Bachelor of Technology (Mechanical Engineering)Kurukshetra University, Kurukshetra

*SCHEME OF STUDIES/EXAMINATIONS**(w.e.f. 2015-16 onwards)***

Semester – VI

S. No.	Course No.	Course Title	Teaching Schedule				Allotment of Marks				Duration of Exam (Hrs.)
			L	T	P	Hours/Week	Theory	Sessional	Practical	Total	
1	ME-302N	Refrigeration and Air Conditioning	3	1	0	4	75	25	0	100	3
2	ME-304N	Tribology & Mechanical Vibration	3	1	0	4	75	25	0	100	3
3	ME-306N	Operation Research	3	1	0	4	75	25	0	100	3
4	CSE-[illegible]	Essentials of IT	3	1	0	4	75	25	0	100	3
5	ME-308N	Computer Aided Design and [illegible]	4	0	0	4	75	25	0	100	3
6	ME-310N	Machine Design-II	2	4	0	6	75	25	0	100	4
7	ME-312N	Refrigeration and Air Conditioning [illegible]	0	0	2	2	0	40	60	100	3
8	ME-314N	Tribology & Mechanical Vibration Lab	0	0	2	2	0	40	60	100	3
9	ME-316N	Computer Aided Design and Manufacturing Lab	0	0	2	2	0	40	60	100	3
		Total	**18**	**8**	**6**	**32**	**450**	**270**	**180**	**900**	

Note:*All the students have to undergo six weeks industrial training after VIth semester and it will be evaluated in VIIth semester*

B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-302N	**REFRIGERATION AND AIR-CONDITIONING**	3	1	0	75	25	100	3
Purpose	The objective of this course is to make the students aware of refrigeration, Air-conditioning, various methods of refrigeration. The course will help the students to build the fundamental concepts in order to solve engineering problems and to design HVAC applications.							
Course Outcomes								
CO 1	Understanding of different refrigeration processes like ice refrigeration, evaporative refrigeration, refrigeration by expansion of air, steam jet refrigeration systems etc.							
CO 2	Identify, formulate and solve air refrigeration, vapour refrigeration and vapour absorption refrigeration problems.							
CO 3	Identify and understand refrigerants and their uses as per their properties and environmental effects etc.							
CO 4	Knowledge of psychometric properties, psychometric chart and its use for different cooling and heating processes along with humidification and dehumidification.							
CO 5	Design of various air-conditioning systems by including the internal and external heat gain.							

(a) REFRIGERATION

UNIT I

Basics of heat pump & refrigerator; Carnot's refrigeration and heat pump; Units of refrigeration; COP of refrigerator and heat pump; Carnot's COP; ICE refrigeration; evaporative refrigeration; refrigeration by expansion of air; refrigeration by throttling of gas; Vapour refrigeration system; steam jet refrigeration; thermoelectric cooling; adiabatic demagnetization.

Basic principles of operation of air refrigeration system, Bell-Coleman air refrigerator; advantages of using air-refrigeration in aircrafts; disadvantages of air refrigeration in comparison to other cold producing methods; simple air refrigeration in air craft; simple evaporative type air refrigeration in aircraft; necessity of cooling the aircraft.

UNIT II

Simple Vapour Compression Refrigeration System; different compression processes(wet compression, dry or dry and saturated compression, superheated compression); Limitations of vapour compression refrigeration system if used on reverse Carnot cycle; representation of theoretical and actual cycle on T-S and P-H charts; effects of operating conditions on the performance of the system; advantages of vapour compression system over air refrigeration system.

Methods of improving COP; flash chamber; flash inter cooler; optimum interstate pressure for two stage refrigeration system; single expansion and multi expansion processes; basic introduction of single load and multi load systems; Cascade systems.

Basic absorption system; COP and Maximum COP of the absorption system; actual NH_3 absorption system; functions of various components; Li-Br absorption system; selection of refrigerant and absorbent pair in vapour absorption system; Electro refrigerator; Comparison of Compression and Absorption refrigeration systems; nomenclature of refrigerants; desirable properties of refrigerants; cold storage and ice-plants.

(b) AIR-CONDITIONING

UNIT III

Difference in refrigeration and air conditioning; Psychometric properties of moist air (wet bulb, dry bulb, dew point temperature, relative and specific humidity of moist air, temperature of adiabatic saturation); empirical relation to calculate P_v in moist air.

