SHRI GURU GOBIND SINGHJI INSTITUTE OF ENGINEERING TECHNOLOGY VISHNUPURI, NANDED – 431 606
S. Y. B.Tech (PRODUCTION) Revised
From the batch 2010-11

Sr No	Course Code	Course Name	Credits	Theory (Hrs/Week)	Tutorial (Hrs/Week)	Practical (Hrs/Week)
		Odd Semester				
1	MA201	Engineering Mathematics-III	4	3	1	--
2	PR232	Strength of Material	4	3		2
3	PR233	Thermal Engineering - I	3	2		2
4	PR234	Machining Processes	3	3		--
4	PR235	Metrology and Inspection	4	3		2
5	PR 236	Manufacturing Lab. I	2	--		4
6	PR237	Computer Lab.	1	--		2
7	PR238	Term Sessionals - I	2	No structured contact hours allotted		
		Sub Total	**23**	**14**	**1**	**12**
		Even Semester				
8	PR241	Engineering Mathematics-IV	4	3	1	--
9	PR242	Theory of Machines	5	4		2
10	PR243	Engineering Materials and Metallurgy	3	2		2
11	PR244	Thermal Engineering - II	4	3		2
12	PR245	Machine Drawing and CAD	3	2		2
13	HU202	Communication Skills	1			2
14	PR247	Term Sessionals - II	2	No structured contact hours allotted		
		Sub Total	**22**	**14**	**1**	**10**
		Total	**45**	**28**	**2**	**22**

The evaluation of subject matter (Theory) shall be Continuous and consist of midterm examination of 30 marks and End term (70 Marks) Examinations as per the Academic Calendar of the Institute. The evaluation of term work and practical shall also be continuous. Evaluation of term sessionals will be carried out at the end of the semester (during the slot provided for practical examinations) by appointment of panel of external examiners (2/3 members) and a faculty representative from the department.

CHAIRMAN, DUGPC AND
HEAD, PRODUCTION ENGINEERING DEPARTMENT

ODD SEMESTER

MA201: ENGINEERING MATHEMATICS-III

For all courses of S.Y.B.Tech. Semester-I
(L-3, T-1, P-0, CR-4)

SECOND ORDER DIFFERENTIAL EQUATIONS:

Homogenous linear differential equations for real and complex roots. Modeling: free oscillations, Euler-Cauchy equation, Existence and Uniqueness theorem (with out proof) and Wronskian, non-homogenous equations, solutions by undetermined coefficients and variation of parameter methods. Modeling: forced oscillations, resonance and electrical circuits, system of differential equations. (15 Hours)

LAPLACE TRANSFORM (LT):
Definition, existence theorem, linearity property of LT, LT of standard functions, theorems on LT, Inverse Laplace transforms (ILT), convolution theorem, unit step function, impulse function, LT of periodic functions, applications to initial and boundary value problems.
(15 Hours)

FOURIER SERIES :
Periodic functions, Fourier theorem, Fourier series, Euler's formulas for the Fourier coefficients, convergence of Fourier series, Change of interval, even and odd functions, half range Fourier Series.
(10 Hours)

PARTIAL DIFFERENTIAL EQUATIONS:
Separation of variables, Vibrations of string, One dimensional Heat Equation.
(10 Hours)

Reference Books
 1.   *Advanced Engineering Mathematics, (Eighth Edition)*
       By : Erwin Kreyszig. Pub. : John Wiley & Sons.

 2.   *Advanced Engineering Mathematics, (Second Edition)*
      By : R. K. Jain and S. R. K. Iyengar. Pub. : Narosa Publication House.

