Gayatri Vidya Parishad College for Degree and PG Courses(A)

**Department of Mechanical Engineering**

Accredited by NBA and NAAC

**R-19**

## ANNEXURE - I

## SEMESTER I (First Year)

| Sl. No. | Category | Code Number | Course | Hours per week | | | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Basic Science Course | 1909101 | Mathematics -1 | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 2 | Basic Science Course | 1909102 | Mathematics -2 | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 3 | Basic Science Course | 1909104 | Physics | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| 4 | Engineering Science Course | 1909106 | Engineering Graphics | 2 | 0 | 4 | 30 | 70 | 100 | 4 |
| 5 | Mandatory Course | 1909108 | Professional Ethics | 2 | 0 | 0 | 30 | 70 | 100 | 0 |
| 6 | Basic Science Course | 1909104P | Physics Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 7 | Engineering Science Course | 1909110P | Workshop | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| | | | **Total** | **13** | **1** | **10** | **250** | **450** | **700** | **17** |

## SEMESTER II (First Year)

| Sl. No. | Category | Code Number | Course | Hours per week | | | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Basic Science Course | 1909201 | Mathematics -3 | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| 2 | Engineering Science Course | 1909202 | Engineering Mechanics-1 | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| 3 | Basic Science Course | 1909203 | Chemistry | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 4 | Engineering Science Course | 1909205 | Computer Programming using C & Numerical Methods | 3 | 1 | 0 | 30 | 70 | 100 | 4 |
| 5 | Mandatory Course | 1909207 | Essence of Indian Traditional Knowledge | 2 | 0 | 0 | 30 | 70 | 100 | 0 |
| 6 | Humanities and Social Sciences Course | 1909209 | English | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 7 | Basic Science Course | 1909203P | Chemistry Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 8 | Engineering Science Course | 1909205P | CPNM Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| | | | **Total** | **17** | **3** | **6** | **280** | **520** | **800** | **21** |

Gayatri Vidya Parishad College for Degree and PG Courses(A)

# Department of Mechanical Engineering

Accredited by NBA and NAAC

**R-19**

## Semester III (Second year)

| Sl. No. | Category | Code | Course Title | Hours per week | | | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Basic Science Course | 1995301 | Mathematics-4 | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 2 | Basic Science Course | 1995302 | Engineering mechanics-II | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 3 | Mandatory course | 1995303 | Environmental Science | 2 | 0 | 0 | 30 | 70 | 100 | 0 |
| 4 | Professional Core Course | 1995304 | Mechanics of Solids-I | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 5 | Professional Core Course | 1995305 | Basic Thermodynamics | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 6 | Professional Core Course | 1995306 | Manufacturing Processes | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 7 | Humanities and Social Sciences Course | 1995307 | Universal Human Values-2 | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 8 | Engineering Science Course | 1995302P | Fuels and Mechanics lab | | | 3 | 50 | 50 | 100 | 1.5 |
| 9 | Professional Core Course | 1995304P | Mechanics of Solids Lab | | | 3 | 50 | 50 | 100 | 1.5 |
| | | | **Total** | **20** | **0** | **6** | **310** | **490** | **800** | **21** |

## Semester IV (Second year)

| Sl. No. | Category | Code | Course Title | Hours per week | | | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Professional Core course | 1995401 | Mechanics of Solids-2 | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 2 | Professional Core course | 1995402 | Theory of Machines - 1 | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 3 | Professional Core course | 1995403 | Metal cutting & Machine tools | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 4 | Professional Core Course | 1995404 | Fluid Mechanics | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 5 | Professional Core course | 1995405 | Metallurgy and Material science | 2 | 0 | 0 | 30 | 70 | 100 | 2 |
| 6 | Engineering Science Course | 1995406 | Electrical and Electronics Engg. | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 7 | Professional Core Course | 1995403P | Manufacturing Technology Lab-I | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 8 | Professional Core Course | 1995407 | Mechanical Engineering Drawing | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 9 | Engineering Science Course | 1995406P | Electrical and Electronics Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| | | | **Total** | **17** | **0** | **9** | **330** | **570** | **900** | **21.5** |

Gayatri Vidya Parishad College for Degree and PG Courses(A)

# Department of Mechanical Engineering

Accredited by NBA and NAAC

**R-19**

## Semester V (Third year)

| Sl. No. | Category | Code | Course Title | Hours per week | | | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Professional Core course | 1995501 | Theory of Machines – 2 | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 2 | Professional Core course | 1995502 | Applied Thermodynamics-I | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 3 | Professional Core course | 1995503 | Hydraulic Machines | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 4 | Professional Core course | 1995504 | Metrology | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 5 | Humanities and Social Sciences Course | 1995505 | Industrial and Entrepreneurial Engg. | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 6 | Professional Elective Course | 1995506 | **Elective-I** | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 7 | Professional Elective Course | 1995507 | **Elective-II** | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 8 | Professional Core Course | 1995503P | FMM Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 9 | Professional Core Course | 1995504P | Manufacturing Technology Lab-II | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| | | | **Total** | **21** | **0** | **6** | **310** | **590** | **900** | **24** |

**Elective-I:**

**1995506A Mechatronics**
**1995506B Work Study**
**1995506C Rapid Prototyping**
**1995506D Power Plant Engineering**

**Elective-II:**

**1995507A Un Conventional Machining Process**
**1995507B Total Quality Management**
**1995507C Industrial Tribology**
**1995507D Automobile Engineering**

## Semester VI (Third year)

| Sl. No. | Category | Code | Course Title | Hours per week | | | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Humanities and Social Sciences Course | 1995601 | Operation Research | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 2 | Professional Core Course | 1995602 | CAD-CAM | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 3 | Professional Core Course | 1995603 | Applied Thermodynamics- II | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 4 | Professional Elective Course | 1995604 | **Elective-III** | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 5 | Professional Core Course | 1995605 | Design of Machine Elements | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 6 | Open Elective Course | 1995606O | Open Elective | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 7 | Professional Core Course | 1995603P | Engines and Mechanisms Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 8 | Professional Core Course | 1995604P | Metrology and Mechatronics Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| | | | **Total** | **18** | **0** | **6** | **310** | **590** | **800** | **21** |

**Elective-III:**

**1995604A Production Planning and Control**
**1995604B Experimental Stress Analysis**
**1995604C Tool Design**
**1995604D Finite Element Analysis**

**Open Elective-1995606O**

**Open Elective offered by Department of ECE, CSE, CE**

Gayatri Vidya Parishad College for Degree and PG Courses(A)

# Department of Mechanical Engineering

Accredited by NBA and NAAC

**R-19**

## Semester VII (Fourth year)

| Sl. No. | Category | Code | Course Title | Hours per week | | | Allotment of Marks | | Total contact hours | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Professional Core Course | 1995701 | Machine Design | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 2 | Professional Elective Course | 1995702 | **Elective IV** | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 3 | Professional Core Course | 1995704 | Statistical Quality Control | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 4 | Professional Core Course | 1995705 | Heat Transfer | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 5 | Open Elective Course | 1995706O | Renewable Energy Technologies | 3 | 0 | 0 | 30 | 70 | 100 | 3 |
| 6 | Project | 1995707 | Mini-Project/Summer Internship | 0 | 0 | 3 | 100 | 0 | 100 | 1.5 |
| 7 | Professional Core Course | 1995705P | Heat Transfer Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 8 | Professional Core Course | 1995704P | Industrial Engineering Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| 9 | Professional Core Course | 1995706P | CAD/CAM Lab | 0 | 0 | 3 | 50 | 50 | 100 | 1.5 |
| | | | **Total** | **15** | **0** | **12** | **400** | **500** | **900** | **21** |

**Elective -IV:**

**1995703A Instrumentation & Control Systems**
**1995703B Supply Chain Management**
**1995703C Renewable Energy Technologies**
**1995703D Refrigeration and Air- conditioning**

## Semester VIII (Fourth year)

| Sl. No. | Category | Code | Course Title | Hours per week | | | Allotment of Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Lecture | Tutorial | Practical | Internal | External | | |
| 1 | Project | 1995801 | Project | 0 | 0 | 18 | 50 | 50 | 100 | 12 |
| 2 | MOOC | 1995802 | MOOCS | 0 | 0 | 0 | 0 | 100 | 100 | 2 |
| | | | **Total** | **0** | **0** | **18** | **50** | **50** | **100** | **14** |

**Total Credits = 17+21+21+21.5+24+21+21+14=160.5**

# Program: ENGINEERING AND TECHNOLGOY PROGRAM

| Year and Semester: | III B.Tech – I Sem | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995501 | Theory of Machines - II | 3 | 0 | 0 | 30 | 70 | 3 |

**Course Objectives:**

| | |
|---|---|
| **CO 1** | To help students to understand and learn the gyroscopic effect on vehicles and concept of gears |
| **CO 2** | To teach students the balancing procedures for rotating and reciprocating masses |
| **CO 3** | To teach students and make them analyze the fundamental concepts of vibrations and cam-follower motion |

**COURSE OUTCOMES:** At the end of the course, student able to

| | |
|---|---|
| **CO 1** | To understand the principle of gyroscope effect and apply the effect of gyroscope on ships, aero planes and automobiles |
| **CO 2** | To compare tooth profiles of gears, explain interference and compute velocity ratio of different gear trains |
| **CO 3** | To develop the balancing test on rotating & reciprocating masses |
| **CO 4** | To recall classification of different types of vibrations and determine the natural frequencies of different systems under vibrations. |
| **CO 5** | To draw the cam profiles for given follower motions and calculate acceleration for cams with specified contours. |

**SYLLABUS:**

**UNIT I:**

**Gyroscopic Couple and Precessional Motion**: Precessional and angular motion- gyroscopic couple- effect of gyroscopic couple on an aero plane and on a naval ship, stability of a four-wheel vehicle moving in a curved path.