Psychometric chart, construction and use, mixing of two air streams; sensible heating and cooling; latent heating and cooling; humidification and dehumidification; cooling with dehumidification; cooling with adiabatic humidification; heating and humidification; by-pass factor of coil; sensible heat factor; ADP of cooing coil; Air washer.

UNIT IV

Classification; factors affecting air conditioning systems; comfort air-conditioning system; winter air conditioning system; summer air- conditioning system; year round air conditioning. unitary air-conditioning system; central air conditioning system; room sensible heat factor; Grand sensible heat factor; effective room sensible heat factor.

Inside design conditions; comfort conditions; components of cooling loads; internal heat gains from (occupancy, lighting, appliances, product and processes); system heat gain (supply air duct, A.C. fan, return air duct); external heat gain (heat gain through building, solar heat gains through outside walls and roofs); solar air temperature; solar heat gain through glass areas; heat gain due to ventilation and infiltration.

Transport air conditioning; evaporative condensers, cooling towers; heat pumps.

Text books

1. Basic Refrigeration and air-conditioning by Annanthana and Rayanan, TMG
2. Refrigeration and air-conditioning by R.C.Arora, PHI

References books

1. Refrigeration and air-conditioning by C.P arora
2. Refrigeration and air-conditioning by Arora and Domkundwar, Dhanpat rai

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

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Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-304N	**Tribology & Mechanical Vibration**	3	1	0	75	25	100	3
Purpose:	To understand the vibration systems with different degrees of freedom in different modes and conditions and the basics of tribology.							
Course Outcomes								
CO 1	To understand the fundamentals of vibrations and study the systems in single D.O.F. under free and damped vibrations.							
CO 2	To study and analyze the different types of forced vibration system in single D.O.F.							
CO 3	To understand the concept of principle modes of vibrations using different methods and study lateral, longitudinal and torsional vibration in case of beams, bars and shafts respectively.							
CO 4	To understand the fundamentals of tribology of lubrication, friction and wear.							

UNIT I

Fundamentals of Vibration: Elements of a vibratory system, S.H.M., degrees of freedom, Types of vibrations, Work done by a harmonic force, Beats. **Undamped free vibrations:** Natural frequency by equilibrium and energy methods, equivalent spring, linear and torsional systems, compound pendulum, Bifilar and Trifilar suspensions.

Damped free vibrations: Different types of damping, differential equations of damped free vibrations, initial conditions, logarithmic decrement, vibrational energy and logarithmic decrement.

UNIT II

Single Degree of Freedom Systems- Forced Vibrations: Sources of excitation**,** equations of motion with harmonic force, response of rotating and reciprocating unbalanced system, Support motion,Vibration Isolation, Force and Motion transmissibility.

Forced vibrations with coloumb damping, structural damping and viscous dampings.

UNIT III

Multi-degree of freedom systems: Principle modes of vibrations, Influence co-efficient, Matrix method, orthogonality principle, Dunkerleys equation, Matrix iteration method, Holzer Method, Rayleigh Method and Rayleigh-Ritz methods, Stodola method, Hamilton principle.

Continuous systems: Transverse vibrations of strings, Longitudinal Vibrations of bars, Lateral vibration of beams, Torsional vibration of circular shafts.

UNIT IV

Introduction to Tribology, Tribology in design, Tribology in industry, economic aspects of Tribology,

Lubrication: Basic modes of lubrication, lubricants, properties of lubricants - physical and chemical, types of additives, extreme pressure lubricants, recycling of used oils and oil conservation, disposal of scrap oil, oil emulsion.

Friction and Wear: Introduction, laws of friction, kinds of friction, causes of friction, friction measurement, theories of friction, effect of surface preparation. Introduction to Wear, Types of wear, various factors affecting wear, measurement of wear, wear between solids and liquids, theories of wear.

Text Books:

1. Grover G. K. “Mechanical Vibrations”, Nem Chand and Bros.,Roorkee
2. Meirovitch, “Elements of Mechanical Vibrations”, McGraw Hill

3. J.S.Rao and K.Gupta, 'Introductory course on theory and practice of Mechanical Vibration, New Age International.
4. Friction and wear of Materials- By E. Robinowicz, Johan Wiley
5. Tribology an Introduction - By Sushil Kumar Srivastava
6. B. C. Majumdar, "Introduction to Tribology and Bearings", S.Chand and Company Ltd. New Delhi.

