	SREE SOWDAMBIKA COLLEGE OF ENGINEERNG **CHETTIKURICHI (PO), ARUPPUKOTTAI – 626134** **DEPARTMENT OF MECHANICAL ENGINEERING** **COURSE PLAN**	**Doc.Ref:2.2.10/2** **Revision:** **Date:24/12/22**

Name of the Course Instructor: U.RAJKUMAR **Class: III Year**

Course Code & Name: ME8594&DYNAMICS OF MACHINES **Semester: V**

VISION of SSCE	**MISSION of SSCE**
To strive continuously for excellence in education, research, technology and interdisciplinary collaboration to meet the changing needs of the society.	To develop high quality technical education through research and innovation by adapting the students to changing technological environment with the highest ethical values.

Department of Mechanical Engineering

DEPARTMENT VISION	DEPARTMENT MISSION
transform the students from rural atmosphere to global scenario and make them to be a committed technocrat with ethical values.	• To enrich the skill sets of the students for sustaining their position in the global job Market. • To install professional ethical practices in the minds of the students. • To encourage them to get adapted for the latest virtual learning. • To provide opportunities to the students to exhibit leadership, professionalism, Teamwork and effective communication skills.

Programme Educational Objectives (PEOs)

The Program Educational Objectives of the Mechanical Engineering Degree Program are to impart Knowledge, Skill and Attitude on the graduates to:

PEO-1	Imparting Knowledge	Have a successful career in Mechanical Engineering and allied industries.
PEO-2	Multi-discipline	Have expertise in the areas of Design, Thermal,
PEO-3	Research Skill	Contribute towards technological development through academic research and industrial practices.
PEO-4	Managerial Skill	Practice their profession with good communication, leadership, ethics and social responsibility.
PEO-5	Life-long learning	Graduates will adapt to evolving technologies through life-long learning.

Programme Outcomes (POs)

The Programme Outcomes of the B.E. Mechanical Engineering program

PO-1	Engineering knowledge	Apply the knowledge of mathematics, science, and basic engineering fundamentals to the solution of complex engineering problems in the major areas of Mechanical Engineering.
PO-2	Problem analysis	An ability to identify, formulates, and solve complex engineering problems. With high degree of competence.
PO-3	Design/development of solutions	An ability to design mechanical systems, component, or a process to meet desired needs within the realistic constraints such as environmental, social, political and economic sustainability.
PO-4	Conduct investigations of complex problems	An ability to design and conduct experiments, as well as to analyze and interpret data obtained through those experiments.
PO-5	Modern tool usage	Create and apply appropriate techniques, resources, and modern engineering tools for executing engineering activities.

PO-6	The engineer and society	Apply reasoning of the societal, safety issues and the consequent responsibilities relevant to engineering practice.
PO-7	Environment and sustainability	The broad education is necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
PO-8	Ethics	Apply ethical principles and commit to professional ethics, responsibilities and norms of engineering practice.
PO-9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams in multi-disciplinary settings.
PO-10	Communication	Communicate effectively to the engineering community and the outside world And also to write effective reports & presentation
PO-11	Project management and finance	Understand engineering and management principles and apply them to handle projects in multi-disciplinary environments.
PO-12	Life-long learning	Recognize the need for life-long learning and apply in the context of technological change.

Programme Specific Outcomes (PSOs)

The graduates of Bachelor of Engineering in Mechanical Engineering Programme will be able to:

PSO-1	Basic Engineering Knowledge	Apply their knowledge in the domain of Thermal, Design, Manufacturing and Industrial engineering to solve engineering problem utilizing advanced technology with the help of modern CAD/CAM tools,
PSO-2	Managerial Skill	An ability to build the nation, by imparting technological inputs and managerial skills to become Technocrats and Entrepreneurs, build the attitude of developing new concepts on emerging fields and pursuing advanced education.
PSO-3	Research Skill	Ability to apply the knowledge to provide optimized solution by applying new ideas and innovation in research gaps of various mechanical engineering domain

ME8594 *DYNAMICS OF MACHINES* *L T P C 4 0 0 4*

UNIT I FORCE ANALYSIS 12

Dynamic force analysis – 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 –Fly Wheels – Flywheels of punching presses- Dynamics of Cam- follower mechanism.

UNIT II BALANCING 12

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.

UNIT III FREE VIBRATION 12

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.

UNIT IV FORCED VIBRATION 12

Response of one degree freedom systems to periodic forcing – Harmonic disturbances – Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

UNIT V MECHANISM FOR CONTROL 12

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL: 60 PERIODS

COURSE OBJECTIVES:

1. To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
2. To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
3. To understand the effect of Dynamics of undesirable vibrations.
4. To understand the principles in mechanisms used for speed control and stability control.

