



**SARVAJANIK UNIVERSITY**  
**Sarvajani College of Engineering and Technology**  
**Bachelor of Technology**



**Mechanical Engineering Department**  
**B. Tech. Semester V**

**Course Name:** Dynamics of Machinery **Course Code:** BTME13502  
**Type of course:** Professional Core Course  
**Prerequisite:** Kinematics of Machinery.  
**Rationale of Course:** The course is intended to give students an understanding of fundamental of the force-motion relationship in components subjected to external forces and analysis of standard mechanisms. The course's purpose is to educate the undesirable effects of unbalances resulting from prescribed motions in mechanism, the effect of Dynamics of undesirable vibrations, the principles in mechanisms used for speed control and stability control.

**Teaching and Examination Scheme:**

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	150
3	0	2	4	60	25	15	30	20	

**CA1:** Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

**Contents**

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	<b>Force Analysis and Flywheel:</b> Inertia force and Inertia torque– D Alembert’s principle – Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams of fly Wheels, fluctuation of energy, fluctuation of speed – flywheels of punching presses.	12	25%
2.	<b>Balancing:</b> Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.	08	20%



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Sr. No.	Topics	Teaching Hrs.	Module Weightage
3.	<b>Free Vibration:</b> Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.	<b>10</b>	<b>22%</b>
4.	<b>Force Vibration:</b> Response of one degree freedom systems to periodic forcing – Harmonic disturbances –Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement	<b>08</b>	<b>20%</b>
5.	<b>Controlling Mechanism:</b> Angular velocity, angular acceleration, gyroscopic torque, gyroscopic effect on naval ships, aero plane, stability of an automobile, stability of two wheel vehicle.	<b>07</b>	<b>13%</b>

**Percentage Distribution of Marks as per Bloom’s Taxonomy (Theory/Practical):**

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>25</b>	<b>25</b>	<b>20</b>	<b>20</b>	<b>5</b>	<b>5</b>

**Legends: R:** Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create  
**Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.



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**Reference Books:**

Sr. No.	Title of book /article	Author(s)	Publisher	Publication year	Publication edition
1	Theory of Machines and Mechanisms	Uicker, J.J., Pennock G.R and Shigley, J.E	Oxford University Press	2014	4 <sup>th</sup> edition
2	Theory of Machines	S. S. Ratan	Tata McGraw-Hill	2017	4 <sup>th</sup> edition
3	Principle of Vibrations	Benson H. Tongue	Oxford University Press	2007	2 <sup>nd</sup> edition
4	Mechanics of Machines	V Ramamurthy	Narosa Publishing House	2009	3 <sup>rd</sup> edition
5	Theory of Machines	R.S. Khurmi	S Chand	2015	4 <sup>th</sup> edition
6	Theory of Machines And Mechanisms	Joseph E. Sighely	Oxford University Press	2016	5 <sup>th</sup> edition
7	Theory of Machines	Thomas Bevan	Pearson	2009	3 <sup>rd</sup> edition

**Course Outcomes (CO's):**

CO. No.	CO Statements After learning this subject, students will be able to	Marks % weightage
CO-1	Summarize dynamic forces and turning moments in mechanisms.	30
CO-2	Minimize unbalance in mechanical systems by means of static and dynamic balancing.	25
CO-3	Demonstrate longitudinal vibrations, transverse vibrations and torsional vibrations in single degree of freedom systems.	25
CO-4	Analyze gyroscopic effect in aero plane, ships and automobiles	20



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**Mapping of (CO's) with Program Outcomes (PO's) and Program Specific Outcomes (PSO's):**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
<b>CO-1</b>	3	1	1	2	1	1	3	3	1	2	1	2	3	1	2
<b>CO-2</b>	3	2	2	1	2	1	2	3	2	2	3	2	3	2	2
<b>CO-3</b>	3	1	1	2	1	2	1	3	1	2	1	2	3	1	2
<b>CO-4</b>	3	3	2	3	3	2	3	3	3	3	3	3	3	3	3
<b>Ratio nale*</b>	<b>12</b>	<b>7</b>	<b>6</b>	<b>8</b>	<b>8</b>	<b>6</b>	<b>9</b>	<b>12</b>	<b>7</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>12</b>	<b>7</b>	<b>9</b>

**Rationale - Mapping of CO's with PO's and CO's with PSO's:**

**CO-PO's:** this course will provide knowledge of understanding of engineering associated with new and traditional synthesis, and multilink mechanisms. Students will demonstrate the ability to perform mechanism analyses to find the position, velocity, acceleration, and dynamics of multi-bar mechanisms. Students will demonstrate the ability to explore the research in gyroscope for recent trends.

**CO-PSO's:** According to the above CO's and PSO's mapping (1), the Students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem.

This course highly maps with Program outcomes 1,7,8,10,12 and Program Specific Outcomes 1. It states that the course will develop engineering knowledge, environment and sustainability, ethics, communication, life-long learning and finally it will lead to convert conceptual knowledge of mechanical engineering to real life applications.

**List of Practical:**

1. Static and dynamic balancing of rotating masses.
2. Understanding of gyroscopic effect using motorized gyroscope.
3. Longitudinal free vibration of spring mass system
4. To Study of torsional vibration in shaft (single rotor and two rotor system).
5. To Study of free damped vibration and logarithmic decrement.
6. To Study of forced damped vibration.
7. Critical speed of the shaft.
8. To Study of dynamic forces and turning moments in mechanisms.



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**Major Equipment:**

1. Universal Vibration Apparatus
2. Motorized Gyroscope
3. Static and Dynamic Balancing Apparatus
4. Whirling shaft apparatus.

**List of open learning website:**

1. NPTEL Video lectures: <http://www.nptel.iitm.ac.in/video.php?subjectId=112104121>
2. NPTEL web course: <http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/index.htm>
3. CMU lectures on mechanic of manipulation: <http://www.cs.cmu.edu/afs/cs/academic/class/16741-s07/www/>
4. A document on mechanisms: <http://wbmtt.tudelft.nl/cadom/Downloads/wb3303chapt2.pdf>
5. An excellent website for all machine design enthusiasts: <http://www.technologystudent.com/>

**List of Open Source Software: Nil**