SHRI VENKATESHWARA UNIVERSITY

Syllabus

B.TECH

Mechanical Engineering

Vth SEMESTER

(Four Years Degree Programme)

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

Mechanical Engineering

SEMESTER-V

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	SME-501	Heat Transfer	3	1	0	20	10	30		70		100	4
2	SME-502	Solid Mechanics	3	1	0	20	10	30		70		100	4
3	SME-503	Manufacturing Processes	3	0	0	20	10	30		70		100	3
4	SME-504	Kinematics & Theory of Machines	3	1	0	20	10	30		70		100	4
5	SOE-051	Applications of Psychology	2	0	0	20	10	30		70		100	2
6	SME-511	Mechanical Engineering Lab (Thermal) I	0	0	4				25		25	50	2
7	SME-512	Project-I	0	0	4				50		50	100	2
8	SMC-501	Essence of Indian Knowledge Tradition	2	0	0								0
		Total										650	21

Course Code	**SME-501**
Course Title	**Heat Transfer**
Number of Credits	**4 (3L:1T:0P)**

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.

Contents:

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.

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.

Interaction of radiation with materials, definitions of radiative 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.

Types of heat exchangers, Analysis and design of heat exchangers using bothLMTD and ε-NTU methods.

Boiling and Condensation heat transfer, Pool boiling curve

Introduction mass transfer, Similarity between heat and mass transfer

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.

Text Books:

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, John Wiley, Sixth Edition, 2007.
4. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002
5. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002

Course Code	**SME-502**
Course Title	**Solid Mechanics**
Number of Credits	**4 (3L:1T:0P)**

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

Course Contents:

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

Constitutive equations: Generalized Hooke's law, Linear elasticity, Material symmetry; Boundary Value Problems: concepts of uniqueness and superposition.

Plane stress and plane strain problems, introduction to governing equations in cylindrical and spherical coordinates, axisymmetric problems.

Application to thick cylinders, rotating discs, torsion of non-circular cross-sections, stress concentration problems, thermo-elasticity, 2-d contact problems. Solutions using potentials. Energy methods. Introduction to plasticity.

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.

Text Books:
[1] G. T. Mase, R. E. Smelser and G. E. Mase, Continuum Mechanics for Engineers, Third Edition, CRC Press, 2004.
[2] Y. C. Fung, Foundations of Solid Mechanics, Prentice Hall International, 1965.
[3] Lawrence. E. Malvern, Introduction to Mechanics of a Continuous Medium, Prentice Hall international, 1969.

Course Code	**SME-503**
Course Title	**Manufacturing Processes**
Number of Credits	**3 (3L:0T:0P)**

Objectives:
To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods

Contents:
Conventional Manufacturing processes:
Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Additive manufacturing: Rapid prototyping and rapid tooling

Joining/fastening processes: Physics of welding, brazing and soldering;design considerations in welding,Solid and liquid state joining processes;Adhesive bonding.

Unconventional Machining Processes:
Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters

Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish.

Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining

Course Outcomes:
Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products

Text Books:
1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson

India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black &Kohser, Materials and Processes in Manufacturing

Course Code	**SME-504**
Course Title	**Kinematics & Theory of Machines**
Number of Credits	**4 (3L:1T:0P)**

Objectives:

 To understand the kinematics and rigid- body dynamics of kinematically driven machine components

 To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link

 To be able to design some linkage mechanisms and cam systems to generate specified output motion

 To understand the kinematics of gear trains

Contents:

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

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- Coriolis component of acceleration- introduction to linkage synthesis- three position graphical synthesis for motion and path generation

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

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 gears, epicyclic and regular gear train kinematics

Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication- friction clutches- belt and rope drives- friction in brakes

Course Outcomes:

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

Text Books:

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
2. CleghornW.L. , Mechanisms of Machines, Oxford University Press, 2005.

3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.

Course Code	**SOE-051**
Course Title	**Applications of Psychology**
Number of Credits	**2 (2L:0T:0P)**

Objectives:

 To understand the application of psychology in industries

UNIT-I : Introduction to Industrial Psychology – Definitions & Scope. Major influences on industrial Psychology- Scientific management and human relations schools Hawthorne Experiments

UNIT-II : Individual in Workplace Motivation and Job satisfaction , stress management. Organizational culture, Leadership & group dynamics.

UNIT-III : Work Environment & Engineering Psychology-fatigue. Boredom, accidents and safety. Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.

UNIT –IV : Performance Management : Training & Development.

References :

1. Miner J.B. (1992) Industrial/Organizational Psychology. N Y : McGraw Hill.
2. Blum & Naylor (1982) Industrial Psychology. Its Theoretical & Social Foundations CBS Publication.
3. Aamodt, M.G. (2007) Industrial/Organizational Psychology : An Applied Approach (5th edition) Wadsworth/Thompson : Belmont, C.A.
4. Aswathappa K. (2008). Human Resource Management (fifth edition) New Delhi : Tata McGraw Hill.

Course Code	**SME-511**
Course Title	**Mechanical Engineering Lab (Thermal) I**
Number of Credits	**2 (0L:0T:4P)**

Objectives:
(i) To understand the principles and performance characteristics of flow and thermal devices
(ii) To know about the measurement of the fluid properties

Contents:
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

Course Code	**SME-512**
Course Title	**Project I**
Number of Credits	**2 (0L:0T:4P)**

Objectives:
This course is aimed to provide more weightage for project work. The project work could be one 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 Code	**SNM-501**
Course Title	**Essence of Indian Knowledge Tradition**
Number of Credits	**0 (2L:0T:0P)**

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Course objective: The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.

Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

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References

- V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
- Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan • Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
- Fritzof Capra, Tao of Physics
- Fritzof Capra, The Wave of life
- VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
- Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
- GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016
- RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi 2016 • P B Sharma (English translation), Shodashang Hridayan

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

Outcome: Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

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