LESSON PLAN

Lect NO.	Syllabus topics	No. of hour required	Cumulative period	Teaching Methodology Used		Page no.		
						T1	R1	R2
	UNIT I- **FORCE ANALYSIS**							
1	Turning moment diagram of flywheel: fluctuation of energy, coefficient of fluctuation of energy, numerical examples	2	2	BB	**Z-A**	1		
2	Flywheel: energy stored in a flywheel, dimensions of the flywheel rim, flywheel and punching press. Numerical example	2	4	BB	**MM**	12		
3	Numerical examples on flywheel	3	7	BB	**MM**	28		
4	partial balancing of multi-cylinder engine, numerical problems.	3	10	BB	**MM**	32		
5	Dynamic force analysis – Inertia force and Inertia torque	2	12	BB	**RP**	135		
6	Dynamics of Cam- follower mechanism.	3	13	BB	**CL**	36		
7.	Bearing loads – Crank shaft torque	3	16	BB	**GD**	52		
	UNIT II- **BALANCING**							
8.	Static and dynamic balancing, balancing of reciprocating mass, partial balancing of single cylinder engine, numerical examples	4	20	BB	**MM**	66		
9	Balancing of single revolving mass in same plane, balancing of several revolving masses in same plane, several rotating masses in different plane.	4	24	BB	**MM**	75		
10	Numerical problems on revolving masses.	2	26	BB	**MM**	79		
11	Direct and reverse crank method of balancing, numerical problems.	2	28	BB	**RP**	80		
12	Balancing machines-Field balancing of discs and rotors.	2	30	BB	**CL**	84		
13.	Balancing a single cylinder engine	3	33	BB	**GD**	88		
	UNIT III -**FREE VIBRATION**							
14.	Vibration: Introduction to vibration, causes of vibration, elimination of vibration, types of vibration	2	35	PPT	**CL**	90		
15.	longitudinal, transverse , torsional	2	37	BB	**ZA**	94		
16.	definition of terminology like natural frequency, amplitude , time	1	38	BB	**FP**	99		

	period							
17	Calculation of natural frequency of undamped single degree of freedom system by Newton's 2nd Law, D-Alembert's principle and energy method	2	40	PPT	**MM**	109		
18	Basic features of vibratory systems – Degrees of freedom – single degree of freedom	2	42	BB	**GD**	125		
19	vibration– Equations of motion – Natural frequency – Types of Damping	2	44	BB	**CL**	145		
20.	Two and three rotor torsional systems.	2	46	PPT	**FP**	149		
	UNIT IV-FORCED VIBRATION							
21	Response of one degree freedom systems to periodic forcing	1	47	BB	**MM**	158		
22	Harmonic disturbances	2	49	BB	**GD**	168		
23	Disturbance caused by unbalance	2	51	PPT	**CL**	188		
24	Support motion –transmissibility	1	52	BB	**FP**	200		
25	Vibration isolation	2	54	BB	**RP**	**220**		
26	vibration measurement.	1	55	PPT	**MM**	**254**		
	UNIT V- MECHANISM FOR CONTROL							
27	Gyroscope: angular velocity, angular acceleration, gyroscopic couple, numerical problems	2	57	BB	**MM**	259		
28	Effect of gyroscopic couple on bearings, numerical problems.	3	60	BB	**GD**	280		
29	Stability of 4-wheel automobile, numerical problems	2	32	PPT	**CL**	300		
30	Stability of two wheel vehicle, numerical problems	1	63	BB	**FP**	320		
31	Effect of gyroscopic couple on naval ship, numerical problems.	2	65	BB	**RP**	345		
32	Effect of gyroscopic couple on aeroplane.	2	67	PPT	**MM**	368		
33	Governors – Types – Centrifugal governors	1	68	PPT	**GD**	420		
34	Gravity controlled and spring controlled centrifugal governors	2	70	BB	**CL**	425		
35	Effect of friction	2	72	BB	**FP**	465		
		NO. OF HOURS ALLOTED IN SYLLABUS: 60 NO. OF HOURS REQUIRED AS PER PLAN: 72						

Course Assessment Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1													1		
CO2			2												
CO3		2													
CO4			2												
CO5	3														

Course Outcome	Skill	PO	Bloom's	Assessing Tools
Co1- Clear understanding the external forces and analysis of standard mechanisms	Remember/ Understand	Po3,pso1	L1/L2	IAT Exam, Assignment and class test
Co2- To apply Equations of motion Solve the three and three rotations problmes	Apply	Po1	L2	
Co3- Analyze and distinguish Balancing of Multi-cylinder inline, V-engines ,Partial balancing in engines	Analyse	Po2	L3	
Co4- To do investigation on the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.	**Investigation**	Po3,pso2	L4	

	CO1	CO2	CO 3	CO4	CO5	JUSTIFICATION
PO1				2		Students Using their research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. As a reason for that Course Outcome 4 is strongly mapped with Programme Outcome 4.
PO2		2			3	Students will able to apply reasoning of the societal, safety issues and the consequent responsibilities relevant to engineering practice based on this relevance Course Outcome 2 is strongly mapped with Programme Outcome 1.
PO3			2			Students can analyze and understand the impact of Management principles in the environment and exhibit the knowledge for sustainable development of the society because of this Course Outcome 3 is strongly mapped on Programme Outcome 2
P04						Case study gives more confident level to students can gains an ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings based on this outcome CO4 is moderately mapped with PO9.
PO5						dents acquires an ability to Communicate effectively on management related activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. This outcome slightly mapped with CO3 and moderately mapped with CO4 because case studies given to students for the improvement of their communication skills.
PSO1	1					Students have a need for life-long learning and apply in the context of technological change this was obtained from course outcome 1 in the similar way CO1 is slightly mapped with PSO1.

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