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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
*(Established by Govt. of A.P., Act. No. 30 of 2008)*
**ANANTHAPURAMU – 515 002 (A.P.) INDIA.**


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**Course Structure for B.Tech-R15 Regulations**
**Mechanical Engineering**
**B.Tech III-I Semester (ME)**

S. No.	Course Code	Subject	L	T	P	C
1.	15A01510	Fluid Mechanics and Hydraulic Machines	2	1	-	3
2.	15A03501	Thermal Engineering - II	2	1	-	3
3.	15A03502	Dynamics of Machinery	3	1	-	3
4.	15A03503	Machine Tools	3	1	-	3
5.	15A03504	Design of Machine Members - I	3	1	-	3
6.	15A03505 15A03506 15A03507	<b>MOOCS -I</b> a. Entrepreneurship b. Nano Technology c. Micro Electro Mechanical Systems	3	1	-	3
7.	15A01511	Fluid Mechanics and Hydraulic Machines Laboratory	-	-	4	2
8.	15A03508	Machine Tools Laboratory	-	-	4	2
9.	15A99501	Audit course – Social Values & Ethics	2	0	2	0
<b>Total:</b>			<b>20</b>	<b>6</b>	<b>10</b>	<b>22</b>

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B. Tech III-I Sem. (ME)

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15A01510 FLUID MECHANICS AND HYDRAULIC MACHINES

#### UNIT - I

**FLUID STATICS** : Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.

**FLUID KINEMATICS** : stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows-equation of continuity for one dimensional flow.

**Fluid dynamics**: surface and body forces – Euler's and Bernoulli's equations for flowing stream line, momentum equation and its application on force on pipe bend.

#### UNIT – II

**CONDUIT FLOW**: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pitot tube, venturimeter and orifice meter, Flow nozzle and Turbine current meter.

#### UNIT – III

**TURBO MACHINERY** : hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.

**HYDROELECTRIC POWER STATIONS**: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.

#### UNIT – IV

**HYDRAULIC TURBINES**: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, hydraulic design-draft tube- theory- functions and efficiency.

**PERFORMANCE OF HYDRAULIC TURBINES** : Unit and specific quantities, characteristics, governing of turbines, selection of type of turbine, cavitation and surge tank.

#### UNIT – V

**CENTRIFUGAL PUMPS** : Classification- working-work done – manometric head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves and NPSH.

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R15**TEXT BOOKS :**

1. Fluid Mechanics, Hydraulic and Hydraulic Machines by Modi & Seth, Standard book house.
2. A Text of Fluid Mechanics and Hydraulic Machines by Dr.R.K.Bansal – Laxmi Publications (P) Ltd., New Delhi.
3. Mechanics of Fluids by Potter, Wiggert, Ramadan, M.M.M.SARCAR, Cengage Publishers.

**REFERENCE BOOKS :**

1. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International,
2. Principles of Fluid Mechanics and Fluid Machines by M.Narayana Pillai, Universities Press.
3. Fluid mechanics and fluid machines by Rajput, S.Chand & Co.

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15A03501 THERMAL ENGINEERING – II

**Course Objective:**

This subject is designed to provide a sound knowledge in various aspects of thermal equipments. This subject has an increasingly dominant role to play in the vital areas of power generation, Automobiles, R&AC and energy sector. The course contents aims at developing the necessary analytical and technical contents among engineers in these areas. The students shall become familiar with steam power plant, boilers, function of nozzle, gas turbines and jet propulsions.

**UNIT I**

BASIC CONCEPTS: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

**Learning Outcome & Suggested Student Activities:**

Student can be able to illustrate the power generation through Rankine cycle. Student can able understand efficiency enhancement methods of Reheating and regeneration. Student can able to understand the key role of quality of steam after evaporation. Students are advised to be acquainted with the terms related to steam, steam tables and mollierchart. Also, students are advised to visit the thermal power station to get real expose.

**UNIT II**

BOILERS: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

DRAUGHT: Classification – Height Of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught.

