Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

(Effective from academic session 2018-19)

Semester-V

Subject Code : PC-ME501	**Category:** Professional Core Courses
Subject Name : Heat Transfer	**Semester** : Fifth
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites: Engineering Thermodynamics	

Course Objectives:

1. The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
2. Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
3. The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.	14
2	Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	10
3	Interaction of radiation with materials, definitions of radioactive properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.	9
4	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and ε - NTU methods.	7
5	Boiling and Condensation heat transfer, Pool boiling curve.	4

6	Introduction to mass transfer, Similarity between heat and mass transfer.	4

Course Outcomes:

1. After completing the course, the students will be able to formulate and analyze a heat transfer problem involving any of the three modes of heat transfer
2. The students will be able to obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer
3. The students will be able to design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.

Learning Resources:

1. A. Bejan, Heat Transfer, John Wiley, 1993
2. J.P. Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3. F.P. Incropera and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, 6 th Edition, John Wiley, 2007.
4. M. Kaviany, Principles of Heat Transfer, John Wiley, 2002
5. Y.A. Cengel, Heat Transfer: A Practical Approach, McGraw Hill, 2002

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Subject Code : PC-ME502	**Category:** Professional Core Courses
Subject Name : Solid Mechanics	**Semester** : Fifth
L-T-P : 3-1-0	**Credit: 4**
Pre-Requisites: Engineering Mechanics	

Course Objectives:

The objective is to present the mathematical and physical principles in understanding the linear continuum behaviour of solids.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to Cartesian tensors, Strains: Concept of strain, derivation of small strain tensor and compatibility, Stress: Derivation of Cauchy relations and equilibrium and symmetry equations, principal stresses and directions	12
2	Constitutive equations: Generalized Hooke's law, Linear elasticity, Material symmetry; Boundary Value Problems: concepts of uniqueness and superposition.	10
3	Plane stress and plane strain problems, introduction to governing equations in cylindrical and spherical coordinates, axisymmetric problems.	10
4	Application to thick cylinders, rotating discs, torsion of non-circular cross-sections, stress concentration problems, thermo-elasticity, 2-D contact problems.	9
5	Solutions using potentials. Energy methods. Introduction to plasticity.	7

Course Outcomes:

Upon completion of this course, students will be able understand the deformation behavior of solids under different types of loading and obtain mathematical solutions for simple geometries.

Learning Resources:

1. G.T. Mase, R.E. Smelser and G.E. Mase, Continuum Mechanics for Engineers, 3rd Edition, CRC Press, 2004.
2. Y.C. Fung, Foundations of Solid Mechanics, Prentice Hall International, 1965.
3. L.E. Malvern, Introduction to Mechanics of a Continuous Medium, Prentice Hall International, 1969.

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Subject Code : PC-ME 503	**Category:** Professional Core Courses
Subject Name : Kinematics and Theory of Machines	**Semester** : Fifth
L-T-P : 3-1-0	**Credit: 4**
Pre-Requisites: Engineering Mechanics	

Course Objectives:

1. To understand the kinematics and rigid- body dynamics of kinematically driven machine components
2. To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link
3. To be able to design some linkage mechanisms and cam systems to generate specified output motion
4. To understand the kinematics of gear trains

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains. Limit positions- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms**.**	6
2	Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coincident points- Corioli's component of acceleration- introduction to linkage synthesis- three position graphical synthesis for motion and path generation**.**	7
3	Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers.	5
4	Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion	6

	gears, epicyclic and regular gear train kinematics**.**	
5	Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication, Friction clutches- Belt and Rope drives- Friction in brakes.	6
6	Vibrations– Free and forced vibration of undamped and damped Single DOF systems, Resonance, Transmissibility Ratio, Effect of damping, Vibration Isolation, Critical Speed of Shafts.	6
7	Balancing of Reciprocating and Rotating Masses- Static balancing, Unbalance of force or moment, Dynamic balancing of rotating masses- graphical and analytical methods; Swaying couple; Hammer blow.	4
8	Governors- Use and classification; Study and analysis of Porter, Proell and Wilson-Hartnell governors; Sensitiveness, stability, isochronism, hunting, effort and power of governors.	3
9	Flywheel- Inertia force and inertia torque in reciprocating engine, correction couple (torque), Turning moment diagram and flywheel design.	3
10	Gyroscope- Gyroscopic couple and precessional motion, Effect of gyroscopic couple on aeroplane and ship, Stability of two wheel and four wheel vehicles taking turn.	2