**UNIT II:**

**Toothed gearing & Gear Trains**: Classification of toothed wheels, technical terms, conditions for constant velocity ratio of toothed wheels - Law of gearing - Velocity of sliding of teeth, forms of teeth- Length of contact, arc of contact - interference in involute gears - Types of gear trains - Simple, compound, reverted and epicyclic gear trains- Velocity ratio of epicyclic gear train- Tabular method.

**UNIT III:**

**Balancing of Rotating and Reciprocating Masses:** Balancing of a single rotating mass - balancing of several masses revolving in the same plane and different planes - Primary and secondary unbalanced forces of reciprocating masses - Partial balancing of unbalanced primary forces in a reciprocating engine.

**UNIT IV:**

**Vibrations: Longitudinal, Transverse and Torsional Vibrations:** Definitions- Types of vibrations- Natural frequencies of free longitudinal vibrations of systems having single degree of freedom

Natural frequency of free transverse vibrations due to point load and uniformly distributed load acting over a simply supported shaft – Natural Frequency for a shaft subjected to number of point loads.

Natural frequency of free torsional vibrations- Free torsional vibrations of single rotor system, two rotor system, three rotor system and gear system.

**UNIT V:**

**Cams:** Classification of followers and cams- Definitions- Motions of the follower- Uniform velocity- Simple harmonic motion- Uniform acceleration and retardation- Displacement-Velocity and acceleration diagrams. Construction of cam profiles- Cam with knife edged follower and roller follower.

**Text Book:**

1. Theory of Machines by S.S. Rattan
2. Theory of Machines by R.S.Khurmi &J.K.Gupta.

**Reference books:**

1. Theory of Machines by Thomas Bevan

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III-I | Regulation: | R 19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995502 | APPLIED THERMODYNAMICS-I | 3 | 1 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

This course will be able to identify issues related to thermodynamics in real world problems, use basic concepts and fundamental laws to construct thermodynamic models, apply mathematical principles to solve these models, draw conclusions based on these solutions and formulate sound recommendations based on these conclusions.

**COURSE OUTCOMES:** At the end of the course, student will be able to:

1. Undertand the basic concepts of a pure substance, phase transformation and variousproperties of steam.
2. Evaluate the performance of simple Rankine cycle and modified Rankine cycle
3. Carry thermodynamic analysis of steam nozzles and condensers under different operating conditions
4. Compute the performance parameters of Impulse and reaction turbines through constructing velocity diagrams
5. Carry thermodynamic analysis of air refrigeration and vapour refrigeration cycles andable to determine Psychrometric properties through analytical and using Psychrometrychart

**UNIT-I**

**Properties of Pure Substance**: Properties of Pure Substance: Definition of pure substance, phase change of a pure substance, property diagrams for phase change process- T-v, p-v, p-T, T-s, h-s (Mollier diagram), formation of steam, terms relating to steam formation, external work done during evaporation, internal latent heat, internal energy of steam, entropy of steam, thermodynamic process of steam-isobaric and isentropic processes only, determination of dryness fraction-throttling calorimeter, separating and throttling calorimeter.

**UNIT-II**

**Vapor Power Cycles**: Simple steam power cycle, Rankine cycle, steam rate, heat rate and thermal efficiency, actual vapor power cycle, comparison of Rankine – Carnot cycles, mean temperature of heat addition, methods for improving efficiency of Rankine cycle - reheat cycle, regenerative cycle, reheat-regenerative cycle, binary vapor power cycle , characteristics of ideal working fluid.

**UNIT-III**

**Steam Nozzles:** Types of nozzles- Flow through nozzles- Condition for maximum discharge Nozzle efficiency- Super saturated flow in nozzles- Relationship between area velocity and pressure in nozzle flow- Under expansion & over expansion.

**Steam Condensers:** Introduction, vacuum, Classification of condensers-Jet and surface condensers, Sources and effects of air leakage in condensers, Vacuum efficiency and Condenser efficiency, Determination of mass of cooling water.

**UNIT-IV**

**Steam Turbines**: Introduction, classification of steam turbines, compounding of turbines.

Impulse Turbines: Velocity diagrams and performance parameters, condition for maximum blade efficiency for single stage impulse turbine, velocity diagram for velocity compounded impulse turbine.

Reaction Turbines: Velocity diagram, degree of reaction, Parson's reaction turbine, condition for maximum blade efficiency of Parson's turbine.

**UNIT-V**

**Refrigeration**: Fundamentals of refrigeration, refrigeration systems, Coefficient of performance, Bell Colemen cycle, Vapor compression cycle- effect of suction and condensing temperature on cycle performance. Refrigerants, Properties of common refrigerants, Vapor absorption system. Principles of psychrometry and Air conditioning - Psychrometric terms, psychrometric process, air conditioning systems.

**Text Books:**

1. Thermal Engineering, by R. K. Rajput.
2. Applied Thermodynamics-II by R. Yadav.
3. Fundamentals of Engineering Thermodynamics by E. Radhakrishna, PHI.

**References:**

1. Fluid Flow Machines, by M.S. GovindaRao, Tata McGraw Hill publishing company Ltd.
2. Refrigeration and Air-conditioning, by C.P.Arora and Domokundwar.
3. Thermal Science and Engineering by D.S. Kumar, S.K. Kataria and Sons
4. Thermodynamics and Heat Engines volume 2-R.Yadav-Central book depot
5. Refrigeration and Air-conditioning, by AhamadulAmeen, PHI.

# Program: Engineering and Technology Program

| Year and Semester: | III year – I Semester (V Semester) | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 195503 | Hydraulic Machines | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. Student gain knowledge on impact of jets on different conditions of objects.
2. Student gain knowledge on types of hydraulic turbines, working and performance of turbines to evaluate.
3. Gains knowledge to distinguish between centrifugal and reciprocating pumps and their working .

**COURSE OUTCOMES:**

At the end of the course, the student will be able to:

1. Analyze the impact of jet on stationary and moving flat plates and curved vanes.
2. Analyze the performance and understand the working principles of impulse turbine
3. Analyze the performance and understand the working principles of reaction turbine
4. Predict the performance and understand the governing of turbine and the performance characteristics of turbine
5. Understand the working principles and various types of hydraulic pumps and to compute their performance

**SYLLABUS:**

**UNIT – I**

**Impact of jets**: Impulse - momentum principle, Impact of jet on stationary vertical flat plate- inclined flat plate; Impact of jet on a stationary curved plate - jet strikes at the centre - jet strikes tangentially at one end of symmetrical curved plate - unsymmetrical curved plate ; Impact of jet on moving vertical flat plate - inclined flat plate - curved plate; Impact of jet tangentially at one of the tips of an unsymmetrical moving curved plate ; Impact of jet of water on a series of vanes ; Impact of jet on a series of radial curved vanes

**UNIT – II**

**Impulse Turbines**: Introduction to hydraulic turbines, Heads and efficiencies of a turbine; Classification of hydraulic turbines; Principle of impulse turbines; Pelton wheel - construction and working ; velocity triangles - work done and efficiencies of Pelton wheel ; Design aspects of Pelton wheel - speed ratio, flow ratio, jet ratio, number of jets, number of buckets.

**UNIT- III**

**Reaction turbines:** Principle of reaction turbines; Radial flow and Axial flow reaction turbines - Component parts, construction and operation of a Francis turbine and Kaplan turbine; Velocity triangles - work done and efficiencies of Francis turbine and Kaplan turbine; Working proportions of Francis and Kaplan turbines; Construction and operation of draft tube - its function and different types - efficiency of draft tube.

**UNIT- IV**

**Performance of Hydraulic Turbines**:
Performance under unit head - Unit quantities - unit speed - unit discharge- unit power ; Performance under specific conditions - specific speed - derivation - significance; Performance characteristic curves - constant head curves- constant speed curves and Iso-efficiency curves ; Model testing of turbines; Cavitation in turbines; Governing of turbines.

**UNIT – V**

**Hydraulic pumps:** Hydraulic pumps - classification; Centrifugal Pumps: Main parts- principle and working- heads and efficiencies- Work done-Minimum speed for starting; Classification, Multi-stage centrifugal pumps, Specific speed of a centrifugal pump, Priming of a centrifugal pump, Characteristic curves ; Effects of Cavitation in hydraulic pumps. Reciprocating Pumps: Classification, main parts- working - slip, Velocity and acceleration variation in suction and delivery pipes due to acceleration of piston; Indicator diagram - Effect of acceleration in suction and delivery pipes on indicator diagram - Effect of friction in suction and delivery pipes on indicator diagram.

**TEXT BOOKS:**

1. Fluid Mechanics and Hydraulic Machinery, by R.K.Bansal, Laxmi publications

**REFERENCE BOOKS:**

1. Hydraulics & Fluid Mechanics Including Hydraulics Machines 22nd ed - Dr. Modi P.N & S.M. Seth
2. A Text book of Fluid Mechanics and Hydraulic machines by R.K.Rajput, S.Chand & Co.
3. Fluid Mechanics & Fluid power Engineering by D.S. Kumar, S.K. Katiraia & Sons publications

# Program: Engineering and Technology Programme

| Year and Semester: | III YEAR I SEMESTER | Regulation: | R 19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995504 | Metrology | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. Equip with knowledge of limits, fits, tolerances and gauging
2. Acquire knowledge on linear and angular measurements, Screw thread and gear measurement & comparators.
3. To make the students acquainted with realistic equipment for alignment test

**COURSE OUTCOMES:** At the end of the course, student able to

1. Understand tolerance, limits of size, fits, geometric and position tolerances and gaugeDesign / Select gauges, fits and tolerances for machine component
2. Use relevant instruments to measure different parameters of screw thread and gear.
3. Use linear and angular measuring instruments and the use different types of comparators.
4. Determine surface roughness using different surface testing methods.
5. Test the alignment of various machine tools such as Lathe, Milling and Drilling.