**Learning Outcome & Suggested Student Activities:**

Student can able to understand the working of different high pressure and low pressure boilers. Student can distinguish mountings and accessories. The student can calculate the chimney height for maximum discharge. Student can know the draughts and its application in the steam generator. Students are advised to visit the Boilers in the power generation units to get better expose. And visit the following URLs will be highly useful to the students to understand various aspects of thermal power plants and boilers.  
[https://www.youtube.com/watch?v=Ota2\\_LUuar0](https://www.youtube.com/watch?v=Ota2_LUuar0),  
<https://www.youtube.com/watch?v=8GSUgwombdE>

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**UNIT III**

STEAM NOZZLES: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio.

Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at The Exit.

CONDENSERS: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

**Learning Outcome & Suggested Student Activities:**

Student can be able to distinguish the ideal flow and actual flow through nozzle. Student can know the importance of maximum discharge through nozzle. Student can able to entail the concept of Critical pressure ratio in calculations. Student can able to understand the effect of meta stable flow/ super saturation flow through nozzle.

Students are advised to visit the thermal power stations to acquire the practical expose and visit URL <http://www.youtube.com/watch?v=cdUNmzcu2rA>

**UNIT IV**

IMPULSE TURBINE: Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine - Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow – Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

REACTION TURBINE: Mechanical Details – Principle of Operation, Thermodynamic Analysis of A Stage, Degree of Reaction –Velocity Diagram – Parson's Reaction Turbine – Condition for Maximum Efficiency.

**Learning Outcome & Suggested Student Activities:**

At the end of unit, student can able to distinguish the working of impulse and reaction turbines. Student can able to construct the velocity triangle and combined velocity triangle and can learn its importance in determining the power produced by the turbine. Student can know why to reduce the rotor speed and methods to reduce.

Students are advised to visit thermal power stations for better understanding the working of turbines. Students are suggested to participate in science exhibitions based on the concept of thermal power plants. Student is advised to visit following URLs

<http://www.youtube.com/watch?v=y2dOmpZgYW8&list=PLBD7B1EEF7CCB7D9D> ,

[https://www.youtube.com/watch?v=1bl1Q3V\\_79I](https://www.youtube.com/watch?v=1bl1Q3V_79I)

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**UNIT V**

GAS TURBINES: Simple Gas Turbine Plant – Ideal Cycle, Essential Components – Parameters of Performance – Actual Cycle – Regeneration, Inter Cooling and Reheating – Closed And Semi-Closed Cycles – Merits and Demerits, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants

JET PROPULSION: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

**Learning Outcome & Suggested Student Activities:**

After the study of the unit, Student can be familiar with the basic components of a gas turbine power plant. Student can illustrate the power generation using Joule Cycle. Student can know the methods to increase the specific power output and efficiency of the cycle. Also, Student can able to know the working of various propulsive devices. Student can aware of using thrust equations in solving problems. Students advised to visit Gas power generation plants.

<http://www.youtube.com/watch?v=hnVWpOV5chs>, <http://www.youtube.com/watch?v=p1TqwAKwMuM>, <http://www.youtube.com/watch?v=MUXP3PCDRTE>

**Text Books:**

1. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013
2. Basic and Applied Thermodynamics, P.K. Nag, TMH, 2<sup>nd</sup> Edition, 2012.

**Reference Books:**

1. Gas Turbines, V. Ganesan, TMH
2. Thermodynamics and Heat Engines, R. Yadav, Central Publishing House, Allahabad, 2002.
3. Thermal Engineering, Mahesh M Rathore, McGrawHill, 2010
4. Gas Turbines and Propulsive Systems, P. Khajuria & S.P. Dubey, Dhanpatrai
5. Thermal Engineering, R.S. Khurmi & J.S. Gupta, S. Chand, 2012.
6. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.
7. Steam Tables SI Units- Dr.B. Umamaheswar Gowd and A. Nagraju, Siri Publ.

**NOTE:** Steam tables and Mollier charts to be supplied for exam.

**Web References:**

<http://www.iscid.org/encyclopedia/Thermodynamics>. <http://www.transtutors.com/>

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**B. Tech III-I Sem. (ME)**

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**15A03502 DYNAMICS OF MACHINERY**
**Course objective:**

To understand the method of static force analysis and dynamic force analysis of mechanism, undesirable effects of unbalance in rotors and engines. To understand the concept of vibratory systems and their analysis and also the principles of governors.