Course Outcomes:
After completing this course, the students can design various types of linkage mechanisms for obtaining specific motion and analyze them for optimal functioning

Learning Resources:

1. T. Bevan, Theory of Machines, 3rd Edition, CBS Publishers & Distributors, 2005.
2. A. Shariff, Theory of Machines, Dhanpat Rai Publication, New Delhi, 2000.
3. W.L. Cleghorn, Mechanisms of Machines, Oxford University Press, 2005.
4. R.L. Norton, Kinematics and Dynamics of Machinery, 1st Edition, McGraw Hill India, 2010.
5. A. Ghosh and A.K. Mallick, Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd., New Delhi, 1988.

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SYLLABUS FOR BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

(Effective from academic session 2018-19)

Subject Code : HM-HU501	**Category:** Humanities and Social Sciences
Subject Name : Humanities I (Effective Technical Communication)	**Semester** : Fifth
L-T-P : 3-0-0	**Credit: 3**
Pre-Requisites: Basic English	

Course Objectives:

The course aims to teach students the principles of technical communication for their academic and professional needs, focusing on essential written and oral skills for presenting technical information effectively.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.	7
2	Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	8
3	Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity	6
4	Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	8
5	Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.	7

Course Outcomes:

After completing this course, the students will be able to

1. Understand the dynamics of Verbal and Non Verbal aspects of technical communication
2. Practice multi-step writing process to plan, draft, and revise reports, correspondence, and presentations.
3. Illustrate and examine the knowledge of ethical aspects of engineering
4. Demonstrate and explain social and professional etiquettes
5. Plan self-development and practice self-assessment to function on multi-disciplinary teams.

Learning Resources:

1. D.F. Beer and D. McMurrey, Guide to Writing as an Engineer, John Willey, New York, 2004
2. D. Hacker, Pocket Style Manual, Bedford Publication, New York, 2003.
3. S. Khera, You Can Win, Macmillan Books, New York, 2003.
4. R. Sharma, Technical Communications, Oxford Publication, London, 2004.
5. D. Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004.
6. R. Sharma and K. Mohan, Business Correspondence and Report Writing, 5th Edition, McGraw Hill Education, 2017.
7. Xebec, Presentation Book, McGraw Hill Education India, New Delhi, 2000.

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SYLLABUS FOR BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

(Effective from academic session 2018-19)

Subject Code : MC ME501	**Category:** Mandatory Courses
Subject Name : Essence of Indian Knowledge Tradition	**Semester** : Fifth
L-T-P : 0-2-0	**Credit: 0**
Pre-Requisites: Nil	

Course Objectives:

To facilitate students with the concepts of Indian traditional knowledge and to make them understand the importance of the root of knowledge system.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge	5
2	Protection of traditional knowledge (TK): the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	4
3	Legal frame work and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.	5
4	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.	5

5	Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.	5

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the concept of Traditional knowledge and its importance
2. Know the need and importance of protecting traditional knowledge.
3. Know the various enactments related to the protection of traditional knowledge.
4. Understand the concepts of Intellectual property to protect the traditional knowledge.