 3.   *Elementary Differential Equations and Boundary Value Problem By Boycs and DiPrima, Seventh Edition.   Pub. : John Wiley & Sons.*

 4.   *Calculus, By Thomos and Finney, Ninth edition.*

PR 232 -STRENGTH OF MATERIALS
(Theory: 3 Credits; Term-work: 1 Credit; Mid-term: 30 Marks, Major: 70 Marks)

Stress and strain, stress-strain relationship and elastic constants, thermal stresses; Mohr's circle for plane stress and plane strain; Thin cylinders; Shear force and bending moment diagrams; Bending and shear stresses; Combination of bending and direct stresses; Deflection of beams; Torsion of circular shafts; Columns; Strain Energy;

Details of the syllabus of Strength of Materials

1. **STRESS AND STRAIN, STRESS-STRAIN RELATIONSHIP AND ELASTIC CONSTANTS, THERMAL STRESSES:**

   Types of loads, Simple stresses & strains, viz. tensile, compressive, Shear, Crushing, Thermal stresses, Hoop stresses & corresponding strains, Volumetric Strain, Bulk modulus, Hook's law, Young's modulus, Modulus of Rigidity, stress-strain curves for ductile & brittle materials, Poisson's ratio.

2. **MOHR'S CIRCLE FOR PLANE STRESS AND PLANE STRAIN:**

   Definition of principal plane & principal stresses, Expression for normal and tangential stress, maximum shear stress, Stresses on inclined planes, Position of principal planes & planes of maximum shear, Graphical solution using Mohr's circle

3. **THIN CYLINDERS:**

   Concept of stresses & strains in thin cylindrical & spherical shells subjected to internal pressure.

4. **SHEAR FORCE AND BENDING MOMENT DIAGRAMS:**

   Shear force, bending moment & relation between them, Shear force & bending moment diagrams for simply supported beam & cantilevers subjected to point loads & Uniformly distribution load, concept of Uniformly varying load & couples acting on beam, Location of point of contra-flexure.

5. **BENDING AND SHEAR STRESSES:**

   Theory of simple bending, equation of bending, Assumptions in the theory of bending, moment of resistance, section modulus & neutral axis, Shear stresses – concepts of direct & transverse shear stress.

6. **COMBINATION OF BENDING & DIRECT STRESSES:**

   Axial load, eccentric load, direct stresses, bending stresses maximum & minimum stresses.

   Application of the above concepts for machine parts such as offset links, C-clamp, Bench vice, Drilling machine frame, stresses at base of a short column, condition for no tension at extreme fibers, total stress variation diagrams.

7. **DEFLECTION OF BEAMS:**

   Concepts of Deflection of beams – relation between bending moment & slope, Deflection of simply supported beams and cantilever beams subjected to point load

8. **TORSION OF CIRCULAR SHAFTS:**

Concept of Pure Torsion, Torsion equation for solid and hollow circular shafts, Assumptions in theory of pure Torsion, Comparison between Solid and Hollow Shafts subjected to pure torsion

9. **COLUMNS:**

Concepts of Buckling – Rankine's & Euler's formulae for buckling load for columns / shafts under compression, concepts of equivalent length for various end conditions

10. **STRAIN ENERGY:**

Concept, derivation & use of expression for deformation of axially loaded members under gradual, sudden & impact load, Strain energy due to self-weight.

TERM WORK:

The term work shall consist of assignments on the syllabus and the following laboratory tests on the mechanical properties of material.

1. Tension test on ductile material.
2. Bending test on different materials like steel, aluminum.
3. Shear test.
4. Torsion test.
5. Hardness test.
6. Impact test.

Text and Reference Books:
R. Ramamrutham, *Strength of Materials,*
F. L. Singer and A. Pytel, *Strength of Materials, 3rd Ed.*, Harper & row Publishers, New York.
R. L. Mott, *Applied Strength of Materials, 4th Ed.*, Prentice Hall of India, New Delhi
E. Popov, *Mechanics of Materials,* Prentice Hall of India, New Delhi
Timoshenko and Young, *Engineering Mechanics*, Tata McGraw Hill,

PR 233 - THERMAL ENGINEERING-I
(Theory: 2 Credits and Practical: 1 Credit, Mid Term - 30 marks and End Term - 70 marks)