**UNIT – I**

**Limits Fits and Tolerance**

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, concept of limits of size and tolerances, fits, hole basis system, shaft basis system, types of fits, geometric tolerance, position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principles), Wear allowance on gauges, Types of gauges.

**UNIT – II**

**Measurements of screw threads and Gears**

Measurement of screw threads, major diameters, Minor diameters and effective diameter, Pitch, Limit gauges for internal and external threads, Tool maker's microscope. Measurement of spur gears, pitch, profile, tooth thickness.

**UNIT- III**

**Linear & Angular Measurements**

Measurements Straightness measurement, Slip gauges, Squareness testing, Optical bevel protractor, Sine bar, Angle gauges, Autocollimator, Angle dekkor, Flatness measurement, Roundness measurement. Comparators - Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Electric comparator, Pneumatic comparator

**UNIT –IV**

**surface texture**

Surface texture: Introduction to surface finish, Parameters, sampling length, Specification, Order of geometrical irregularities, Evaluation of Surface Finish, Stylus instruments Profilometer, CMM, Tomlinson Surface meter and Taylor-Hobson Talysurf for surface roughness measurement. .

**UNIT – V**

**Acceptance tests on machine tools**

Alignment test for Lathe, Alignment test for Milling machine, Alignment test by Radial drill, Alignment test by Laser equipment.

**TEXT BOOKS:**


1. A Textbook of Engineering Metrology, I.C. Gupta, Dhanpat Rai Publications, Delhi.
2. A Textbook of Engineering Metrology, R.K. Jain, Khanna Publishers.


**REFERENCE BOOKS:**


1. A Textbook of Metrology by M. Mahajan, Dhanpat Rai Publications, Delhi.
2. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.
3. A.S.T.M.E., Hand book of Industrial Metrology, Prentice-Hall of India, New Delhi

# Program: ENGINEERING AND TECHNOLOGY

| Year and Semester: | III & I SEM | Regulation: | R 19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995505 | Industrial & Entrepreneurial Engineering | 3 | 1 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. To produce graduates with the ability to adopt a system approach to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy.
2. To enable students to understand the interactions between engineering, business, technological and environmental spheres in the modern society.
3. To enable students to understand their role as engineers and their impact to society at the national and global context

**COURSE OUTCOMES:**

At the end of the course students will be able to

1. Apply management theories in organization and aware of personal management techniques to motivate the workers.
2. Understand the growth of small scale industries and Government policy for small scale industry.
3. Understand the economics of plant layout.
4. Aware of materials handling principles and equipment
5. Understand the fundamentals of economic systems and various factors of production.

**UNIT – I Introduction to personnel management-** Functions, Motivation, Theories of motivation, Hawthrone studies, Discipline in industry, Promotion, Transfer, lay off and discharge, Labour turnover.

**UNIT – II Entrepreneurship**- definition. Growth of small scale industries in developing countries and their positions vis-a-vis large industries; role of small scale industries in the national economy; characteristics and types of small scale industries; demand based and resources based ancillaries and sub-control types. Government policy for small scale industry; stages in starting a small scale industry.

**UNIT- III Plant Layout**: Economics of plant location, Rural Vs Suburban sites, Types of layouts, Types of building, Travel chart technique, Assembly line balancing simple problems.

**Materials Handling**- Principles, Concept of unit load, Containerization, Pelletization, Selection of material handling equipment, Applications of belt conveyors, Cranes, Forklift trucks in industry.
**Plant Maintenance:** Objectives and types.

**UNIT –IV Materials Management:** Introduction, Purchasing, Objectives of purchasing department, Buying techniques, Purchase procedure, Stores and material control, Receipt and issue of materials, Store records. Inventory Control, EOQ model(Simple problems).

**UNIT – V Economic Systems and Factors of Production**: Economic Systems - Capitalism, Socialism and Mixed Economy; Factors of Production -Classification of Factors of Production - Meaning and characteristics of Land, Labor, Capital and Organization.

**TEXT BOOKS:**


1. Industrial Engineering Management, by Dr. O. P .Khanna.
2. Havinal, Veerbhadrappa, "Management and Entrepreneurship" New Age International.
3. Managerial Economics and Financial Analysis - By A.R. Aryasri, Tata McGraw Hill Education Private Ltd, New Delhi.


**REFERENCE BOOKS:**


1. Principles of Management by Koontz &Donnel.
2. Production and Operations Management by Everette Adam & Ronald Ebert.
3. Operations Management by John McClain & Joseph Thames.
4. Industrial Engineering and Production Management by Telsay, S. Chand & Co.

# Program: ENGINEERING AND TECHNOLGOY PROGRAM

| Year and Semester: | III-I | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995506A | MECHATRONICS | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. Find the importance of industrial automation to reduce the production time
2. Development of the various modelling and simulation techniques to analyses the physical systems
3. Application of electronics and electrical principles to mechanical systems

**COURSE OUTCOMES:**

**After completion of this course, the students will be able to**

1. Understand mechatronics systems and its working principles
2. Known the basic principles of sensors, transducers, limit switches and relays
3. Able to understand the advanced industrial applications by fundamental knowledge of mechatronics principles.
4. Signals, system controls, and time delays are all known.
5. Able to understand the sensors condition monitoring and artificial intelligence in mechatronics.

**SYLLABUS:**

**UNIT-I**

**Mechatronics system design:** Introduction to Mechatronics: What is mechatronics, integrated design issues in mechatronics, Mechatronics key elements, the mechatronics design process, advanced approaches in mechatronics.

**UNIT-II**

**Modeling and simulation of physical systems:** Simulation and block diagrams, Analogies and impedance diagrams, Electrical systems, Mechanical translational systems, Mechanical rotational systems, electromechanical coupling, Fluid systems.

**UNIT-III**

**Sensors and transducers:** An introduction to sensors and transducers, Sensors for motion and position measurement, Force, torque and tactile sensors, Flow sensors, Temperature-Sensing devices. Actuating devices: Direct current motor, Permanent magnet stepper motor, Fluid power actuation.

**UNIT-IV**

**Signals, systems and controls:** Introduction to signals, systems and controls, System Representation, Linearization of nonlinear systems, Time delays.

**Real time interfacing:** Introduction, Elements of a data acquisition and control system, Overview of the I/O process, Installation of the I/O card and software.

**UNIT-V**

**Advanced applications in mechatronics:** Sensors for condition monitoring, Mechatronic Control in automated manufacturing, Artificial intelligence in mechatronics, Micro sensors in Mechatronics.

**Text Book:**

1. Mechatronics System Design by DevdasShetty and Richard A. Kolk, P.W.S. Publishing Company, 2001.

**References:**

1. Mechatronics by W. Bolton, Pearson Education, Asia, II-Edition, 2001
2. Introduction to Mechatronics and Measurement Systems by David G. Alciatore and Michael B. Histand, Tata McGraw Hill Company Ltd.

# Program: ENGINEERING AND TECHNOLOG YPROGRAM

| Year and Semester: | III year I semester | Regulation: | R 19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995506 B | WORK STUDY | 03 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. To provide basic understanding to the students about the concept and significance of work study as a tool for increasing the efficiency and effectiveness in organizational systems.
2. To impart through knowledge and skills to students with respect to allowances, rating,calculation of basic and standard time for manual operations in an organization.
3. To develop basic ideas of ergonomics and its design.

**COURSE OUTCOMES:** At the end of the course students will be able to

1. Recollect the basic concepts of productivity, work content and define the objective and scope of Work Study.
2. Define the various charts and to construct the charts on the basis of present method and develop an improved method through questioning technique.
3. Understand the concept of allowance and rating and apply them to rate a worker engaged on a live job and calculate basic, allowed and standard time for the same.
4. Devise appropriate wage and incentive plan for the employees of an organization.
5. Determine the basic concepts of Ergonomics and demonstrate a sound knowledge of Ergonomics in engineering applications

**UNIT – I**

**Introduction:** Scientific management, Taylor's scientific management, work study-significance, applications

**Productivity:** Definition, reasons for low productivity, methods to improve productivity, work-study and productivity

**UNIT – II**

**Method Study**: Introduction - Process charts, Critical Examination, Identification of key activities on process charts, Diagrams and Templates, Therbligs, Micro motion analysis, cycle graph, Chrono-cycle graph, Memo motion study. Development and installation of new method.

**Principles of Motion Economy:** Related to human body, work place, equipment.

**UNIT- III**

**Work Measurement**: Definition, various techniques of work-measurement - work-sampling; stopwatch time study & its procedure, methods of Rating , Measuring the job ,Allowances and their types, Standard time-numerical problems; Synthetic data; Analytical estimating; PMTS ;Work factor, MTM ;Activity sampling- applications.

**UNIT –IV**

**Job Evaluation, Merit Rating, Wage Payment Plans:** Introduction, Definition, Objectives, Techniques of job evaluation, Merit rating (definition, Objectives and Methods ) , Incentives, wage-Incentive plans(Piece rate, Hasley plan, Rowan plan, Gantt plan, Bedaux plan, Emerson's efficiency plan, and group plan).