**UNIT I**

**FRICTION:** Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

**CLUTCHES:** Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch.

**BRAKES AND DYNAMOMETERS:** Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

**Learning outcome & Suggested Student Activities:**

After completion of this unit students are able to understand the basic concepts of friction in pivots and collars with uniform pressure and uniform wear, and also to solve the numerical problems on brakes, clutches and dynamometers.

Students may go through text books given for more number of problems on friction, brakes and clutches. The following URLs will be highly useful to the students to understand various concepts of friction and its application.

<http://nptel.iitm.ac.in/video.php?subjectId=112104121>,

<http://www.youtube.com/watch?v=FA04XFpJgwE>

**UNIT II**

**PRECESSION:** Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes and ships.

**TURNING MOMENT DIAGRAMS AND FLY WHEELS:** Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

**Learning outcome & Suggested Student Activities:**

After completion of this unit students can apply gyroscopic principles on Aeroplane, ship, four wheel and two wheel vehicles. Students are able to design a flywheel for IC engine. Students may go through text books given for more number of problems on gyroscopic

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effects and flywheels. The following URLs will be highly useful to the students to understand various concepts of gyroscopic couple and turning moment diagrams.

<http://www.youtube.com/watch?v=FydJu1A1oeM&list=PL46AAEDA6ABAFCA78&index=7>

<http://www.youtube.com/watch?v=swgvKwyOnYk&list=PL46AAEDA6ABAFCA78&index=16>

### UNIT III

GOVERNORS: Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

#### **Learning outcome & Suggested Student Activities:**

The outcome of this unit is to study the basics and definitions related to governors and forces acting on various governors. After completion of this unit students are able to solve numerical problems on different governors.

Students may go through text books given for more number of problems on governors.

The following URLs will be highly useful to the students to understand various concepts on governors.

<http://nptel.iitm.ac.in/video.php?subjectId=112104121>,

<http://www.youtube.com/watch?v=OG1AiaNTT6s>

### UNIT IV

BALANCING: Balancing of rotating masses - single and multiple – single and different planes.

BALANCING OF RECIPROCATING MASSES: Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder in-line and radial engines for primary and secondary balancing.

#### **Learning outcome & Suggested Student Activities:**

After completion of this unit students can solve numerical problems on balancing of rotating masses and reciprocating masses in V-engine and multi cylinder engines.

Students may go through text books given for more number of problems on balancing of rotating masses and balancing of reciprocating masses in locomotives and IC engines.

The following URLs will be highly useful to the students to understand various concepts of balancing of masses.

<http://www.youtube.com/watch?v=aRuIDXMuNDc&list=PL46AAEDA6ABAFCA78&index=8>

<http://nptel.iitm.ac.in/video.php?subjectId=112104121>

### UNIT V

VIBRATION: Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. ~~Vibration Isolation & Transmissibility. Transverse vibrations of~~



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beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Torsional vibrations - two and three rotor systems.

**Learning outcome & Suggested Student Activities:**

Upon completion of this unit, the student will perform detailed analysis of the response of one degree of freedom systems with free and forced vibrations, evaluate the critical speed of the shaft and simple vibration calculations of rotor systems. Students may go through text books given for more number of problems on single degree of freedom system, transverse and torsional vibrations. The following URLs will be highly useful to the students to understand various concepts on vibrations.

<http://nptel.iitm.ac.in/video.php?subjectId=112104121>

<http://www.youtube.com/watch?v=irudCaBrij0&list=PL46AAEDA6ABAFCA78&index=30>

**Text Books:**

1. Theory of Machines, S.S. Rattan, MGH Publishers, 3<sup>rd</sup> Edition, 2013.
2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.

**Reference Books:**

1. Theory of Machines, Thomas Bevan, Pearson, 3<sup>rd</sup> Edition, 2012.
2. The theory of Machines, Ballaney, Kanna Publishers
3. Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.