1. **AIR STANDARD CYCLES:**
   Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Brayton (Joule cycle) (04)
2. **INTERNAL COMBUSTION ENGINES:**
   Introduction, classification, working, valve timing diagrams, port timing diagrams, theoretical and actual indicator diagrams, power and efficiencies, Indicated mean effective pressure, indicated power, brake power, fuel consumption, air consumption, mechanical efficiency, thermal efficiencies, volumetric efficiency, fuel pump, fuel injector, spark plug, carburetors, fuel ignition systems, governing, supercharging, cooling methods, scavenging, properties of lubricating oil, lubrication methods, testing of I. C. engines, heat balance sheet (10)
3. **VAPOUR POWER CYCLES:**
   Carnot vapour cycle, Rankine cycle, modified Rankine cycle, efficiencies (04)
4. **STEAM AND GAS TURBINES:**

Classification of turbines, simple impulse turbine, reaction turbine, classification of gas turbines, constant pressure gas turbine, constant volume gas turbine(04)

5. **STEAM NOZZLES**:

Types, flow through steam nozzle, mass of steam discharged through a nozzle, condition for maximum discharge, critical pressure ratio, throat and exit areas for maximum discharge(04)

6. **STEAM CONDENSERS:**

Advantages, types, vacuum in condenser and its measurement, vacuum efficiency, condenser efficiency, sources of air leakage and their effects, detection of air leakage, cooling tower, air pumps (04)

TERM WORK :

➢ **Part I :** This will consists of record of at least four assignments (preferably based on latest development in a particular field based on above syllabus).
➢ **Part II :** Conduct of following laboratory work.
  a) Trial on Four Stroke Petrol Engine. The range of experiment to determine Brake power, indicated power, mechanical and thermal efficiencies, air-fuel ratio, specific fuel consumption, heat balance sheet at various load conditions.
  b) Determination of flash and fire point of a lubricating oil.
  c) Trial on Two stroke petrol engine.
  d) Trail on Gas/steam turbine test rig.
  e) Study of different condensers.
  f) Study of fuel injection system
  g) Study of fuel pump
  h) Study of carburetors.
  i) Study of different types of turbines.

REFERENCE BOOKS :
1. R. K. Rajput, *"Thermal Engineering"*, Laxmi Publications Pvt. Ltd., New Delhi.
2. B. K. Sarkar, *"Thermal Engineering"*, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. J. Selwin Rajadurai, *"Thermodynamics and Thermal Engineering"*, New Age International Publishers, New Delhi.
4. P. K. Nag, *"Engineering Thermodynamics"*, Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. V. Ganeshan, *"Internal Combustion Engines"*, Tata McGraw Hill Publishing Company Ltd., New Delhi.

PR 234 - MACHINING PROCESSES
(Theory: 3 Credits; Mid Term - 30 marks and End Term - 70 marks)

1. **INTRODUCTION:**

Definition, Principles, Types, Components, Machining Parameters, Drives And Power Requirements. (2l)

2. **THEORY OF METAL CUTTING:**

Tool Geometry, Tool Signature, Chip Formation, Types Of Chip, Tool Wear, Surface Finish, Cutting Fluids And Machinability, Selection Of Tool Materials.(4L)

3. **MACHINE TOOLS:**

Machining Principles, Setting For Typical Products And Operations, Types, Parts, Accessories And Attachments Of Lathe, Drilling, Milling, Shaping, Planning, Slotting, Boring And Broaching Machines. Machining Time Calculations For Lathe, Drilling, Shaping, Planning And Milling Machines. (26)

4. **BATCH PRODUCTION MACHINES:**

Capstan And Turret Lathes - Principle, Constructional Details, Parts, Operations And Applications. (4l)

5. **GRINDING MACHINES:**

Principle, Constructional Details, Components, Types Of Grinding Processes, Accessories. Grinding Wheels - Specifications, Shapes, Applications, Dressing And Truing, Mounting, Cutting Fluids Used In Grinding. Selection Of Grinding Wheels.(6L)

6. **FINISHING PROCESSES:**

Lapping, Honing, Super Finishing Operations, Tools For These   Operations.(4)

Reference Book:

1. Production Technology: HMT
2. Workshop Technology: Chapman
3. Workshop Technology: Hajra Chaudhary
4. Manufacturing Process: M.L. Begman, B.H. Amsted
5. Manufacturing Process: Lindberg

PR 235 - METROLOGY AND INSPECTION
(Theory: 3 Credits and Practical: 1 Credit; Mid term: 30 Marks, End term – 70 Marks)

1. **INTRODUCTION:**

Need, Precision, Accuracy, Errors, Linearity, Repeatability, Calibration, Sensitivity, Methods of Measurement. **Linear Measurement**: Vernier Calipers, Height Gauge, Depth Gauges, Feeler Gauges, Micrometer, Slip Gauges. **Measurement Standards**: Line Standard, End Standard, Wavelength Standard, Classification of Standards.