**UNIT – V**

**Ergonomics:** Basics of Ergonomics- importance, principles, applications**,** Anthropometry.

**TEXT BOOKS:**

1.InternationalLabour organization, "Work-study", Oxford and IBH publishing company Pvt. Ltd., N.Delhi
2. Elements of Work Study and Ergonomics by Dalela et al, Standard Publications.

**REFERENCE BOOKS:**

1. Industrial Engineering and management by O.P Khanna, Khanna Publishers.
2.Marvin E, Mundel& David L, "Motion & Time Study: Improving Productivity", Pearson Education
3.Industrial Engineering and Production Management, MartandTelsang, S.Chand& Company Ltd. New Delhi.

## PROGRAM: ENGINEERING AND TECHNOLOGY

| Year and Semester: | III YEAR I SEMESTER | Regulation: | R -19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995506C | Rapid Prototyping | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. Generating a good understanding of RP history, its development and applications.
2. To expose the students to different types of Rapid prototyping processes, materials used in RP systems
3. It helps the students to get familiarized with the various methods of rapid prototyping technologies and rapid tooling.

**COURSE OUTCOMES:** At the end of the course the student would able to

1. Understand the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Rapid Prototyping and tooling Technologies.
2. Understand the process capabilities of liquid and solid based rapid prototyping methods
3. Understand the process capabilities and advantages of powder based rapid prototyping techniques
4. Select the appropriate material for processing through various rapid prototyping techniques
5. Develop innovative components and products through RP applications and case studies

**UNIT I**

**INTRODUCTION:** History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format – Other translators – medical applications of RP - On demand manufacturing – Direct material deposition - Shape Deposition Manufacturing.

**UNIT II**

**LIQUID AND SOLID BASED RAPID PROTOTYPING SYSTEMS:** Classification – Liquid based system - Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

**UNIT III**

**POWDER BASED RAPID PROTOTYPING SYSTEMS:** Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

**UNIT IV**

**MATERIALS FOR RAPID PROTOTYPING SYSTEMS:** Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

**UNIT V**

**RAPID TOOLING:** Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications. Case studies - automotive, aerospace and electronic industries.

**TEXT BOOKS**

1. Rafiq I. Noorani, Rapid Prototyping, "Principles and Applications", Wiley & Sons, 2006. 89

2. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific, 2003.

**REFERENCES:**

1. N.Hopkinson, R.J.M, Hauge, P M, Dickens, "Rapid Manufacturing – An Industrial revolution for the digital age", Wiley, 2006

2. Ian Gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying", Wiley, 2006

3. Paul F.Jacobs, "Rapid Prototyping and Manufacturing : Fundamentals of Stereolithography", McGraw Hill 1993. 4. Pham. D.T., and Dimov. S.S., "Rapid Manufacturing", Springer Verlog 2001.

# Program: ENGINEERING AND TECHNOLOGY

| Year and Semester: | III year –I Semester | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995506D | Power Plant Engineering (E) | 3 | 1 | 0 | 30 | 70 | 4 |

**COURSE OBJECTIVES:**

1. Students at the end able to identify the necessity of energy generation from power plants.
2. Able to understand the working of numerous power plant and methods to improve the efficiency.
3. Identify the significance of economics related to power plants.

**COURSE OUTCOMES:** At the end of the course, student able to

1. Analyse the working of Steam Power plant layout, identify the components and understand the application of it.
2. Analyse the layout of diesel engine power plant and gas turbine plant.
3. Analyse the significance of hydrology and evaluate the layout and components utilized in working of various hydroelectric power plant.
4. Understand the working of nuclear power plant layout , importance in disposing the radioactive waste.
5. Understand the application of renewable energy sources in power plant and analyse the economics significance in any type of power plant.

**UNIT – I**

**Steam Power Plants:** Power plant cycle – improvisations, General Layout of power plant, Layout of Coal storage- Overfeed and underfeed fuel beds-Pulverized Fuel preparation and burning system -Ash handling systems-Dust collection and its disposal, Draught systems, Chimney , Boilers: Cochran, Locomotive , Babcock and Wilcox , Mountings and accessories. High pressure and high duty forced circulation boilers description -La Mont –Benson-Loeffler –Velox Boilers.

**UNIT – II**

**Internal Combustion Power Plants:** Types of engines for power generation, Super charging, Exhaust heating, fuel tanks and oil supply systems. Air supply for starting, Lubricating oils and systems of lubrication, Modern trends and design in diesel engines, Performance of CI engines, Care of diesel plants.
**Gas Turbine and other Propelled Power Plants**: Introduction – Components of gas turbine plant, Classification and comparison of different types of gas turbine power plants –different arrangements of the gas turbine plants –Governing system of gas turbine plant.

## UNIT- III

**Hydro Electric Plants:** Hydrology, Catchment, Reservoir, Run-off flow and fall, Storage and pondage, Losses due to percolation, Evaporation and transpiration. Hydrometric survey rainfall, Mass–duration and flood discharge. Frequency studies and gauging. Selection of site. Different types of plants : Low, medium and high head plants and pumped storage plants. General layout of the plant – Head works, Spillways, Canals, Tunnels, Governing, Lubrication, Penstock, Anchorages and relief valves, different types of surge tanks, intakes, Gates and Valves.

## UNIT –IV

**Nuclear Power Plants:** Nuclear Fission and Fusion - Nuclear Fuels, Breeding Components of Reactor - Fuel moderator and coolant, Control and safety rods, Classification of reactors -Pressurized water reactor(PWR)-Boiling water reactor(BWR)-CANDU reactor-Gas cooled reactor-Liquid metal cooled reactor, Radiation hazards and shielding, Radio active waste disposal.

## UNIT – V

**Direct Energy Conversion:** Solar Energy–Introduction, Solar radiation- constant, Solar collectors-storage. Wind Energy–Wind mills. Thermo Electric–MHD and introduction of other non conventional energy sources.
**Power Plant Economics**: Introduction- Connected load, Maximum demand- Demand factor -Capacity factor, Load factor, Diversity factor, Load curves-Load duration curve -Basics of Fixed cost-Operating cost of power plant-General arrangement of Power Distribution& determination of rates(tariffs)Methods.

## Text Books:


1. Power Plant Engineering by GR Nagpal,Khanna Publishers.
2. Power Plant Engineering by RK Rajput, Laxmi Publications (P) Ltd,
3. A Course in Power Plant Engineering, S.C.Arora& S.Domdundwar.


## References:


1. Power Station Engineering and Economy by Benhaedt G.A.Skrotzki, William A. Vopat, MGH Book , Inc.
2. Solar Energy by S.P. Sukhatme, T MGH pub. Co.
3. Heat Engineering, I.T. Shvets et al, MIR Pub Moscow
4. Solar Power Engineering by B.S. Magal, TMGH Pub Co..
5. Modern Power Plant Engineering by Joel Weisman, Roy Eckart, PHI.
6. A textbook of Power Plant Engineering by P.C. Sharma,S.K. Kataria&Sons, ND.
7. Fundamentals of Nuclear Power Engineering by D.K. Singhai,Khanna Pub.
8. Non ConventionalEnergy Sources, G.D.Rai.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III Year I Semester (V Semester) | | | | Regulation: | | R-19 |
|---|---|---|---|---|---|---|---|
| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
| | | L | T | P | Int | Ext | |
| 1995507A | UN CONVENTIONAL MACHINING PROCESSES | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES**

1. Understand the need and importance of non-traditional machining methods and process selection.
2. Gain the knowledge to remove material by thermal evaporation, mechanical energy process.
3. Apply the knowledge to remove material by chemical and electro chemical methods.

**COURSE OUTCOMES:** At the end of the practice, the students will be able to,

1. Understand the need and importance of non-traditional machining methods and process selection and importance of USM
2. summarize the principle and processes of abrasive, water jet machining and electro chemical techniques.
3. Understand the principles, processes and applications of thermal metal removal processes.
4. Identify the principles, processes and applications of EBM and LBM.
5. Understand the principles, processes and applications of Plasma Machining.

**UNIT – I**

Introduction – Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process, parameters, economic considerations, applications and limitations, recent development.

**UNIT - II**

Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining: Basic principles, equipment, process variable, and mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing, metal removal rate in ECM, Surface finish and accuracy.

**UNIT – III**

Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy,

Electric Discharge Grinding and electric discharge wire cutting processes, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

**UNIT – IV**

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes. Machining accuracy and applications.

General Principle and application of laser beam machining – thermal features, cutting speed, accuracy of cut and applications.

**UNIT - V**

Application of plasma for machining, metal removing mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

Chemical machining – principle - maskants - applications. Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolyte machining.

**Text Books**

1. Advanced Machining Processes / VK Jain / Allied publishers
2. Modern Machining Processes - P. C. Pandey, H. S. Shan/ Mc Graw Hill

**Reference Books**

1. Advanced Machining Processes, Hassan Abdel-Gawad El-Hofy /Mc Graw Hill
2. Unconventional Manufacturing Processes/ Singh M.K/ New Age Publishers, first edition

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III Year ISemester | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995507B | Total Quality Management | 3 | 0 | 0 | 30 | 70 | 3 |

## COURSE OBJECTIVES:

1. To understand the concept and philosophy of TQM.
2. To get acquainted with the tools of quality control.
3. To understand the quality function-Quality function deployment, Designing for quality, Manufacturing for quality.
4. Get acquainted with ISO series and the process of implementing it.
5. Will be able to apply quality tools like KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods.