**NOTE:** End Exam Should be conducted in Drawing Hall

**Suggestions:**

Students may visit near by machine tool shops and automobile work shops to know about clutches, bearings, brakes, dynamometers, flywheel, centrifugal governors and balancing equipment like wheel balancing. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

**Web References:**

Machine Dynamics by Prof. Amitabha Ghosh, IITK, Kanpur -  
<http://nptel.iitm.ac.in/video.php?subjectId=112104114>

Machine Dynamics by Prof. C. Amarnath, Prof. K. KurienIssac, Prof. P. Seshu of IITB, Mumbai

<http://www.cdeep.iitb.ac.in/nptel/Mechanical/Dynamics%20of%20Machines/TOC.html>

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**B. Tech III-I Sem. (ME)**

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**15A03503 MACHINE TOOLS**
**Course Objective:**

*The objectives of this course are to introduce to demonstrate the fundamentals of machining processes and machine tools.*

*To develop knowledge and importance of metal cutting parameters, tool materials, cutting fluids and tool wear mechanisms.*

*To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes and acquire knowledge on advanced manufacturing processes. The students will have the knowledge and hands-on experience that will enable them to work in a typical machine shop.*

**UNIT I**

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability –economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

**Learning outcome & Suggested Student Activities:**

*After completion of this unit students are able to understand the basic concepts of the philosophy of metal cutting and the mechanism of chip formation. Student will understand the interface in the machining zone between the tool and the work piece and how the physical and mechanical parameters dictate the cutting performance.*

**UNIT II**

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.Turret and capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

**Learning outcome & Suggested Student Activities:**

*After completion of this unit students are able to understand the basic concepts of turning. Student shall be made familiar with various tooling accessories used in turning and understand different constructions of lathe depending on the nature of operation.*

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**UNIT III**

Drilling and Boring Machines – Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring tools – machining time calculation.

Shaping, Slotting and Planning machines –Principles of working – Principal parts – specification, classification, Operations performed. Machining time calculations

**Learning outcome & Suggested Student Activities:**

*After completion of this unit students are able to understand the basic principle of drilling, shaping and planning operation, parts of the drilling, shaping and planning machines and tool holding devices, operations performed on drilling, shaping and planning and machining calculations.*

**UNIT IV**

Milling machine – Principles of working – specifications – classifications of milling machines – Principal features – machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to milling machines.

Grinding machine –Theory of grinding – classification– cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel. Static and dynamic balancing of a wheel Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing. machining time calculations.

**Learning outcome & Suggested Student Activities:**

*After completion of this unit students are able to understand the principle of milling, grinding, Lapping, Honing and Broaching operation, parts of the milling machine and types of milling and grinding machines.*

**UNIT V**

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices, Typical examples of jigs and fixtures

Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications

**Learning outcome & Suggested Student Activities:**

*After completion of this unit students are able to understand the design of Jigs and fixtures and uses, Classification of Jigs & Fixtures – Principles of location and clamping. Some examples of jigs and fixtures. The outcome of this unit is to understand the basic principle of unconventional machining methods USM,AJM,EDM,LBM,EBM,CM and ECM and machining of the USM,AJM,EDM,LBM,EBM,CM and ECM.*

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1. *Workshop Technology – Vol II*, B.S.RaghuVamshi, Dhanpat Rai & Co, 10<sup>th</sup> edition, 2013
2. *Production Technology* by R.K. Jain and S.C. Gupta, Khanna Publishers, 17<sup>th</sup> edition, 2012

**Reference Books:**

1. *Manufacturing Technology*-Kalpakzian- Pearson
2. *Metal cutting Principles* by Milton C.Shaw, oxford Second Edn, 2<sup>nd</sup> edition, 2012
3. *Production Technology* by H.M.T. (Hindustan Machine Tools),TMH, 1<sup>st</sup> edition, 2001
4. *Production Technology* by K.L.Narayana, IK International Pub.
5. *Machining and machine tools* by AB. Chattopadyay, WileyEdn,2013
6. *Unconventional Machining process* by V.K.Jain, Allied Pub.
7. *Manufacturing technology Vol II* by P.N. Rao, Tata McGraw Hill, 4<sup>th</sup> edition, 2013
8. *Machine Technology Machine tools and operations* by Halmi A Yousuf&Hanson, CRC Press Taylor and Francies .