Reference Books:

1. Rao S. S. "Mechanical Vibrations", Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. New Delhi.
2. V.P. Singh, "Mechanical Vibrations", Dhanpat Rai & Co. Pvt. Ltd., Delhi
3. Prashant Sahoo, ''Engineering Tribology'', PHI publications.
4. Halling J., "Principles of Tribology", McMillan Press Ltd.

NOTE: In the semester examination, the examiner will set 8 questions in all, at least one question from each unit, and students will be required to attempt only 5 questions.

B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-306N	**OPERATION RESEARCH**	3	1	0	75	25	100	3
Purpose	To make the students aware of various optimization techniques used for solving engineering problems.							
Course Outcomes								
CO1	To study necessity, applications, scope related to industry. To make the students aware of linear programming and its graphical representation.							
CO 2	To minimize the transportation cost using transportation models. To discuss and understand the network analysis representations.							
CO 3	To understand simulation. Its applications, merits and demerits. Furthermore, waiting line theory and decision theory are also helpful to solve various engineering problems.							
CO 4	Solve the problems related to Queuing theory and game theory.							

UNIT 1

Introduction: Definition and Development of Operations Research, Necessity and scope of OR in Industry, Operations Research in Decision making, Models in OR, Fields of application, Difficulties and Limitation of OR.

General Linear Programming Problems: Introduction, Maximization and minimization of function with or without Constraints, Formulation of a linear programming problem, Graphical method and Simplex method, Big M method, Degeneracy, Application of linear Programming (LPP) in Mechanical Engineering.

UNIT 2

The Transportation Problems: Mathematical formulation, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of degeneracy, Assignment problems, Least time transportation problem

Network Analysis: CPM/PERT, Network Representation, Techniques for drawing network, Numbering of events (Fulkersen Rule), PERT calculations - Forward path, back-ward path, Slack, probability, comparison with PERT, Critical path, Float, Project cost, Crashing the net work, updating (PERT and CPM).

UNIT 3

Simulation: Basic concept of simulation, Applications of simulation, Merits and demerits of simulation, Monte Carlo simulation, Simulation of Inventory system, Simulation of Queuing system.

Waiting Line Theory: Basic queuing process, Basic structure of queuing models, some commonly known queuing situations, Kendall's notation, Solution to M/M/1: ∞ /FCFS models.

Decision Theory: Steps in decision theory approach, Decision Machinery environment, Decision machining under certainty and uncertainty, Decision machining under condition of risk, Decision trees, Minimum enchained criteria, Advantages and limitations of decision tree solutions, Post Optimality.

Unit 4

Queuing Theory: Introduction, Applications of queuing Theory, Waiting time and idle time costs, Single channel queuing theory and multi-channel queuing theory with Poisson arrivals and exponential services, Numerical on single channel and multi channel queuing theory.
Game Theory: Theory of games, competitive games, Rules and Terminology in game Theory, Rules for game theory- saddle point, dominance, Mixed strategy (2 x2 games) , Mixed strategy (2 x n games or m x 2 games), Mixed strategy (3 x3 games),Two person zero sum games, N-person zero sum games.

Text books

1. Operations Research by Prem Kumar Gupta and D. S. Heera, S. Chand Publications
2. Introduction to Operations Research, by F.S. Hillier and G.J. Lieberman, seventh edition, McGraw Hill publications

Reference Books:

1. Introduction to Mathematical Programming by Winston, W.L. (4th ed.), Duxbury Press.
2. Operations Research by P Sankara Iyer, Mc Graw Hill publications.

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For Mechanical Engg, Electronics Engg and Bio Tech Engg students only

B. Tech. 6th Semester Mechanical Engineering								
Course No.	Course Title	Teaching Schedule			Allotment of Marks			Duration of Exam (Hrs.)
		L	T	P	Theory	Sessional	Total	
CSE-209N	ESSENTIALS OF IT	3	1	0	75	25	100	3
Purpose	To introduce the concepts of Object Oriented Programming using Java and RDBMS							
COURSE OUTCOMES								
CO-1	Solve Problems using various efficient and reliable Algorithms							
CO-2	Design and Study the basic concepts in Java							
CO-3	Document and implement Object oriented paradigms and design models in Java							
CO-4	Design and study RDBMS Modeling and its program implementation							

UNIT I

Problem Solving Techniques: Introduction to Problem Solving, Introduction to Algorithms and Flowchart, Searching algorithms: Linear search, Binary search and Sorting algorithms: Insertion and Selection sort, Basic Data Structures: Stack, and Linear Queue.