## COURSE OUTCOMES:

At the end of the course, the student will be able to:

1. Understand quality management philosophies, and techniques.
2. Adopt TQM methodologies for continuous quality improvement.
3. Apply TQM process and concepts to enhance the performance of systems.
4. Understand the implications of quality management standards and systems.
5. Will be able to apply quality tools like KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods.

## UNIT – I

**Introduction:** Definition and Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs - Analysis, and Techniques for Quality Costs.

**Concepts of TQM:** Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Crossby and Muller.

## UNIT – II

**TQM process:** QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.

## UNIT- III

**TQM systems:** Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.

## UNIT –IV

**Quality system:** Need for ISO 9000 system, Clauses of ISO 9000, Implementation of ISO 9000, ISO 9000:2000 Quality System, ISO 9001:2015 Quality System - Elements, Implementation of Quality System, Quality costs, Quality Auditing, QS 9000, ISO 14000 - Concept, Requirements and Benefits, Case Studies.

**UNIT – V**

**Implementation of TQM:** Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

## TEXT BOOKS:


1. Dale H. Besterfiled, "Total Quality Management", Pearson Education.
2. Subburaj Ramasamy, "Total Quality Management", Tata McGraw Hill Publishing Company Ltd.
3. Narayana V and Sreenivasan N.S., "Quality Management - Concepts and Tasks", New Age International.


## REFERENCE BOOKS:


1. The Essence of Total Quality Management by John Bank, PHI, 1993.
2. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, McGraw Hill, 1994.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III B.Tech – I SEM | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995507C | Industrial Tribology | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

| | |
|---|---|
| **COB 1** | To help students to understand history of tribology and the role of friction, effects of wear and its classification |
| **COB 2** | To teach students about the importance of lubrication and film lubrification |
| **COB 3** | To make students analyze about surface engineering phenomenon and material selection for bearings. |

**COURSE OUTCOMES**

| | |
|---|---|
| **CO 1** | To understand the historical background of tribology and effects created by friction |
| **CO 2** | To Interpret effects of wear and factors causing it. |
| **CO 3** | To Recall different types of lubricants used and their testing methods |
| **CO 4** | To outline abut film lubrication theory and apply Reynolds equation to it. |
| **CO 5** | To Illustrate surface engineering different surface modification methods and choose required materials to bearings. |

**UNIT I:**

**Tribology & Friction:** Introduction to tribology, bearings, historical background, economic considerations.

**Friction:** Sources of sliding friction, adhesion, ploughing, energy dissipation mechanisms, friction characteristics of metals and nonmetals, friction of ceramic materials.

**UNIT II:**

**Wear:** Types of wear, various factors affecting wear, simple theory of sliding wear, mechanism of sliding wear of metals, abrasive wear, materials of adhesive and abrasive wear situation, corrosive wear, surface fatigue wear situations, brittle fracture wear, wear of ceramics, wear measurement.

**UNIT III:**

**Lubricants and Lubrication Types:** Importance of lubrication, Types and properties of lubricants, viscosity, viscometry, effect of pressure temperature on viscosity, testing methods, hydro dynamic lubrication, elasto-hydro dynamic lubrication, boundary lubrication, solid lubrication, hydrostatic lubrication.

**UNIT IV:**

**Film Lubrication Theory:** Fluid film in simple shear, Navier Stokes equation, Taylor's number, viscous flow between very close parallel plates, shear stress variation, Reynolds equation for film lubrication, high speed unloaded journal bearings, loaded journal bearings, reaction torque on the bearings.

**UNIT V:**

**Surface Engineering and Materials for Bearings:** Introduction to Ball Bearings, Surface modifications, transformation hardening, surface fusion, thermo chemical processes, surface coatings, plating and anodizing, fusion processes, vapor phase processes, materials for rolling element bearings, materials for fluid film bearings, materials for marginally lubricated and dry bearings.

**TEXT BOOKS:**


1. "Introduction to Tribology of Bearings" by BC Majumdar, S Chand Publisher.
2. "Engineering Tribology" by Prasanta Sahoo, PHI Publisher.
3. "Principles of Tribology" by Halling j., McMillan Press Ltd.
4. "Friction and Wear of Engineering Materials" by ,I.M. Hutchings, Edwar Arnold, London ,1992.
5. "Friction and Lubrication" E.P. Bowden and Tabor., Heinemann Educational Books Ltd.,1974.


**REFERENCE BOOKS**


1. Tribology Hand Book", by Neale M.J., Butterworths
2. "Introduction to Tribology of Bearings", B.C. Majumdar, H. Wheeler and Company Pvt. Ltd.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III-I | Regulation: | R 19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995507D | AUTOMOBILE ENGINEERING | 3 | 1 | 0 | 30 | 70 | 3 |

**COURSE OUTCOMES:** At the end of the course, the student able to

1. Understand the basic lay-out of an automobile.
2. Understand the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
3. Explain the working of various parts like engine, transmission, clutch, brakes
4. Describe how the steering and the suspension systems operate and understand the principles of braking systems.
5. Understand the environmental implications of automobile emissions

**UNIT I**

**VEHICLE STRUCTURE AND ENGINES**

Types of automobiles, vehicle construction and different layouts, chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine-their forms, functions and automotive materials.

**UNIT II**

**ENGINE AUXILIARY SYSTEMS**

Classification: 'In-line' and 'V' type, Multi-Valve Engines, VCR Engines, Super Charging/Turbo charging, Air filters, Electronically controlled gasoline injection system for SI engines., Electronically controlled diesel injection system ( Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system ,Turbo chargers, Engine emission control , Air pollution and their control: EGR and Catalytic Converters, EURO/Bharat Stage Norms: I, II, III, IV and V., Engine Cooling and Lubrication.

**UNIT III**

**TRANSMISSION SYSTEMS**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel –torque converter, propeller shaft, slip joints, universal joints, Differential, and rear axle, Hotchkiss Drive and Torque Tube Drive.

**UNIT IV**

**STEERING, BRAKES AND SUSPENSION SYSTEMS**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System and Traction Control

**UNIT V**

**ALTERNATIVE ENERGY SOURCES**

Use of Natural Gas, Liquefied Petroleum Gas. Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell

## Text Books:


1. Automotive Mechanics (10/e) - William H. Crouse and Donald L. Anglin, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-059054-0
2. Automobile Engineering – KK Jain/ RB Asthana, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-044529-X
3. Internal Combustion Engines and Air Pollution- E.F. Obert, Harper & Row International Publishers Inc., ISBN: 0-06-350561-4


## Reference Books:


1. Automotive Mechanics – S. Srinivasan, Tata McGraw-Hill Publishing company Limited, ISBN: 0-07-044941-6
2. Internal Combustion Engines – Heywood, John, B. McGraw-Hill Publications Limited.
3. Automotive Engines- S Srinivasan, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-040265-5

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III year – I Semester | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995503P | Fluid Mechanics and Machinery Lab | - | - | 3 | 50 | 50 | 1.5 |

**COURSE OUTCOMES:**

1. Student able to evaluate the pressure measurement by understanding the hydrostatic law, Pascal's law.
2. Students apply the Bernoulli's principle to flow meters to measure the co-efficient of discharge.
3. Students understand the working principle of Turbines and Pumps .

## LIST OF EXPERIMENTS

1 a. Calibration of Venturimeter
   b. Calibration of Orifice meter.

2 Determination of Co efficient of discharge for Nozzle meter.

3 a. Determine Co efficient of discharge for small orifice.
   b. Determine Co efficient of discharge for mouth piece.

4 Find the Co efficient of discharge for Rectangular Notch.

5 Find the Co efficient of discharge for Triangular Notch.

6 Experimentation to determine the performance of Pelton wheel.

7 Experimentation of Centrifugal pump to find the performance and draw the performance characteristic curves.

8 Performance on Reciprocating pump to draw the characteristic curves.

9 Performance of Francis turbine a study experiment.

**Program: ENGINEERING AND TECHNOLOGY**

| Year and Semester: | III YEAR I SEMESTER (V SEMESTER) | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| 1995504P | MANUFACTURING TECHNOLOGY LAB-II | L | T | P | Int | Ext | 1.5 |
| | | 0 | 0 | 3 | 50 | 50 | |

**COURSE OUTCOMES:**

1. The student would able to understand the relation between cutting forces, feed and depth of cut of various machine tools (lathe, drilling machine and milling)
2. The students would able to understand the single point cutting tool as per given tool signature.
3. The student would able to understand the various properties of sand and their testing procedure.

**List of Experiments**

1. Experiments on Lathe to establish the following Curves.
    a. Depth of Cut Vs Cutting Forces
    b. Feed Vs Cutting Forces
    c. Cutting Speed Vs Cutting Force
2. Grinding of Single point cutting tool as per given specifications (to check the tool angles).
3. Study of Chip formation on shaping machine (with lead samples).
4. Torque measurement on drilling/milling machine.
5. Effect of speed and feed on surface roughness.
6. Measurement of cutting tool temperature in turning.
7. Sieve analysis to evaluate G. F. No.
8. Moisture and Clay content test.
9. Green Compression and Shear test.
10. Shatter Index and hardness test.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III YEAR- II SEMSTER (V SEMESTER) | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| 1995601 | OPERATIONS RESEARCH | L | T | P | Int | Ext | 3 |
| | | 3 | 0 | 0 | 30 | 70 | |

**COURSE OBJECTIVES:**

1. To discuss about basic Operations Research concepts, Formation of LPP and its solution using graphical method and standard form of LPP, solving LPP using various methods.
2. To study the various solutions of transportation problems and assignment problems.
3. To study the sequencing and waiting line problems.
4. To discuss about replacement problems, inventory problems and game theory.
5. To discuss about PERT and CPM charts.