Learning Resources:

1. A. Jha, Traditional Knowledge System in India, 2009.
2. B.K. Mohanta and V.K. Singh, Traditional Knowledge System and Technology in India, Pratibha Prakashan, 2012.
3. K. Kapoor and M. Danino, Knowledge Traditions and Practices of India, Central Board of Secondary Education, 2012.
4. E-Resources: http://nptel.ac.in/courses/121106003/

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Subject Code : PC-ME591	**Category:** Professional Core Courses
Subject Name : Mechanical Engineering Laboratory (Thermal) I	**Semester** : Fifth
L-T-P : 0-0-3	**Credit: 1.5**
Pre-Requisites: Engineering Thermodynamics and Fluid Mechanics and Fluid Machines	

Course Objectives:

To understand the principles and performance characteristics of flow and thermal devices
To know about the measurement of the fluid properties

Course Contents (12 experiments/ studies/ problems are to perform from the list given below or relevant others):

1. Measurement of coefficient of discharge of given Orifice and Venturi meters
2. Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe
3. Determination of the performance characteristics of a centrifugal pump
4. Determination of the performance characteristics of Pelton Wheel
5. Determination of the performance characteristics of a Francis Turbine
6. Determination of the performance characteristics of a Kaplan Turbine
7. Determination of the thermal conductivity and specific heat of given objects
8. Determination of the calorific value of a given fuel and its flash & fire points
9. Determination of the p-V diagram and the performance of a 4-stroke diesel engine
10. Determination of the convective heat transfer coefficient for flow over a heated plate
11. Determination of the emissivity of a given sample
12. Determination of the performance characteristics of a vapour compression system

Course Outcomes:

The students who have undergone the course will be able to measure various properties of fluids and characterize the performance of fluid/thermal machinery

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Subject Code: PC-ME592	**Category:** Professional Core Courses
Subject Name: Machine Drawing-II	**Semester**: Fifth
L-T-P: **0-0-3**	**Credit: 1.5**
Pre-Requisites: Engineering Drawing	

Course Objectives:

Student will get methodically and well thought out presentation that covers fundamental issues common to almost all areas of machine drawing.

1. Students have an ability to apply knowledge of Modeling, science & engineering.
2. Student can modeled this drawing even in CAD/CAM software by applying the basic knowledge of machine drawing.
3. Students will able to demonstrate an ability to design and conduct experiments, analyze and interpret data and assembly and disassembly drawings knowledge will be provided.

The contents should include about 10 assignments with the focus given as outlined below:

UNIT - I Projection and Isometric Drawing of Machine components

Fasteners: Drawings of various views of Screw threads, metric and BSW threads, Square thread and multi start threads. Nut bolts, Washers, Setscrew, Locknuts and foundation bolts. Riveted joints: Forms and proportions of river heads, Different views of different types of riveted Lap and Butt joints.

Drawings of various views of Shaft joints: Cotter joint and Knuckle joint. Keys & Shaft coupling: Muff, Flanged, Flexible, Universal and Oldhams coupling.

UNIT - II Assignments using graphic software

Assembly and detailed drawings: Tool head of a shaping machine; Engine parts: Eccentric, Piston, Cross head and Connecting rod; Valves: Steam stop valve, Anyone of safety, relief and non-return valves; Solid modeling of Plummer block

Course Outcomes:

1. Understand and apply the knowledge of machine drawing as a system of Communication in which ideas are expressed clearly and all information fully conveyed.
2. To understand the design a system, component or process to meet desired needs within, realistic constraints such as manufacturability, economic, environmental, safety & sustainability etc., to represent a part drawing and assembly drawings.
3. To identify, formulates, analyzes and solve Engineering Problems in Optimum time.

Learning Resources:

1. N.D.Bhatt, Machine Drawing, 46th Edition, Charotar Publishing House, India, 2011.
2. P.S. Gill, Machine Drawing, 18th Edition, S.K. Kataria & Sons, Delhi, 2013.
3. T. Jones, Machine Drawing, John Heywood Ltd, Manchester, UK, 2012.

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SYLLABUS FOR BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

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Subject Code : PW-ME581	**Category:** Project (Summer internship)
Subject Name : Project-I	**Semester** : Fifth
L-T-P : **0-0-2**	**Credit: 1**
Pre-Requisites: Nil	

Course Objectives:

This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

Course Outcomes:

Students will be able to gather some exposure on some projects, may be designing some innovative ideas, fabricating and/or demonstrating an innovative machine or product, etc.