Name of Institute : Indus Institute of Technology & Engineering
Name of Faculty : Prof. Rahul Patel (Mechanical Engineering)

Course code : ME0721
Course name : Machine Design II
Pre-requisites : MD 1
Credit points : 3
Offered Semester : VII

Course coordinator
Full name : Prof. Rahul Patel
Department & location: Department of Mechanical Engineering, DOM Lab, 1st floor , Bhanwar Building
Telephone : 9428192514
Email : rahulpatel.me@indusuni.ac.in
Consultation times : 4:30 to 5:00 (Monday to Friday)

Course Objectives
By participating in and understanding all facets of this course a student will:

1. To introduce design consideration for various types of gear.
2. To design various types of bearing for different service conditions.
3. To design various I. C. Engine components by consideration mechanical conditions.
4. To design gear box for various applications

Course Outcomes (CO)
Students will be able to :
CO 1: Student will learn to make proper assumption/ perform correct analysis while designing specific mechanical components.
CO 2: Ability to design various mechanical systems like gears, machine tool gear boxes,bearings for the specification stated/formulated.
CO 3: Ability to prepare ray diagram for variable speeds.
CO 4: Design journal bearing and select antifriction bearing for state application.
CO 5: Learn design of IC engine components and crane components.

Course Outline

UNIT-I **[08]**
Spur and Helical Gears
Introduction, Classification of Gears, terminology, Selection of types of gears, Gear materials selection, law of gearing, Standard system of gear tooth, force analysis of spur gear, tooth failure, beam strength equation, design of spur gear, check for dynamic-static and wear loading condition, Equivalent no. of

teeth, Design of helical gear with checking for dynamic-static and wear loading condition

UNIT-II **[08]**

Bevel Gear & Worm Gear

Introduction, Classification, terminology, formative no. of teeth, Beam strength of bevel gears, Design of bevel gear, Design of worm gear, efficiency, force analysis of worm gear, thermal consideration worm gear

Design of Gearbox

Geometric progression – Standard step ratio – Ray diagram, kinematics layout - Design of sliding mesh gear box

UNIT-III **[08]**

Sliding contact bearing

Introduction, Classification, Properties of bearing material, lubrication – types of lubrication, lubricants -properties, selection. Hydrostatic bearings, petroff's equation, hydrostatic footstep bearing, Terms used in hydrodynamic bearing, hydrodynamic lubrication-Reynold's equation, Bearing characteristics number, Journal bearing.

Rolling contact bearing

Selection, types, stribeck's equation, Static & dynamic load rating, bearing life, selection of bearing from manual catalog, bearing designation, failure of rolling contact bearing.

UNIT-IV **[06]**

Internal Combustion Engine Components

Introduction, Design of principal parts – cylinder, cylinder head, piston, connecting rod, crank, valve gear mechanism, flywheel.

Method of delivery

(Chalk & Talk, PPT, Active Learning Techniques with solving Assignment)

Study time

2 hours for Lectures per week
2 hours for Practical per week

CO-PO Mapping

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering 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.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	3	1	-	-	-	-	-	-	-	-	-
CO2	-	2	3	2	1	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	-
CO4	1	2	1	2	1	-	-	-	-	-	-	1
CO5	1	2	2	2	1	-	-	-	-	-	-	1