**COURSE OUTCOMES:** At the end of the course, the student able to

1. Ability to solve LPP problems using various methods
2. Ability to solve transportation problems and assignment problems using several methods.
3. Ability to solve sequencing and waiting line problems
4. Ability to solve replacement and game theory problems
5. Analyze the inventory and PERT & CPM charts.

**UNIT – I**

**Development:** Definition, Characteristics and phase of Scientific Method, Types of models. General methods for solving operations research models.

**Allocation:** Introduction to linear programming formulation, graphical solution, Simplex method, Artificial variable technique, Duality theory and Dual simplex method.

**UNIT – II**

**Transportation Problem:** Formulation optimal solution. Unbalanced transportation problems, Degeneracy. Assignment problem, Formulation optimal solution, Variations i.e., Non-square (m*n) matrix restrictions.

**UNIT- III**

**Sequencing**: Introduction, Terminology, notations and assumptions, problems with n-jobs and two machines, optimal sequence algorithm, problems with n-jobs and three machines, problems with n-jobs and m-machines, graphic solutions. Travelling salesman problem.

**Waiting lines**: Single channel Poisson arrivals, Exponential service times, Unrestricted queue with infinite population and finite population models; Single channel Poisson arrivals, Exponential service times with infinite population and restricted queue.

**UNIT –IV**

**Replacement**: Introduction, Replacement of items that deteriorate with time - value of money unchanging and changing, Replacement of items that fail completely.

**Theory of games**: Introduction, Two-person zero-sum games, The Maximum -Minimax principle, Games without saddle points - Mixed Strategies, 2xn and mx2 Games - Graphical solutions, Dominance property, Use of L.P. to games, Algebraic solutions to rectangular games.

**UNIT – V**

**Inventory**: Introduction, inventory costs, Independent demand systems: Deterministic models - Fixed order size systems - Economic order quantity (EOQ) - Single items, back ordering, Quantity discounts (all units quantity discounts), Batch - type production systems: Economic production quantity - Single items, Economic production quantity multiple items. Fixed order interval systems: Economic order interval (EOI) - Single items, Economic order interval (EOI) - Multiple items.

**Network Analysis**: Network definitions, Minimum spanning tree algorithm, Shortest root problem, Maximum flow model. Elements of project scheduling by CPM and PERT.

**TEXT BOOKS:**


1. Operations Research, Kanti Swaroop, P.K. Gupta, Man Mohan, Sulthan Chand & Sons Edition
2. Operations Research- An Introduction, Handy A Taha, Pearson Edition.


**REFERENCE BOOKS:**


1. Operations Research, Panneer Selvan, Prentice Hall of India.
2. Operations Research by S.D. Sharma.
3. Introduction to Operations Research, F.S.Hiller, G.J. Liberman, TMH.
4. Operations Research, Richard Bronson, Schaum's Series, Magrawhill.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III-II | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995602 | CAD/CAM | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. Know the development of the various design steps to manufacture the products with high quality in less time.
2. Understand the importance of the computer aided designing and manufacturing techniques

**COURSE OUTCOMES:** After completion of this course, the students will be able to

1. Understand the importance of computer in design and manufacturing of different products.
2. Interpret the various transformation systems and knowledge of various geometric modelling techniques that are used in CAD.
3. Understand the importance of finite element analysis before manufacturing a component.
4. Apply the GT coding and computer aided process planning techniques in an industry. attain the knowledge of automated material handling.
5. Examine the various computer aided quality inspection techniques and gaining knowledge of FMS & CIMS

**UNIT – I**

**Fundamentals of CAD –** Introduction, Design process, Application of computers for design; Operating systems and Hardware in CAD; The design work station - I/O Devices, CAD system configuration, Creating database for manufacturing, Benefits of CAD.

**UNIT – II**

**Interactive Computer Graphics**- Graphic display devices- Graphics system- Graphics standards, Graphical user interface; Coordinate systems; Transformation systems- 2D and 3D transformations, Linear transformation- windowing, clipping; Geometric Modeling - Modeling Techniques - Wire frame Modeling - Surface Modeling - 3 D Solid Modeling. Boundary representation (B-rep) and Constructive Solid Geometry (CSG).

**UNIT- III**

**Introduction to Finite Element Analysis –** Types of elements – 1D, 2D and 3D elements; Steps of FEM for solving physical problem, CAD techniques to finite element data preparation- Automatic mesh generation- Presentation of results - CAD applications of FEM.

**UNIT –IV**

**Group technology** - Classification and Coding systems, Merits & demerits, Applications of GT; Cellular manufacturing.

**Computer aided process planning** - Introduction to process planning, Methods of process planning, Computer aided process planning, CAPP systems

**Computer aided material handling -** Robots: Structure and operation and configuration of Robots, robot sensors and applications, Automated guided vehicles.

**UNIT – V**

**Computer aided inspection and quality control** - Quality assurance and quality control. Contact and Non-contact inspection techniques - Coordinate measuring machine.

**FMS & CIM**S - Building blocks of Flexible Manufacturing Systems (FMS), Machining systems of FMS, Tool management systems, Advantages of FMS, Computer integrated manufacturing systems (CIMS).

**TEXT BOOKS:**

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D. Groover & E.W. Zimmer.
2. Computer Aided Manufacturing, by P.N. Rao, N.K. Tewari & T.K. Kundra, Tata McGraw-Hill publishing company Ltd, New Delhi.

**REFERENCE BOOKS:**

1. Computer Aided Design and Manufacturing, by Dr. Sadhu Singh, Khanna Publishers.
2. CAD/CAM/CIM by Radhakrishna, New age international.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III year –II Semester | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| 1995603 | Advanced Thermodynamics II | L | T | P | Int | Ext | 4 |
| | | 3 | 1 | 0 | 30 | 70 | |

**COURSE OBJECTIVES:**

1. Students would appreciate the fundamentals of IC engines being extended to Working of real time applications.
2. Students might come out with pioneering ideas which may be extended in the form of Projects
3. Course could bridge the gap between conventional and non-conventional methods of power generation.

**COURSE OUTCOMES:** At the end of the course, the student able to

1. Student could distinguish between the CI and SI engine and thermal analysis of air cycles.
2. Gain knowledge on importance of stages of combustion in SI and CI engines and understand the significance of combustion chamber design and fuel rating.
3. Students understand the working of types of compressors and evaluate the efficiency.
4. Understand the working of Gas Turbine plants and Nuclear power plants.
5. Students identify the different renewable energy sources and could understand the significance of those sources.

**UNIT – I**

**I.C. engines:** Heat Engine, IC Engine Classification, Working principles of two stroke and four stroke engines, Comparison of S.I. and C.I. engines, Thermal analysis of Air cycles-Otto- Diesel-Dual - Problems, Stirling- Ericson and Atkinson cycles representation on P-V and T-S diagrams ,Valve timing and port timing diagrams, Efficiencies- air standard efficiency- indicated thermal efficiency- brake thermal efficiency-mechanical efficiency-volumetric efficiency and relative efficiency- Problems, Basic introduction to testing of IC engine.

**UNIT – II**

**Combustion in I.C. Engines:**

**S.I. engines**- Normal combustion and abnormal combustion, Importance of flame speed and effect of engine variables, types of abnormal combustion, pre-ignition and knock, Fuel requirements and fuel rating, anti-knock additions, Combustion chamber -requirements and Types.

**C.I. engines**- Stages of combustion, Delay period and its importance, effect of engine variables, diesel knock, suction compression and combustion induced turbulence, open and divided combustion chambers, Fuel requirements and fuel rating.

**UNIT- III**

**Reciprocating and Rotary Compressors:** Reciprocating compressors- working of single stage compressor -effect of work with and without clearance, volumetric efficiency, isothermal efficiency, multi stage compressors-effect of inter cooling in multi stage compressors
Vane type blower- Centrifugal compressor- Components-Adiabatic efficiency- Diffuser- Axial flow compressors- Velocity diagrams, degree of reaction, performance characteristics.

**UNIT –IV**

**Gas Turbines:** Simple gas turbine plant- Ideal cycle, closed cycle and open cycle for gas turbines- Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle, Parameters of performance- Actual cycle, regeneration, Inter-cooling and reheating, comparison of closed and semi-closed cycle-Jet propulsion and Rockets.

**Nuclear Power Plants:** Nuclear Fission and Fusion - Nuclear Fuels, Breeding Components of Reactor - Fuel moderator and coolant, Control and safety rods, Classification of reactors -Pressurized water reactor(PWR)-Boiling water reactor(BWR)-CANDU reactor-Gas cooled reactor-Liquid metal cooled reactor, Radiation hazards and shielding, Radio active waste disposal.

**UNIT – V**

**Direct Energy Conversions and non conventional energy sources**: Solar Energy Introduction, Solar radiation, Solar collectors, Energy storage-Wind Energy- Wind mills types – Working of Horizontal and Vertical, Thermo Electric- MHD.

**Text Books:**

1. I.C. Engines by V. Ganesan.
2. Thermal Engineering, by R.K.Rajput.

**References:**


1. Applied Thermodynamics-II by R. Yadav.
2. A Treatise on Heat Engineering by Vasandhani and Kumar
3. Gas Turbines, by Cohen and Rogers.
4. I.C. Engines / Heywood /McGrawHIll
5. Fluid Flow Machines, by M.S. GovindaRao, Tata McGraw Hill publishing company Ltd.
6. Power Plant Engineering, P.K.Nag
7. Non ConventionalEnergy Sources, G.D.Rai

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III year II semester (VI semester) | Regulation: | R 19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995604A | Production Planning and Control | 03 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1)To make the student understand the concept of Production planning and production control.