**Web Resources:**

[www.hgfarley.com](http://www.hgfarley.com)  
[www.kennametal.com/](http://www.kennametal.com/) - United States  
[www.mini-lathe.com/links.htm](http://www.mini-lathe.com/links.htm); [machinedesign.com/.../designer-s-guide-to-metalcutting-machinery-0608](http://machinedesign.com/.../designer-s-guide-to-metalcutting-machinery-0608) -  
[www.metalwebnews.com/wc.html](http://www.metalwebnews.com/wc.html)  
[www.britannica.com/EBchecked/topic/463000/planer](http://www.britannica.com/EBchecked/topic/463000/planer)  
[www.americanmachinist.com](http://www.americanmachinist.com)  
[www.machinetools.net.tw/parts/taiwan\\_voltage\\_regulator.htm](http://www.machinetools.net.tw/parts/taiwan_voltage_regulator.htm)

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B. Tech III-I Sem. (ME)

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15A03504 DESIGN OF MACHINE MEMBERS – I

**Course Objective:**

The primary objective of this course is to demonstrate how engineering design is used for many principles learned in previous engineering science courses and to show how these principles are practically applied. This subject will help to the students to learn to analyze and design basic machine elements in mechanical systems. By this subject students will become familiar on design principles, materials selection, stresses developed in machine elements under different loads. The students will also get knowledge on design of the permanent and temporary joints, shafts and keys.

**UNIT I**

INTRODUCTION: General considerations of design, design process. Selection of Engineering Materials - properties –Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

STRESSES IN MACHINE MEMBERS: Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Theories of failure – factor of safety.

**Learning Outcome & Suggested Student Activities:**

After completion of this unit students are capable to apply design procedures using theories of failure for different elements. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of machine design.  
<http://machinedesign.com/>  
<http://www.youtube.com/watch?v=qVj4VvMmQjc&list=PL3D4EECEFAA99D9BE&index=6>

**UNIT II**

DESIGN FOR FLUCTUATING LOADS: Stress concentration –notch sensitivity – Design for fluctuating stresses – Estimation of Endurance strength – Goodman's line – Soderberg's line. Design of components for finite and infinite life.

**Learning Outcome & Suggested Student Activities:**

After completion of this chapter students are able to design simple components under cyclic loading using Goodman's and Soderberg's criterions. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of cyclic loading design. <http://machinedesign.com/>  
<http://www.youtube.com/watch?v=SLqkITQfN1I&list=PL3D4EECEFAA99D9BE&index=8>

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**UNIT III**

DESIGN OF RIVETED JOINTS: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

DESIGN OF BOLTED JOINTS: Forms of Screw threads. Stresses in Screw fasteners. Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

**Learning Outcome & Suggested Student Activities:**

After completion of this unit students are able to design riveted joints with different configuration, boiler shell joint design and eccentric loading design of riveted joints. Further students are able to design bolted joints with direct loading and eccentric loading. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of joints. <http://machinedesign.com/>  
<http://www.youtube.com/watch?v=Z38Aq9ykUCM&list=PL3D4EECEFAA99D9BE&index=16>

**UNIT IV**

DESIGN OF COTTERS AND KNUCKLE JOINTS: Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

DESIGN OF SHAFTS: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads.

**Learning Outcome & Suggested Student Activities:**

After completion of this unit students are able to design cotter joint, knuckle joint and shafts. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of shafts, <http://machinedesign.com/>  
<http://www.youtube.com/watch?v=4nIQwVqruRo&list=PL3D4EECEFAA99D9BE&index=20>

**UNIT V**

DESIGN OF KEYS AND COUPLINGS: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

**Learning Outcome & Suggested Student Activities:**

After completion of this unit students are able to design various rigid and flexible shaft couplings. In addition to text books, the following URLs will be highly useful to the students to understand various concepts of design of couplings. <http://machinedesign.com/>  
<http://www.youtube.com/watch?v=4nIQwVqruRo&list=PL3D4EECEFAA99D9BE&index=21>