2. **LIMITS, FITS AND GAUGES:**

Tolerances, Interchangeability, Selective Assembly Terminology, Limits Of Size, Allowances, Clearances, Interference, Is 919, Fits, Selection Of Fits, Numerical Problems On Limits Of Size And Tolerances, Gauges (Ring, Snap), Taylor's Principle, Gauge Design, Tolerance and Geometry, Geometric Dimensioning and Tolerance.

3. **COMPARATORS:**

Definition, Types, Characteristics, Applications, Construction and Working of Different Mechanical, Electrical, Optical, and Pneumatic Comparators.

4. **MEASUREMENTS BY LIGHT WAVE INTERFERENCE:**

Basic Principle, Optical Flats, Fringe Patterns and Their Interpretation, Testing Of Flat Concave, Convex and Irregular Surfaces, and Checking Of Slip Gauges, Michelson Interferometer, NPL Flatness Interferometer.

5. **ANGULAR MEASUREMENT:**

Principle and Applications of Measuring Instruments Like Protractor (Optical and Bevel), Sine Bar, Angle Gauges, Spirit Level, Clinometer, Autocollimator, Angle Dekkor, Constant Deviation Prism, and Miscellaneous Measurement of Angle.

6. **MEASUREMENT OF SURFACE FINISH:** Definitions, Terminology and Basic Concepts, Methods of Measuring Surface Finish, Analysis of Surface Roughness, Symbols and Values of Surface Roughness.,

7. **MEASUREMENT OF SURFACE CHARACTERISTICS**:

Straightness, flatness, square ness, parallelism etc.

8. **METROLOGY OF SCREW THREADS:**

Terminology, Errors and Their Effects, Elements and Their Measurements.
9. **MEASURING MACHINES:**
Profile Projector, Toolmaker's Microscope and CMM.

TERM WORK

The term work shall consist of record of following experiments and one to two assignments on every chapter.
1. Use of precision measuring instruments for linear measurements.
2. Experiment on mechanical comparator and study of different types comparators.
3. Experiment on sine bar for measurement of taper angle.
4. Study of auto collimeter / angle dekkor.
5. Experiment on pitch errors of screw threads.
7. Assignment on design of gauges.
8. Experiment on profile projector/ Tool maker's Microscope.
9. Experiment on CMM.
10. Experiment on Height master

Recommended Books:

1. Engineering Metrology by R.K. Jain- Khanna Publisher, New Delhi. 1997.
2. Metrology by Dobler – Tata McGrawHill Co. New Delhi.
3. Practical Metrology by K.G. Hume

PR 236 - MANUFACTURING LAB. - I
(Credit: 02;Continuous evaluation: 100 Marks)

TERM WORK:

It shall consist of following
1) study of working, constructional details, various mechanisms, accessories, attachments and different operations of Lathe, Milling M/c, Drilling M/c, Grinding M/c, shaper, planer, slotting M/c, Boring M/c, Broaching M/c and Finishing processes.

2) Each students will prepare and submit the following jobs.
   a) External taper turning - 1 Job
   b) Internal taper turning and fitting on (a-above) - 1 job
   c) Eccentric turning - 1 Job
   d) A simple job on shaper

The student shall submit the record of term work in the form of journal.