2)To make the student understand the different types of production and their selection criteria and make the student knowledgeable to deal with production planning and control in different types of production.

3) To make the student to understand the concept of forecasting and its necesicity in real world requirements and its linkage to other functions of production manager

**COURSE OUTCOMES:** At the end of the course, the student able to

1. Student is able to participate and can interact in real world scenario regarding production planning and production control and suggest the type of production required for specific real world requirement.
2. Student can undertake the responsibility of doing forecasting in real world situation is able to suggest correct forecasting method/technique for a specific real world situation
3. Student can understand the need of inventory control and can able to undertake activities relating to inventory management.
4. The student is knowledgeable about MRP-1&2, JIT , Aggregate planning can able to implement them in real world situation.
5. Student can understand and participate in the design of both forward and backward scheduling and Master scheduling and can able to evaluate different job shop schedules with reference to priority scheduling rules.

**UNIT-I Introduction :** Definition – Objectives of production Planning and Control – Functions of production planning and control – Types of production – Organization of production planning and control department.

**UNIT -II Forecasting :** Importance – Types of forecasting– Forecasting techniques – qualitative methods and quantitative methods.

**UNIT -III Inventory management :** Functions of inventories – relevant inventory costs – EOQ model – Inventory control systems – ABC analysis – VED analysis Material Requirement Planning, Bill of material, MRP II, Master Production Scheduling.

**Aggregate planning,:** Chase planning, Expediting, controlling aspects.

**UNIT -IV Routing :** Definition – Routing procedure –Route sheets — Factors affecting routing, procedure – Difference with loading

**UNIT - V Scheduling:** Policies – Types of scheduling- Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – Job shop Scheduling – 2 jobs and n machines – Line of Balance.

**Dispatching :** Activities of dispatcher – Dispatching procedure – follow up – priority rules for dispatching jobs. Applications of computer in production planning and control.

**Text Books:**

1. Elements of Production Planning and Control / Samuel Eilon.
2. Modern Production/ operation managements / Baffa&RakeshSarin

**References:**

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach / John E. Biegel.
4. Operations Management / Joseph Monks.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III B.Tech – II Sem | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995604B | Experimental Stress Analysis | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

| | |
|---|---|
| **COB 1** | To help students to understand overview of experimental stress analysis and how light can be used to determine the stresses in a component |
| **COB 2** | To teach students about the 3D photo elasticity and importance of a hologram |
| **COB 3** | To teach students about different photo elastic coatings and make them analyze about strain gauges and their sensitivity |

**COURSE OUTCOMES:** By the end of this course student will be able to

| | |
|---|---|
| **CO 1** | To outline about the methods of experimental stress analysis and strain gauges |
| **CO 2** | To understand the usage of light to find stresses in a component |
| **CO 3** | To infer about 3D photo elasticity and hologram inferometry |
| **CO 4** | To choose photo elastic coating materials |
| **CO 5** | To inspect about sensitivity of different strain gauges. |

**SYLLABUS**

**UNIT I:**

Overview of Experimental stress analysis - Stress, strain and displacement fields – Physical principle of strain gauges, photo elasticity and Moire - Introduction to Moire – Multi-scale analysis in Experimental mechanics – selection of an experimental technique.

**UNIT II:**

Transmission Photo elasticity – Introduction – ordinary and extraordinary rays – light ellipse, passage of light through crystal plate – stress optic law – plane polariscope – jones calculus – circular polariscope – determination of photo elastic parameters – calibration of photo elastic materials.

**UNIT III:**

Introduction to three dimensional photo elasticity and digital photo elasticity – introduction to brittle coatings, holograph – hologram inferometry and speckle methods.

**UNIT IV:**

Photo elastic coatings – introduction – correction factors – coating materials – selection of coating thickness – industrial application of photo elastic coatings – calibration of coatings.

**UNIT V:**

Strain gauges – introduction – sensitivity of strain gauges – bridge sensitivity – rosettes – performance of strain gauge system – selection of strain gauge – bonding of strain gauge.

**Text Book:**


1. Dally,J.W., and Riley, W.F., Experimental Stress Analysis, 4/e, McGraw-Hill Inc. , 2005.


**References:**


1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., Experimental Stress Analysis,Tata McGraw-Hill, 1984.
2. Hetyenyi M., Hand book of Experimental Stress Analysis, John Wiley and Sons Inc., 1972.

# Program: ENGINEERING AND TECHNOLOGY

| Year and Semester: | III Year II Semester | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995604C | Tool Design | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. To make the student to be familiar with jigs and fixtures
2. To make the student able to locate and clamp the devices in industries for manufacturing, inspection and assembly processes.
3. The make the student able to design dies, fixtures and cutting tools for a given component for conventional and NC machines.

**COURSE OUTCOMES:** At the end of the course, the student will be able to:

1. Analyze and design the locating and clamping system for the given component.
2. Classify jigs and fixtures and design jigs and fixtures for given component.
3. Choose and design the appropriate dies for producing a given component.
4. Design single point and multipoint cutting tools for conventional and CNC Machining.
5. Design jigs and fixtures for conventional and NC machining

**SYLLABUS:**

**UNIT – I**

**Introduction:** Tool design - An overview, Introduction to Jigs and fixtures.

**Locating and Clamping of Devices:** Principles of Jigs and Fixtures design, Locating principles, Locating elements, Standard parts, Clamping devices, Mechanical actuation, Pneumatic & hydraulic actuation, Analysis of clamping forces, Tolerance and error analysis.

**UNIT – II**

**Jigs & Fixtures:** Drill bushes, Different types of jigs, Plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs, Automatic drill jigs, Rack & Pinion operated, Air operated jigs components.

General principles of turning, milling and broaching fixtures, Grinding, drilling and shaping fixtures, Assembly, Inspection and Welding fixtures, Modular fixtures.

Design and development of jigs and fixtures for simple components.

**UNIT- III**

**Press Tools:** Introduction to press and classifications, Press working terminology, Computation of capacities and tonnage requirements, Introduction to Centre of pressure, Design and development of various types of cutting, forming and drawing dies.

**UNIT –IV**

**Design of cutting tools:** Introduction to cutting tools, Design of single point cutting tool, Design of drill bit, Design of milling cutter.

**UNIT – V**

**Tool Design for Numerically Controlled Machine Tools:** Fixture Design for Numerically Controlled Machine Tools, Cutting Tools for Numerical Control, Tool-holding Methods for Numerical Controlled Machine Tools.

**TEXT BOOKS:**


1. Donaldson. C, Tool Design, Tata McGraw-Hill, 1986
2. Basu, Mukherjee, Mishra, Fundamentals of Tool Engg. Design, Oxford & IBH Publishing, N. Delhi


**REFERENCE BOOKS:**


1. A. K. Goroshkin, Jigs and Fixtures Handbook, Mir Publishers, Moscow, 1983.
2. Production technology, HMT, Tata McGraw Hill.
3. Die Design Handbook, Ivana Suchy, McGraw Hill Book Co., 2005.

# Program: ENGINEERING AND TECHNOLGOY PROGRAM

| Year and Semester: | III-II | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995604D | FINITE ELEMENT ANALYSIS | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

1. This subject deals with fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures.
2. Emphasis an ability to apply knowledge of mathematics, science and engineering to do the analysis of simple and complex elastic structures using the finite element analysis.
3. Demonstrate an ability to design and conduct numerical analysis as well as analyze and interpret the results.

**COURSE OUTCOMES:**

**After completion of this course, the students will be able to**

1. Ability To gain the knowledge and understand the basics concepts of Finite element analysis.
2. Ability to understand the mathematical problems and get experience for problems solving of machine members.
3. To gain the knowledge of dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
4. Ability to understand advanced computing techniques and tools in the area develop the applications of FEA in engineering. To gain experience in the application of FE analysis to real engineering designs/Problems.
5. Get experience to implement different FEA/FEM tools for solving Structural engineering problems and write code for some of them in MATLAB.
6. To build up the skills in the actual implementation of FEM methods (e.g. boundary conditions, Elements, Meshing etc.) in using commercial FEM codes. Also get exposure to solve problems by using analysis software's like ANSYS/NISA/NASTRAN etc

**UNIT-I**

**Fundamental Concepts:** Introduction, Historical background, Outline of presentation, General procedure for FEA, Stresses and Equilibrium, Boundary conditions, Strain- Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy

and equilibrium. The Rayleigh-Ritz method, Hamilton's principle.Galerkin's method, Saint Venant's principle.

**UNIT-II**

**One-dimensional Problems:** Introduction, Finite element modeling, coordinates and Shape functions. The potential energy approach. The Galerkin approach, Assembly of the global stiffness matrix- mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects. Trusses: Introduction, Plane trusses, Three-dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

**Two-dimensional Problems**: Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle, In plane and Bending, problem modeling and boundary conditions.

**UNIT-III**

**Axisymmetric Solids Subjected to Axisymmetric Loading:** Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

**UNIT-IV**

**Two-dimensional Isoparametric Elements and Numerical Integration:** Introduction, The four-node quadrilateral, Numerical integration, requirements, h-refinement and p-refinement, Higher-order elements, Convergence

**UNIT-V**

**Beams and Frames:** Introduction, Finite element formulation, Load vector, Boundary Considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

**Text Book:**


1. Introduction to Finite Elements in Engineering, by Tirupati R. Chandrupatla, Ashok D.Belegundu.


**References:**


1. Introduction to Finite Element Method, by S.S.Rao
2. Finite Element Method, by O.C. Zienkiewicz.
3. Concepts and Applications of Finite Element Analysis, by Robert D. Cook.
4. Introduction to Finite Element Method, by J.N.Reddy.