UNIT II

Programming Basics: Identifiers, Variables, Data Types, Operators, Control Structures: Loop, If else, Nested If, Switch Statement, Arrays, Strings, Object Oriented Concepts: Class & Object, Operator, Instance Variables & Methods, Access Specifiers, Reference Variables: This, Super, Parameter Passing Techniques, Constructors, Static, and Command Line Arguments.

UNIT III

Relationships: Inheritance, Types of Inheritance, Static Polymorphism: Method Overloading, Constructor Overloading, Method Overriding, Abstract, Interface, Introduction to Packages.

UNIT IV

RDBMS: Data Processing, Database Technology, Data Models, Data Independence, ER Modeling Concept, ER-notations, Converting ER Diagram into Relational Schema, Definition of Keys: Primary key, Foreign key, UniqueKey.

SQL: DDL Statements, DML Statements, DCL Statements, Joins, Sub queries, Views.

Books on Java

1. Java: The Complete Reference, Seventh Edition. Herbert Schildt, McGraw-Hill Education. Programming with Java 3e A Primer, E Balagurusamy, McGraw Hill Education.
2. Introduction to Java Programming, K. Somasundaram , Jaico Publishing House; 1st edition

Books on RDBMS, Oracle, MYSQL

1. Fundamentals of Database Systems, with E-book (3rd Edition) by Shamkant B.Navathe, Ramez Elmasri, Published by Addison Wesley Longman , January 15th, 2002
2. MySQL by Paul DuBois Published by New Riders.
3. Murach's MySQL Paperback, Joel Murach , Published by Shroff/Murach, 2012.
4. SQL: The Complete Reference , James R. Groff, Paul N. Weinberg, Published by McGraw-Hill Companies, March 1999.

5. Schaum's Outline of Fundamentals of Relational Databases, Ramon Mata-Toledo, Published by McGraw-Hill, 2000.

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		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-308N	**COMPUTER AIDED DESIGN AND MANUFACTURING**	4	0	0	75	25	100	3
Purpose	The subject empowers the students to know about the extreme function of computer in designing, manufacturing as well as in the business scenario.							
Course Outcomes								
CO1	Student gets aware about the introduction of CAD/CAM, and CIM. This unit explains the history and application CAD/CAM.							
CO 2	Student gets aware about the Modeling of different types of curves, surface and solid. The modeling is used for further analysis.							
CO 3	To know about the transformation of points and lines in computer aided software. Group technology is used for utilization machines.							
CO 4	Student knows the usages of the numerical control machines and its code. How computer is useful in making the process planning.							

UNIT-I

Introduction to CAD/CAM, Historical Development, Industrial look at CAD/CAM Application of CA/CAM, Display devices, Input/ Output Devices, CPU.
Introduction to CIM, Definition, Nature of Elements of CIM, CIM Wheel,
Introduction to computer aided quality control, Contact and Non Conduct Inspection Method.

UNIT-II

Wireframe modeling, Representation of curves, Parametric and non-parametric curves, straight lines, Hermite cubic splines, B splines curves.
Plane surface, ruled surface, surface of revolution, bi-cubic surface, Bezier surface, B spline surface, Solid modeling, boundary representation, sweeping, parametric solid modeling.
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UNIT-III

Introduction, Transformation of points & line, 2-D translation, rotation, Reflection, Scaling, shearing and combined transformation, Homogeneous coordinates, Orthographic and perspective Projections.
Group technology, Part families, Part classification and coding, Optiz method, product flow analysis, Machine cell Design, Advantages of GT

UNIT-IV

Numerical control, Types of NC systems, MCU & other components, Co-ordinate system, NC manual part programming, G & M codes, part program for simple parts, Computer assisted part programming.
Introduction, FMS component, Types of FMS, FMS layout, planning for FMS, advantage and applications

Introduction, conventional process planning, Steps in variant process planning, types of CAPP, planning for CAPP

Text books:

1. **Chris McMahon and Jimmie Browne**, CAD/CAM – Principle Practice and Manufacturing Management, Addison Wesley England, Second Edition, 2000.
2. **Rogers, D.F. and Adams, A**., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989
3. **Ibrahim Zeid**, CAD/CAM theory and Practice, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1992.
4. **M.P. Groover**, Automation, Productions systems and Computer-Integrated Manufacturing by Prentice – Hall