PR 237 - COMPUTER LABORATORY
(Practical: 1 Credit, 2 hours/week)

TERM WORK:

Development of programs based on object oriented programming aspects viz. classes, objects, operator and function overloading, inheritance and polymorphism.
Use of spread-sheets for data processing and automation of calculations
Project based lab sessions on topics like Thermal engineering, metrology, applied mechanics, Costing, Numerical methods, statistics, etc
Reference books:

1. Schaum's outline of theory and problems of programming with C++. - John R. Hubbard (Schaum's outline series, McGraw-Hill)
2. The complete reference C++ (Third edition)- Herbert Schildt (Tata McGraw -Hill)
3. Tutorials, manuals and documentation of spreadsheet packages

PR 238 – TERM SESSIONALS - I
(2 credits)

The term sessionals shall consists of a bonafide work carried out by the each student in terms of any of the following components:
- Software development
- Term paper
- Reporting of the recent advances in the specific area
- Course project
- Fabrication of prototypes
- Concept developing and its appeal
- Product development activities and so on

This component with out the structured contact hours is considered as a knowledge application activity across the semester by use of combination of courses of study
Every student is required to prepare the journal for the activity and submit in the department as per the schedule given for the same.

> **Evaluation of term sessionals will be carried out at the end of the semester (during the slot provided for practical examinations) by appointment of panel of external examiners (2/3 members) and a faculty representative from the department.**

EVEN SEMESTER

PR 241: ENGINEERING MATHEMATICS – IV
Course for S.Y.B.Tech. (Production) Semester-II
(L-3, T-1, P-0, CR-4)

STATISTICS AND PROBABILITY **Role of statistics in engineering,**
Moments: Moments about mean moments about the mean in terms of moments about any point, skewness and kurtosis, introduction of correlation, regression coefficients, lines of regressions. Probability distribution, discrete and continuous probability distribution, Binomial, Poisson and normal distribution and its applications and importance in engineering field. (20 Hours). **VECTOR CALCULUS:** Introduction of vector algebra, Limit, Continuity, derivative of a vector function, curves Tangents and arc lengths. Velocity and acceleration, radial and transverse components of velocity and acceleration, tangential and normal acceleration, scalar and velocity point functions, gradient of a scalar field, Directional derivative, divergence of a vector field, curl of a vector field. Line integrals, green's theorem in the plane, surface integrals, divergence theorem, Stoke's theorem. (20 Hours). **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:** Picard's Method, Euler's Method, improved and modified Euler's Method and Runge –Kutta Method. (10 Hours)
REFERENCES BOOKS
1. Advanced Engineering Mathematics, (Eighth Edition) By : Erwin Kreyszig.   Pub. : John Wiley & Sons.
2. Advanced Engineering Mathematics, (Second Edition)   By : R. K. Jain and S. R. K. Iyengar. * Pub. : Narosa   Publication House.*
3. Introductory Methods of Numerical Analysis, By : S.S.Sastry. *   Pub. : Prentice-Hall of India New Delhi*
4. Probability By J.Pitman (1993) Pub. : Narosa Publication House *5. Applied Statistics And Probability For Engineers:* *   third edition, wiley & sons (asia) 2003.* *6. A First Course In Probability, Second Edition (2003)* *   by j.k. chandra and d. chatterjee. pub. : narosa publication house.*

(Theory: 4 Credits and Practical: 1 Credit, Mid Term - 30 marks and End Term - 70 marks)

1. **MECHANISMS AND INVERSIONS**:

   Mechanisms, machines, kinematics pairs, kinematics chains, kinematics inversions.

2. **VELOCITY AND ACCELERATION ANALYSIS:**

   Instantaneous centre, Kennedy's three centre theorem, Instantaneous centre method and relative velocity method for velocity diagrams, acceleration diagram. Short cut methods for velocity and acceleration diagrams.

3. **BALANCING OF MASSES:**

   Need for balancing, Balancing of one / several masses rotating in one/different planes, the effect of inertia force of a reciprocating mass on the engine frame, partial primary balance.

4. **TURNING MOMENT AND FLYWHEELS:**

   Turning moment diagram for an IC engine, fluctuation of energy and speed, flywheel.

5. **GOVERNORS:**

   Introduction, types of governors, centrifugal governors, watt governor, porter governor, proell governor, spring loaded governors, Hartnell governor, sensitiveness, stability, Isochronisms, Hunting, governor effort and power, controlling force.