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III B.Tech – II SEM | Regulation: | R19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995605 | Design of Machine Elements | 3 | 0 | 0 | 30 | 70 | 3 |

**COURSE OBJECTIVES:**

| | |
|---|---|
| **CO 1** | To Acquainted with standards like ASTM, ASME etc. and to analyze static and fluctuating stresses |
| **CO 2** | To learn to formulate Stress and strains for Temporary fasteners and design of power transmission elements |
| **CO 3** | To learn and design of springs under static and dynamic conditions |

**COURSE OUTCOMES:** At the end of the course, the student able

| | |
|---|---|
| **CO 1** | To understand standards used for machine elements, different materials used in manufacturing and their mechanical properties |
| **CO 2** | To able to define different stresses in machine members and apply theories of failures in machine components. |
| **CO 3** | To recall different forms of screw threads, welded joints and analyze permanent joints under concentric and eccentric conditions |
| **CO 4** | To design and analyze shafts, couplings and keys under various loading conditions |
| **CO 5** | To classify different types of spring and their terminology, and design spring system. |

**SYLLABUS:**

**Unit I:**

**Introduction to Mechanical engineering design:** Traditional design methods - different design models - Problem formulation - Design considerations, engineering materials and processes and their selection - BIS designation of steels - Mechanical properties, Load determination, manufacturing considerations in design

**Unit II:**

**Design against static loads, fluctuations and fatigue stresses:** Modes of failure, Factory of safety - Axial, bending and torsional stresses - Stress concentration factors. Static failure theories.

Soderberg - Goodman and modified Goodman diagrams - fatigue failure - design consideration in fatigue

**Unit III:**

**Threaded and welded joints:** Forms of threads, basic types of screw fastenings - ISO metric screw threads - eccentrically loaded bolted joints, Fluctuations loads on bolted joints.

Types and strength of weld joints subjected to bending and fluctuating loads - welding inspection.

**Unit IV:**

**Shafts, keys and couplings:** Shafts design on strength basis, torsional rigidity basis, Design of hollow shafts, flexible shafts, ASME codes for shafts, Keys - introduction, Flat, square keys, Couplings - Rigid and flange couplings, Flexible couplings

**Unit V:**

**Spring Design:** Classification and spring materials - Design of helical compression springs, helical extension springs, torsion springs, leaf springs - Surge in springs, nipping and shot peening.

**Text Books:**

1. Design of Machine Elements by V.B.Bhandari, TMH Publishing Co. Ltd., New Delhi

**References:**

1. Machine Design by Jain, Khanna Publications.
2. Machine Design by Pandya and Shaw, Charotar publications

# Program: ENGINEERING AND TECHNOLOGY

| Year and Semester: | III YEAR II SEMESTER | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| 1995606O | BASIC MECHANICAL ENGINEERING | L | T | P | Int | Ext | 3 |
| | | 3 | 0 | 0 | 30 | 70 | |

**COURS OBJECTIVES:**

Basic Mechanical Engineering Practices is a basic subject for all branches of Engineering and Technology. This subject is aimed at providing basic understanding of the fundamentals of practical sections; mainly planning, marking, cutting, filing, wiring connections, standards & conventions of wiring, the tools, the use of measuring instruments in engineering applications and plumbing tools and practices.

The subject is planned to include sufficient practices which would help the student to understand the principles of manufacturing.

**COURSE OUTCOMES:** At the end of the practice, the students will be able to,

1. Acquire skills in basic engineering practice.
2. Identify the hand tools and instruments.
3. Study and use measuring instruments.
4. Practical skills in the fitting, Carpentry and wiring trades.

**Carpentry**

Introduction to various types of wood such as Deodar, Teak, Mango, Sheesham, etc. Demonstration, function and use of commonly used hand tools. Introduction to various types of wooden joints, their relative advantages and uses. Care, maintenance of tools and safety measures.

1. Job – I: Preparation of half lap joint
2. Job – II: Preparation of TEE-Joint

**Welding**

Introduction to welding and its importance in engineering practice, types of welding, common materials that can be welded, introduction to welding equipment e.g. A.C. welding set, D.C. rectifier, Electrode holder, electrodes and their specifications, welding screens and other welding related equipment and accessories. Electric arc welding, preparation ,procedure and precautions while using electric arc welding,

1. Job – I: Preparation of Lap weld joint
2. Job – II: Preparation of Butt weld Joint

**House Wiring.**

Introduction, of common electrical materials such as wires, cables, switches, fuses, ceiling roses, PVC Conduits, PVC Channels and allied items, tools and accessories. Electrical safety measures and about use of protective devices. Such as fuses, MCBs and relays Job I Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin, plugs. Job II Preparation of a house wiring circuit on wooden board using fuse, Switches, socket, holder,

ceiling rose etc. by PVC Conduit and PVC casing and capping. Study of common electrical appliances such as electric iron, electric kettle, ceiling fan, table fan, electric mixer, electric Geyser, gas geyser, desert cooler, refrigerator, water purifier

1. Job - 1: One lamp controlled by one-way switch – measure and check the voltage and current using multimeter.
2. Job – 2: Two lamps connected in series - measure and check the voltage and current using multimeter.
3. Two lamps connected in parallel - measure and check the voltage and current using multimeter.

**TEXT BOOKS**

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay

2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

3. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd. New Delhi

4. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi

5. Workshop Technoogy by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi

6. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi

# Program: ENGINEERING AND TECHNOLOGY

| Year and Semester: | III B.Tech – II Sem | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Course | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995603P | Engines and Mechanisms Lab | 0 | 0 | 3 | 50 | 50 | 1.5 |

## COURSE OUTCOMES

| | |
|---|---|
| **CO 1** | The Student will be able to understand the practical training on the basics of internal combustion engines, Compressor. |
| **CO 2** | The Student will be able to understand various mechanisms and apply the kinematic principles to them |
| **CO 3** | The Student will be able to understand the theoretical concepts of Gyroscope, Balancing of masses through practical performance assessment. |

## LIST OF EXPERIMENTS

1. To Conduct Load Test on IC Engine and draw performance curves
2. To calculate the Air-Fuel ratio for a given load on IC Engine.
3. To draw Heat Balance Sheet on IC Engine
4. Study of Multi-cylinder Engine and determination of its firing order
5. To calculate the efficiencies at different pressure conditions of an Air Compressor
6. To Verify Laws of Balancing using motorized balancing apparatus
7. To determine the ratio of times and ram velocities of Withworth quick return mechanism
8. To find the magnitude of gyroscopic couple and compare it with theoretical value using motorized gyroscopic apparatus

# Program: ENGINEERING AND TECHNOLOGY PROGRAM

| Year and Semester: | III YEAR – II SEMESTER | Regulation: | R-19 |
|---|---|---|---|

| Course code | Title of the Lab | Contact Hours/week | | | Allotment of Marks | | Credits |
|---|---|---|---|---|---|---|---|
| | | L | T | P | Int | Ext | |
| 1995604P | Metrology and Mechatronics Lab | 0 | 0 | 3 | 50 | 50 | 1.5 |

**COURSE OUTCOMES:**

1. Demonstrate the necessary skills for calibration and testing of different instruments.
2. Demonstrate the necessary skills to collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures using various metrology instruments.
3. Develop the ability to apply the principles in instruments and measuring techniques.

**METROLOGY LAB. EXPERIMENTS - (Any Five)**

1. Calibration of the following instruments: (using slip gauges)
   i. Calibration of Micrometer. ii. Calibration of Vernier Height Gauge.
   iii. Calibration of Vernier Caliper. iv. Calibration of Dial Gauge.
2. Measurement of taper angle using
   i. Bevel Protractor ii. Dial Gauge iii. Sine-Bar iv. Auto-Collimator.
3. Alignment tests:
   i. Parallelism of the spindle ii. Circularity & Concentricity of the spindle
   iii. Trueness of running of the spindle.
4. Gear parameters Measurement
   i. Diameter, pitch/module ii. Pitch circle diameter iii. Pressure angle
   iv. Tooth thickness.
5. Measurement of Central Height of Spigot
6. Check the Straightness of a surface plate.
   i. Using spirit level ii. Using Auto-collimator
7. Tool Maker's Microscope:
   i. Establish the thread details ii. To find the cutting tool angles.
8. Profile of Gear Tooth and Screw Thread and compare the parameters by
   i. Profile Projector ii. Gear tooth Vernier Calipers
9. Miscellaneous:
   i. To find the diameter of a cylindrical piece ii. Taper angle of a V-block

**MECHATRONICS LAB. EXPERIMENTS - (Any Five)**

I. Training on Programmable Logic Controller (any ONE of the Following)
- i) Lift Control Using Ladder Logic Programme
- ii) Traffic Signal Control using Ladder Logic Programme

II. Training on Programmable Logic Controller - Sensor Training Kit
- a) Proximity Switch
- b) Photo Electric Switch
- c) Limit Switch

III. Training on Sensor and Transducer (any ONE of the Following)
- i). Linear position or Force applications
  - a. LVDT (Linear variable differential transformer)
  - b. The strain gauge Transducer
- ii). Rotational Speed or Position Measurement (The inductive Transducer)
- iii). Linear or Rotational Motion
  - a. D.C. Solenoid
  - b. D.C. Relay

IV. Training on Automation Studios
- i). Punch Machine operation
- ii). Hydraulic Cylinder operation

V. Training on Material Handling

VI. Training on any Controller Package

VII. Training on Servo Fundamental Trainer.