**Text Books:**

1. MachineDesign, Schaum'sseries, TMH Publishers, NewDelhi, 1<sup>st</sup> edition, 2011
2. MachineDesign, R.S. Kurmi and J.K. Gupta, S.ChandPublishers, NewDelhi

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R15**Reference Books:**

1. Machine Design, R.K. Jain, Khanna Publishers, New Delhi.
2. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi
3. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, New Delhi, 9<sup>th</sup> edition, 2011 R
4. Design of Machine Elements, M.F. Spotts, PHI Publishers, New Delhi.
5. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17<sup>th</sup> edition, 2009
6. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2<sup>nd</sup> edition, 2002
7. Machine Design by Groover – CBS Publications, 5<sup>th</sup> edition, 2012.
8. Machine Design Data Book, V B Bhandari, McGraw Hill, 2014

**NOTE:** Design data books are not permitted in the examinations.

**Web Resources:**

<http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv077-page1.htm>  
<http://www.fastenal.com/content/feds/pdf/Article%20-%20Bolted%20Joint%20Design.pdf>  
[http://people.rit.edu/megite/Lec%203%20Fatigue%20Failure%20031004\\_for\\_students.ppt](http://people.rit.edu/megite/Lec%203%20Fatigue%20Failure%20031004_for_students.ppt)  
<http://engineershandbook.com/Tables/materials.htm>  
[www.nptel.iitm.ac.in/video](http://www.nptel.iitm.ac.in/video)

**Suggestions:**

1. Students may visit nearby automobile workshops and machine tool shops or IC Engine Lab/Automobile Lab to know about different machine elements like shafts, keys, couplings and riveted and bolted joints.
2. In addition to the text books students may also go through the reference books authored by V.B. Bhandari, by Pandya and Shah for more number of numerical problems.

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**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**
**B. Tech III-I Sem. (ME)**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>3</b>

**15A03505 ENTREPRENEURSHIP  
(MOOCS-I)**

**UNIT 1:** Introduction to Entrepreneurship Definition Types of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad.

Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creative problem solving, product planning and development process.

**UNIT II:** The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

**UNIT III:** Financing and Managing the new venture, Sources of capital, venture capital , angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

**UNIT IV:** New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits.Choosing location and layout, Issues related to Selection of layout.

**UNIT V:** Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control.Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Global aspects of Enterprership.

**Text Books:**

- 1.Entrepreneurship, Robert Hisrich, & Michael Peters, TMH, 5th Edition
2. Entrepreneurship, Dollinger, Pearson, 4/e 2004.

**REFERENCES:**

1. Dynamics of Entrepreneurial Development and management, Vasant Desai, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, . Robert J.Calvin:, TMH, 2004.



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B. Tech III-I Sem. (ME)

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**15A03506 NANO TECHNOLOGY  
(MOOCS-I)**

**Course objective**

On successful completion of the course, students should be able to: Understand the basic scientific concepts of nanoscience. Understand the properties of nano materials, characterization of materials, synthesis and fabrication. Understand the applications of nano technology in various science, engineering and technology fields.

**UNIT-I**

**INTRODUCTION:** History of nano science, definition of nano meter, nano materials, nano technology. Classification of nano materials. Crystal symmetries, crystal directions, crystal planes. Band structure.

**PROPERTIES OF MATERIALS:**

Mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto electronic properties. Effect of size reduction on properties, electronic structure of nano materials.

**UNIT-II**

**SYNTHESIS AND FABRICATION:** Synthesis of bulk polycrystalline samples, growth of single crystals. Synthesis techniques for preparation of nano particle – Bottom Up Approach – sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD; Top Down Approach – Ball milling, micro fabrication, lithography. Requirements for realizing semiconductor nano structures, growth techniques for nano structures.

**UNIT-III**

**CHARACTERIZATION TECHNIQUES:** X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, XANES and XAFS, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy.

**UNIT-IV**
**CARBON NANO TECHNOLOGY:**

Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalline diamond films, grapheme, applications of carbon nano tubes.