Blooms Taxonomy and Knowledge retention

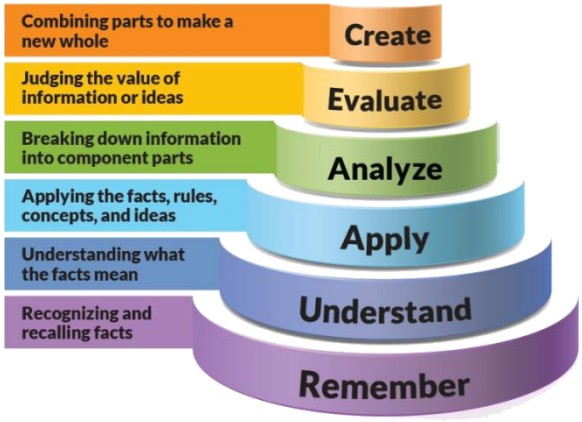

Figure 1: Blooms Taxonomy

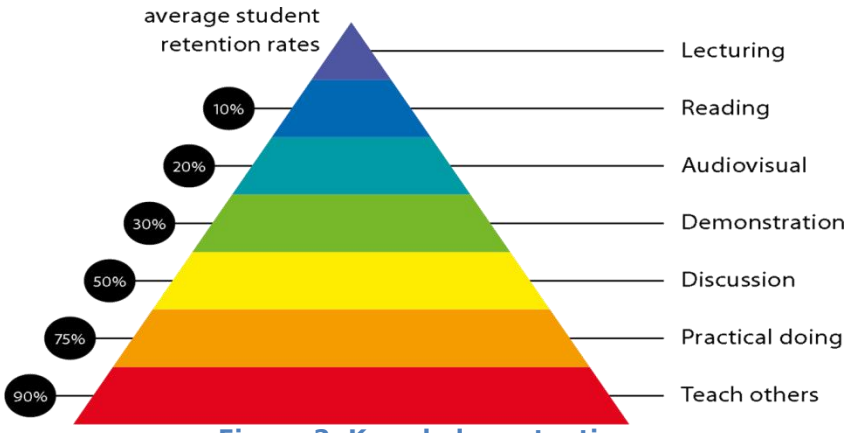

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**

Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

1. Drawing of Spur Gear assembly.
2. Drawing of Worm and worm gear assembly.
3. Drawing of Gearbox with Ray diagram
4. Drawing of assembly of IC engine components in AutoCAD.

Lecture/tutorial times:(As per Time Table)

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for semester examinations.

Text books

1) Machine Design, Dr. P. C. Sharma, Dr. D. K. Aggarwal, Kataria Publication, New Delhi, Twelfth Edition ,2015.
2) Design of Machine Elements, V. B. Bhandari, McGraw Hill Publishing Co.
3) Machine Design, Farazdak Haideri, Nirali Prakashan.

Reference Books

1) Machine Design by Robert L Nortan, Pearson Education
2) Mechanical engineering design by Joseph shigley, McGraw Hill Publishing Co.
3) Fundamentals of Machine component design by Juvinall & Marshek, Wiley India
4) Machine Design by Dr. S.S. Wadhwa, Dhanpatrai & Co.
5) Material Handling Equipement by Rudenko, MIR publishers, Moscow.
6) PSG design data book, DPV printers, Coimbatore.

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

1) Theory Assessment:

(a) **Continuous Internal Evaluation (CIE) - Theory - 60 Marks Bifurcation:**

Marks	Bifurcation
40 Marks	MSE
10 Marks	Assignments
10 Marks	Attendance/Class Participation

(b) **ESE Theory 40 marks.**

2) Practical Assessment:

a) **Continuous Internal Evaluation (CIE) - Practical-60 Marks bifurcation:**

Marks	Bifurcation
20 Marks	Active Participation
20 Marks	File work
20 Marks	Lab Work

b) **ESE Practical 40 marks.**

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in internal component or less than 40% in the end semester will be considered for supplementary assessment in the respective components (i.e internal component or end semester) of semester concerned. Students must make they available during the supplementary examination period to take up the respective components (internal component or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

Course schedule

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	**Spur Gear & Helical Gear** Introduction, Classification of Gears, terminology, Selection of types of gears, Gear materials selection, law of gearing,	1,2	Chalk & Talk, Tutorial
	Weeks 2	Standard system of gear tooth, force analysis of spur gear, tooth failure, beam strength equation,	1,2	Chalk & Talk, Tutorial
	Week 3	design of spur gear, check for dynamic-static and wear loading condition, Equivalent no. of teeth,	1,2	Chalk & Talk, Tutorial
	Week 4	Design of helical gear with checking for dynamic-static and wear loading condition.	1,2	Chalk & Talk, Tutorial
	Week 5	**Bevel Gear & Worm Gear** Introduction, Classification, terminology, formative no. of teeth,	1,2	Chalk & Talk, Tutorial
	Week 6	Beam strength of bevel gears Design of bevel gear	1,2	Chalk & Talk, Tutorial
	Week 7	Design of worm gear, efficiency,force analysis of worm gear, thermal consideration worm gear	1,2	Chalk & Talk, Tutorial
	Week 8	**Design of Gearbox** Geometric progression – Standard step ratio – Ray diagram, kinematics layout -Design of sliding mesh gear box	3	Chalk & Talk, Tutorial
	Week 9	**Sliding contact bearing** Introduction,Classification, Properties of bearing material, types of lubrication, lubricants,properties,Hydrostatic bearings,	*4*	Chalk & Talk, Tutorial
	Week 10	petroff's equation, hydrostatic footstep bearing, Terms used in hydrodynamic bearing, hydrodynamic lubrication-Reynold's equation, Bearing characteristics number, Journal bearing.	4	Chalk & Talk, Tutorial

	Week 11	**Rolling contact bearing** Selection, types, stribeck's equation, Static & dynamic load rating, bearing life,	4	Chalk & Talk, Tutorial
	Week 12	selection of bearing from manual catalog, bearing designation, failure of rolling contact bearing	*4*	Chalk & Talk, Tutorial
	Week 13	**Internal Combustion Engine Components** Introduction, Design of principal parts – cylinder	5	Chalk & Talk, Tutorial
	Week 14	cylinder head, piston, connecting rod, crank,	5	Chalk & Talk, Tutorial
	Week 15	valve gear mechanism, flywheel.	5	Chalk & Talk, Tutorial