Reference Books:

1. **Ibrahim Zeid**, Mastering CAD/CAM, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. **P. Radhakrishnan, S. Subramanayan and V.Raju**, CAD/CAM/CIM, New Age International (P) Ltd., New Delhi.
3. **Groover M.P. and Zimmers E. W.**, CAD/CAM: Computer Aided Design and Manufacturing, Prentice Hall International, New Delhi, 1992.
4. **Dr. Sadhu Singh**, Computer Aided Design and Manufacturing, Khanna Publishers, New Delhi, Second Edition, 2000.
5. **Chang, Wang &Wysk** Computer Aided Manufacturing. Prentice Hall
6. **Kundra** &**Rao**, Numerical Control and Computer Aided Manufacturing by, Rao and Tiwari, Tata Mc-Graw Hill.
7. **Mattson**, CNC programming Principles and applications, Cengage Learning India Pvt. Ltd. Delhi

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Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Theory**	**Sessional**	**Total**	
ME-310N	**MACHINE DESIGN-II**	2	4	0	75	25	100	4
Purpose	To deal effectively with engineering problems associated with an individual machine component.							
Course Outcomes								
CO 1	To analyze the force components acting on the gears and solve design problems of different types of gears.							
CO 2	To solve design problems of belts, chains, pulleys and friction clutches and brakes.							
CO 3	To make selection of bearings from manufacturer's catalogue and solve spring design problems.							
CO 4	To design and solve the problems of IC engine components and flywheels.							

UNIT-I

Gear Drives: Classification of gears, selection of type of gears, law of gearing, standard systems of gear tooth, interference and undercutting, backlash, **Spur Gears:** geometry and nomenclature, force analysis, material selection, beam strength of gear tooth, effective load on gear tooth, module estimation based on beam strength, wear strength of gear tooth, module estimation based on wear strength, spur gear design procedure. **Helical Gears:** geometry and nomenclature, force analysis, beam strength of helical gears, effective load on gear tooth, wear strength of helical gears, design procedure. **Bevel Gears:** geometry and nomenclature, force analysis, beam strength of bevel gears, effective load on gear tooth, wear strength of bevel gears, design procedure. **Worm Gears:** terminology, force analysis, friction in worm gears, material selection, strength rating and wear rating, thermal considerations and design procedure.

UNIT-II

Flat Belt Drives and Pulleys: Introduction, Selection of flat belts from manufacturer's catalogue, Pulleys for flat belts. **V-Belts and Pulley:** selection of V-Belts and V-grooved pulley. **Chain Drives:** roller chains, geometric relationships, polygonal effect, power rating, sprocket wheels, design of chain drives, chain lubrication.

Clutches: Various types of clutches in use, design of friction clutches-single disc, multidisc, cone & centrifugal, torque transmitting capacity, friction materials, thermal considerations. **Brakes:** Various types of brakes, self-energizing condition of brakes, design of shoe brakes – internal & external expanding, band brakes, thermal considerations in brake designing.

UNIT-III

Springs: Types of springs, design for helical springs against tension and their uses, compression and fluctuating loads, design of leaf springs, surging in springs.

Bearings: Classification, selection of bearing type, static and dynamic load carrying capacity, equivalent bearing load, load-life relationship, selection of bearings from manufacturer's catalogue, selection of taper roller bearing, design for cyclic loads and speeds, bearing failure-causes and analysis. **Sliding Contact Bearings:** design of journal bearings using Raimondi and Boyd's Charts.

UNIT IV

I.C. Engine Components: Design of cylinder, design of studs for cylinder head, design of piston, design of crank shaft, design of connecting rod.

Flywheel: Flywheel materials, torque analysis, coefficient of fluctuation of energy, design of solid disc and rimmed flywheel.

Text books:

1. Mechanical Engineering Design, Joseph E. Shigley and Charles R. Mischke, Tata McGraw Hill Book Co.

2. Design of Machine Element,V. B. Bhandari, Mc Graw Hill Edu. Pvt. Ltd.
3. Machine Component Design, Robert C. Juvinall and Kurt M. Marshek, Wiley India Pvt. Ltd.
4. Mechanical Design of Machine Elements and Machines, Collins and Busby, Wiley India Pvt. Ltd.