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R15**UNIT-V****APPLICATIONS OF NANO TECHNOLOGY:**

Applications in material science, biology and medicine, surface science, energy and environment. Applications of nano structured thin films, applications of quantum dots.

**TEXT BOOK:**

1. Nano science and nano technology / M.S Ramachandra Rao, Shubra Singh/Wiley publishers.
2. Introduction to Nanotechnology by Risal Singh, Shipra Mital Gupta, Oxford Higher Education, First Publication 2016.

**REFERENCE BOOKS:**

1. Introduction to Nano Technology /Charles P. Poole, Jr., Frank J.Owens/Wiley publishers.
2. Nanotechnology /Jermy J Ramsden/Elsevier publishers
3. Nano Materials/A.K.Bandyopadhyay/ New Age
4. Nano The Essentials, T.Pradeep, McGrawHill, 2014
5. Nanotechnology the Science of Small / M.A Shah, K.A Shah/Wiley Publishers.

**Course outcomes:**

- Upon successful completion of this course the student shall be able to:
- Identify the essential concepts used in nanotechnology. Identify the materials, properties, syntheses and fabrication, characterization and applications in various fields.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech III-I Sem. (ME)	L	T	P	C
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15A03507	MICRO ELECTRO MECHANICAL SYSTEMS (MEMS) (MOOCS-I)			

**Course Objectives:**

1. To learn basics of Micro Electro Mechanical Systems (MEMS).
2. To learn about various sensors and actuators used in MEMS
3. To learn the principle and various devices of MOEMS, Fluidic, bio and chemical systems

**UNIT – I**

**INTRODUCTION:** Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

**MECHANICAL SENSORS AND ACTUATORS:** Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

**UNIT – II**

**THERMAL SENSORS AND ACTUATORS:** Thermal energy basics and heat transfer processes, thermistors, thermo devices, thermo couple, micro machined thermo couple probe, peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever.

**UNIT – III**

**MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS:** Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

**MAGNETIC SENSORS AND ACTUATORS:** Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators

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**UNIT – IV**

**MICRO FLUIDIC SYSTEMS:** Applications, considerations on micro scale fluid, fluid actuation methods, dielectrophoresis (DEP), electro wetting, electro thermal flow, thermocapillary effect, electro osmosis flow, optoelectro wetting (OEW), tuning using microfluidics, typical microfluidic channel, microfluidic dispenser, micro needle, molecular gate, micro pumps.

**RADIO FREQUENCY (RF) MEMS:** RF – based communication systems, RF MEMS, MEMS inductors, varactors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

**UNIT - V**

**CHEMICAL AND BIO MEDICAL MICRO SYSTEMS:** Sensing mechanism & principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemoresistors, chemocapacitors, chemotransistors, electronic nose (E-nose), mass sensitive chemosensors, fluorescence detection, calorimetric spectroscopy.

**TEXT BOOK:**

1. MEMS/Nitaigour Premchand Mahalik/TMH Publishing co.
2. MEMS and NEMS/Sergey Edwrd Lyshevski/CRC Press, Indian Edition, 2013

**REFERENCE BOOKS:**

1. Foundation of MEMS/Chang Liu/Prentice Hall Ltd.
2. RF MEMS Theory, Design and Technology Gabriel M. Rebeiz, Wiley-India, 2010
3. MEMS and Micro Systems: Design and Manufacture/Tai-Ran Hsu/TMH Publishers.
4. Introductory MEMS/ Thomas M Adams, Richard A Layton/Springer International Publishers.

**Course outcomes:**

Upon successful completion of this course the student shall be able to know the importance and various devices of MEMS and their applications.

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15A01511 FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY

**OBJECTIVE:** The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices.

**SYLLABUS :**

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli's equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

**LIST OF EQUIPMENT :**

1. Venturimeter Setup.
2. Orifice meter setup.
3. Small orifice setup.
4. External mouthpiece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Hydraulic jump test setup.
10. Pelton wheel and Francis turbines.
11. Centrifugal pumps.

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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**15A03508 MACHINE TOOLS LABORATORY**

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, Slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine
3. Job on Thread cutting and knurling on -lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping and Planning
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.