6. **CAMS:**

   Definition, Applications, types of cams, types of followers, Displacement, velocity and acceleration time curves, generation of cam profile, cams with specified contours circular arc cam with flat faced reciprocating follower,

7. **GEARS:**

   Concept of friction wheel, types of gears, selection of gears, gear terminology, law of gearing, gear profiles, Interference and undercutting, methods of eliminating reducing/ Interference.

   The following topics are to be covered in practical classes

8. **VIBRATIONS:**
   Introduction, spring mass system, natural frequency computations, spring mass, simple pendulum, torsional vibrations and compound pendulum.

9. **GYROSCOPE:**

   Introduction, gyroscopic couple, gyroscopic stabilization

PRACTICALS/TERM WORK:

It shall consist of a journal prepared by conducting following practicals.

1. Study of at least four inversions of each single slider and double slider crank mechanisms.
2. Drawing of kinematic link diagram for a given mechanisms.

3.   At least 4 typical problems of velocity and acceleration analysis to be solved on quarter imperial size drawing sheet. (4hrs)
4.   Practical on vibration analysis of spring mass system and compound pendulum etc
5.   Practical analysis on Gyroscope.
6.   Static and dynamic balancing.
7.   Study of generation of involutes tooth profile.
8.   4 sheets on cam profile generation.
9.   Practical analysis on Governors
10.   Practical analysis on belt tension apparatus

Text Books:

Theory of Machines. -   Thomas Bewan
Machine and Mechanisms – David H. Myszka
Theory of Machines -   Rattan
Theory of Machines -   Khurmi

Reference Books :

Theory of Machine & Mechanisms. -   Shigley
Theory of Machines. - P.L. Ballaney

PR243 - ENGINEERING MATERIALS AND METALLURGY
(Theory: 2 Credits and Practical: 1 Credit, Mid Term - 30 marks and End Term - 70 marks)

1. **INTRODUCTION:**
   Pig iron Production, Manufacture of steel, by Basic oxygen steel making, Electric Arc steel making. Introduction to phase diagram (2L)

2. **STEEL AS AN ENGINEERING ALLOY:**
   Iron –Iron carbide equilibrium diagram, non-equilibrium cooling of steels, classification and applications of steel, specifications of steel, transformation products of austenite, time Temperature transformation (TTT) diagrams, Austenite and ferritic grain size in steels,. (6L)

3. **CAST IRONS**:
   White C.I. Gray C.I. malleable C.I., Nodular cast iron, Alloy cast irons and heat treatment of cast irons.(4L)

4. **HEAT TREATMENT OF STEEL:**
   Conventional annealing, Bright annealing, box annealing, Isothermal (cycle) annealing, Spheroidised annealing, Subcritical annealing, Normalising, Hardening, Retention of austenite, Effect of retained austenite, elimination of retained austenite, Tempering, Secondary hardening, Temper brittleness, Quench cracks, Hardenability, Carburizing, Selective carburizing, heat treatment after carburizing, Nitriding,Carbonitriding, flame hardening, Induction hardening(8L)

5. **ENGINEERING NON-FERROUS METALS:**

Copper and copper alloys, Brasses, Alumnium and Aluminium alloys, Nickel and Nickel alloys, Tin and tin alloys and Bearing materials. (4l)

6. POWDER METALLURGY:
Introduction, characterization and testing of metal powders, powder manufacture, powder conditioning, Oil impregnated bearings, cemented carbide, cermets, advantages and limitations of powder metallurgy.(4L)

7. COMPOSITE MATERIALS AND ITS APPLICATION:
Different composite materials and its application in manufacturing processes (2L)

TERM WORK
The term - work shall consist of a journal based on the below mentioned laboratory experiments/study (at least 8). Term shall be evaluated on continuous basis.
1. Study of Metallurgical Microscope.
2. Preparation of Specimen for microscopic examination.
3. Heat Treatment of PCS and determine change in percentage of hardness and grain structure.
4. Study of microstructure of plain carbon steels of various compositions.
5. Study of microstructure of various types of C.I.
6. Study of microstructure of various types of alloy steels.
7. Study of microstructure of non – ferrous metals and their alloys.
8. Surface hardening and study of microstructure (study expt.)
9. Study of I.S. codes of steels and selection procedure.

