GEAR ENGINEERING

CourseCode	20ME6502	**Year**	III	**Semester**	I
Course Category	HONORS	**Branch**	ME	**Course Type**	Theory
Credits	4	**L – T – P**	3 – 1 – 0	**Prerequisites**	Design of Machine Elements
Continuous Internal Evaluation	30	**Semester End Evaluation**	70	**Total Marks**	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	**Skill**	**BTL**	**Units**
CO1	Select and design appropriate gear for the given application and against the failures.	Analyze	L4	1,2,3,5
CO2	Design the gear box for given specifications.	Analyze	L4	3
CO3	Optimization of Tooth geometry for gears.	Analyze	L4	4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	2				2			1		2	3	2
CO2	3	3	2				2			1		2	3	2
CO3	3	3	2				2			1		2	3	2

Syllabus

UNIT	**Contents**	**Mapped COs**
I	**INTRODUCTION**: Principles of gear tooth action, Generation of Cycloid and Involute gears, Involutometry, gear manufacturing processes and inspection, gear tooth failure modes, stresses, selection of right kind of gears. **GEAR FAILURES**: Analysis of gear tooth failures, Nomenclature of gear tooth wear and failure, tooth breakage, pitting, scoring, wear, overloading, gear-casing problems, lubrication Failures.	**CO1**
II	**BEVEL GEARS:** Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of bevel gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Design of gear shaft. **WORM GEARS:** Tooth loads, Principles of Geometry, Design considerations and methodology, Complete design of worm gear teeth considering Lewis beam strength, Buckingham's dynamic load and wear load, Heat dissipation considerations. Design of gear shaft	**CO1, CO3**
III	**PLANETARY GEAR TRAIN**: Introduction, Gear Ratio, Conditions of Assembly, Phase Angle of Planet Gears, Efficiency of a Planetary Gear Train, Modifications of Gear Tooth	**CO1, CO2, CO4**

	Geometry, Tooth Contact Analysis. **GEARBOX DESIGN - REAR-ENGINED RACING CARS:** In-line shaft arrangement, Internal gear arrangement, Face-dog selectors, Bearing arrangement, Crown wheel and pinion layout, Differential location and type, Transverse-shaft arrangement, Selector system, Selector interlock system, Lubrication method, Gearbox casing, Materials guide.	
IV	**ADVANCES IN GEAR MANUFACTURING:** Subtractive or Material Removal Processes, Laser Machining, Abrasive Water Jet Machining, Spark Erosion Machining, Additive or Accretion Processes, Metal Injection Molding, Injection Compression Molding, Micropowder Injection Molding, Additive Layer Manufacturing Processes. **TOOTH GEOMETRY OPTIMIZATION:** Involute Profile Optimization, Gear Pair Size Reduction, Asymmetry Factor Selection, Mesh Efficiency Maximization, Tooth Modeling and Bending Stress Calculation, Root Fillet Optimization, Root Fillet Optimization Method, Fillet Optimization Analysis, Benefits of Fillet Optimization.	**CO3**
V	**GEAR DESIGN DETAILS:** Gear Transmission Density Maximization, Introduction of Volume Function, Volume Functions for Two-Stage Gear Drives, Internal Gear Ratio Optimization, High Gear Ratio Planetary Drives, One-Stage Arrangements, Two-Stage Arrangements. **SELF-LOCKING GEARS:** Self-Locking Conditions, Self-Locking Gear Design, Plastic Gear Design Specifics, Polymer Benefits and Limitations, Direct Gear Design of Polymer Gears, Metal-to-Plastic Conversion.	**CO1**

Learning Resources

Text books

1.Maleev and Hartman, Machine Design, C.B.S. Publishers, 1983.
2.Gear engineering by Henry E. Merrit, 3rd Edition, Ah Wheeler & Co Ltd, Allahabad,1992.
3.Hand Book of Practical Gear design by Darle W. Dudley, CRC Press, 1994.

Reference books

1. Earle Buckingham, Analytical mechanics of gears, Dover publications, New York, 1949.
2. G. M. Maitha, Hand book of gear design, TaTa Mc.Graw Hill publishing company Ltd., New Delhi, 1994.
3. Kapil Gupta, Neelesh Kumar Jain, Rudolph Laubscher, Advanced Gear Manufacturing and Finishing a Classical and Modern Processes, Academic Press is an imprint of Elsevier, UK, 2017.
4. Damir Jelaska, University of Split, Croatia Gears and Gear Drives, A John Wiley & Sons Publication, UK, 2012.
5. Alexander L. Kapelevich, Direct Gear Design, CRC Press, Taylor & Francis Group, New York, 2013.
6. Alec Stokes, Manual Gearbox Design, International Society of Automotive Engineers, Butterworth-Heinemann Ltd, 1992.
7. Faydor L. Litvin, Alfonso Fuentes, Gear Geometry and Applied Theory, Cambridge University Press , Cambridge, New York,2004.

Data Book to be allowed in Examination

1. Design Data (Data Book of Engineers), P. S. G. College of Technology, Revised Edition, Coimbatore, 2004.
2. Design data hand book by K Mahadevan & K Balaveera Reddy, (4th Edition), CBS Publishers, 2013.