References books:

1. Machine Design by Sharma and Aggarwal
2. Machine Design-an integrated Approach, Robert L. Norton, Addison Wisley Longman
3. PSG Design Data Book by PSG college of Engineering, PSG Publication.
4. Design Data Handbook for Mechanical Engineers by K. Mahadevan and K. Balaveera Reddy.

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B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-312N	**Refrigeration and Air Conditioning Lab**	0	0	2	40	60	100	3
Purpose	To make students understand about the applications of refrigeration and Air-conditioning.							
Course Outcomes:								
CO1	To understand about the basics and working principle of water cooler.							
CO2	Identify the different cycle of operation in air-conditioning							
CO3	To analyze the humidity measurement and its importance in air-conditioning							
CO4	To learn about the various control devices and parts of refrigeration and air-conditioning systems							

List of Experiments

1. To study and perform experiment on basic vapour compression Refrigeration Cycle.
2. To study and perform experiment on Solar Air-conditioner based on vapour absorption cycle.
3. To find COP of water cooler.
4. To study and perform experiments on compound compression and multi-load systems.
5. To study and perform experiment on vapour absorption apparatus.
6. Perform the experiment & calculate various performance parameters on a blower apparatus.
7. To find the performance parameter of cooling tower.
8. To study various components in room air conditioner.
9. To find RH of atmospheric air by using Sling Psychrometer.
10. To find performance of a refrigeration test rig system by using different expansion devices.
11. To study different control devices of a refrigeration system.
12. To find the performance parameters of Ice Plant.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

B. Tech. 6th Semester Mechanical Engineering								
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		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-314N	**TRIBOLOGY & MECHANICAL VIBRATION LAB**	0	0	2	40	60	100	3
Purpose:	To make the students understand about the tribological properties of specimen and principles of vibration.							
Course outcomes:								
CO 1	To understand the concept of sliding and abrasive wear using wear and friction monitoring apparatus and dry abrasion tester.							
CO 2	To measure the extreme pressure properties of a lubricant using four ball tester.							
CO 3	To study the concept of free and forced vibration for a spring mass system and determine the natural frequency.							

LIST OF EXPERIMENTS:

1. To study undamped free vibrations of equivalent spring mass system and determine the natural frequency.
2. To study the free vibration of system for different damper settings. Draw decay curve and determine the log decrement and damping factor. Find also the natural frequency.
3. To study the torsional vibration of a single rotor shaft system and determine the natural frequency.
4. To determine the radius of gyration of given bar using bifilar suspension.
5. To verify the dunker ley's rule.
6. To study the forced vibration of system with damping. Load magnification factor vs. Frequency and phase angle vs frequency curves. Also determine the damping factor.
7. To determine the two frequencies of torsional spring type double pendulum & compare them with theoretical values.
8. To determine the radius of gyration of a compound pendulum.
9. To determine the radius of gyration of disc using trifilar suspension.
10. To determine the wear rate, friction force and coefficient of friction of a metallic pin/ball by using wear and friction monitor apparatus.
11. To determine abrasion index of a material with the help of dry abrasion test rig.
12. To evaluate the wear and extreme pressure properties of a lubricating oil by using four ball tester.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.

B. Tech. 6th Semester Mechanical Engineering								
Course No.	**Course Title**	**Teaching Schedule**			**Allotment of Marks**			**Duration of Exam (Hrs.)**
		L	**T**	**P**	**Sessional**	**Practical**	**Total**	
ME-316N	**COMPUTER AIDED DESIGN AND MANUFACTURING LAB**	0	0	2	40	60	100	3
Purpose	The lab empowers the students to know about the computer aided manufacturing by using CAD							
Course Outcomes								
CO1	Student gets aware about the 2D drawing and modelling.							
CO 2	Student knows how to use 3D software in part designing.							
CO 3	To know about the assembly and aware about the G codes and M codes.							
CO 4	Students will aware about the NC part programming and OPTIZE method.							

List of experiments:

1 To study the 2 dimensional drawing, orthographic views, front view, top view and side view.
2 To study the wireframe, surface and solid modelling.
3 Draw the part drawing of product 1 using any 3D software.
4 Draw the part drawing of product 2 using any 3D software.
5 Make assembly by using any 3D software.
6 To study the G codes and M codes.
7 Write a NC program for milling operation.
8 Write a NC program for drilling operation.
9 Write a NC program for turning operation.
10 To study the optiz method.

Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory. Product 1 and Product 2 must be based on ME 308N.