P and Q	CO4	(9)



14	Determine the support reactions, analyse using method of joints and tabulate the forces in all the members	CO4	(9)



Module 4

15	A block of mass 12 kg is placed on a 20° inclined plane. A force of 60 N is applied parallel to the plane upwards. Coefficient of friction = 0.2. Using D'Alembert's principle:Determine the acceleration of the block. State whether the block moves up or down	CO5	(9)
16	Two blocks of masses M1 and M2 are connected by a flexible but inextensible string as shown in Fig.. Assuming coefficient of friction between block M1 and horizontal surface to be 0.25, find the acceleration of the masses and tension in the string. M1 = 10 kg and M2 = 5 kg	CO5	(9)