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<b>B. Tech III-I Sem. (ME)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>15A99501 SOCIAL VALUES &amp; ETHICS (AUDIT COURSE)</b>				
<i>(Common to all Branches)</i>				

**UNIT - I**

**Introduction and Basic Concepts of Society: Family and Society:** Concept of family, community, PRIs and other community based organizations and society, growing up in the family – dynamics and impact, Human values, Gender Justice.

**Channels of Youth Moments for National Building: NSS & NCC:** History, philosophy, aims & objectives; Emblems, flags, mottos, songs, badge etc.; Organizational structure, roles and responsibilities of various NSS functionaries. **Nehru Yuva Kendra (NYK):** Activities – Socio Cultural and Sports.

**UNIT – II**

Activities of NSS, NCC, NYK:

**Citizenship:** Basic Features Constitution of India, Fundamental Rights and Fundamental Duties, Human Rights, Consumer awareness and the legal rights of the consumer, RTI.

**Youth and Crime:** Sociological and psychological Factors influencing youth crime, Peer Mentoring in preventing crimes, Awareness about Anti-Ragging, Cyber Crime and its prevention, Juvenile Justice

**Social Harmony and National Integration:** Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building.

**UNIT – III**

**Environment Issues:** Environment conservation, enrichment and Sustainability, Climate change, Waste management, Natural resource management (Rain water harvesting, energy conservation, waste land development, soil conservations and afforestation).

**Health, Hygiene & Sanitation:** Definition, needs and scope of health education, Food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan.

**Disaster Management:** Introduction to Disaster Management, classification of disasters, Role of youth in Disaster Management. Home Nursing, First Aid.

**Civil/ Self Defense:** Civil defense services, aims and objectives of civil defense, Need for self defense training – Teakwondo, Judo, karate etc.,

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**UNIT – IV**

**Gender Sensitization:** Understanding Gender – Gender inequality – Role of Family, Society and State; Challenges – Declining Sex Ratio – Sexual Harassment – Domestic Violence; Gender Equality – Initiatives of Government – Schemes, Law; Initiatives of NGOs – Awareness, Movements;

**UNIT - V**

**Physical Education :** Games & Sports: Health and Recreation – Biological basis of Physical activity – benefits of exercise – Physical, Psychological, Social; Physiology of Muscular Activity, Respiration, Blood Circulation.

**Yoga:** Basics of Yoga – Yoga Protocol, Postures, Asanas, Pranayama: Introduction of Kriyas, Bandhas and Mudras.

**TEXT BOOKS:**

1. NSS MANUAL
2. SOCIETY AND ENVIRONMENT: A.S.Chauha, Jain Brothers Publications, 6<sup>th</sup> Edition, 2006
3. INDIAN SOCIAL PROBLEM: G.R.Madan, Asian Publisher House
4. INDIAN SOCIAL PROBLEM: Ram Ahuja, Rawat Publications
5. HUMAN SOCIETY: Kingsley Davis, Macmillan
6. SOCIETY: Mac Iver D Page, Macmillan
7. SOCIOLOGY – THEMES AND PERSPECTIVES: Michael Honalambos, Oxford University Press
8. CONSTITUTION OF INDIA: D.D.Basu, Lexis Nexis Butterworth Publishers
9. National Youth Policy 2014 (available on [www.yas.nic.in](http://www.yas.nic.in))
10. TOWARDS A WORLD OF EQUALS: A.Suneetha, Uma Bhargudanda, Duggirala Vasantha, Rama Melkote, Vasudha Nagraj, Asma Rasheed, Gogu Shyamala, Deepa Streenivas and Susie Tharu
10. LIGHT ON YOGA : B.K.S.Iyengar, Penguin Random House Publishers

[www.un.org](http://www.un.org)

[www.india.gov.in](http://www.india.gov.in)

[www.yas.nic.in](http://www.yas.nic.in)

<http://www.who.int/countries/ind/en/>

<http://www.ndma.gov.in>

<http://ayush.gov.in/event/common-yoga-protocol-2016-0>