References Books :
1. Material Science and Metallurgy for engineers -Dr. V.D. KOTGIRE
2. Physical Metallurgy Principles and practice by -V. RAGHAVAN
3. Introduction to Physical Metallurgy by -SIDNEY H. AVNER
4. Physical Metallurgy by -VIRENDRE SINGH
5. Heat Treatment principles and Techniques by -T.V. RAJAN, C.P. SHARMA
6. Production Technology by -R.K. JAIN & S.C. GUPTA

PR244 - THERMAL ENGINEERING-II
(Theory: 3 Credits and Practical: 1 Credit, Mid Term - 30 marks and End Term - 70 marks)

1. FUELS AND COMBUSTION:
Types of fuel, combustion of solid and liquid fuels, minimum air required for complete combustion of solid or liquid fuels, combustion of gaseous fuel, minimum air required for complete combustion of gaseous fuel, mass of excess air supplied, conversion of volumetric analysis into mass (gravimetric) analysis, conversion of mass analysis into volumetric analysis, flue gas analysis (08)

2. AIR COMPRESSORS:
Application of compressed air, classification of air compressors, terminology, single stage reciprocating air compressor, work done, effect of clearance volume, power and efficiencies, multistage air compression, advantages and disadvantages, two stage air compressor with perfect intercooling, two stage air compressor with imperfect intercooling, minimum work required for a two stage compressor with perfect intercooling, ratio of cylinder diameters, heat rejected in the air compressor, Comparison

between reciprocating and rotary compressors, classification of rotary compressors, roots blower compressor, vane blower compressor, centrifugal compressor, comparison between centrifugal and axial compressors (10)

3. **PSYCHROMETRY:**
Dalton's law of partial pressure, hygrometry, psychrometer, definitions and relations in psychrometry, adiabatic saturation temperature, psychrometric chart, psychrometric processes (04)

4. **REFRIGERATION:**
Applications, unit of refrigeration, coefficient of performance, air refrigeration cycle, air refrigerator working on reversed Carnot cycle, air refrigerator working on a Bell-Coleman cycle, vapour compression refrigeration system, process representation in chart, theoretical vapour compression cycle, actual vapour compression cycle, vapour absorption refrigeration system, ammonia and lithium bromide absorption refrigeration system, electrolux refrigeration, cryogenic refrigeration, essential properties of refrigerant, commonly used refrigerants (08)

5. **AIR CONDITIONING:**
Applications, human comfort, factors of human comfort, functions, classification of air conditioning system, winter air conditioning system, summer air conditioning system, year round air conditioning system, comfort air conditioning system, industrial air conditioning system, unitary air conditioning system, by-pass factor of heating and cooling coil, efficiency of heating and cooling coils, sensible heat factor (06)

TERM WORK:
➢ **Part I :** This will consists of record of at least four assignments (preferably based on latest development in a particular field based on above syllabus).
➢ **Part II :** Conduct of following laboratory work.
   1. Trial on reciprocating air compressor. This will consist of following
      Determination volumetric efficiency, Determination free air delivered, Determination of mechanical efficiency
   2. Trial on refrigerator. This will consist of following
      Demonstration of basic vapour compression refrigeration cycle, Finding out refrigerating effect and work input and hence actual and theoretical COP, Drawing of P-H and T-S charts, Finding of volumetric efficiency of compressor.
   3. Trial on air conditioner. This will consist of following
      Determination of actual and theoretical COP, Calculation of refrigerating effect and HP of unit, Determination of sensible heat factor of air, Finding out volumetric efficiency of compressor, Study of psychrometric charts.

REFERENCE BOOKS :
   1. R. K. Rajput, *"Thermal Engineering"*, Laxmi Publications Pvt. Ltd., New Delhi.
   2. C. P. Arora, *"Refrigeration and Air Conditioning"*, Tata McGraw Hill Publishing Company Ltd., New Delhi.
   3. P. N. Ananthanarayanan, *"Basic Refrigeration and Air Conditioning"*, Tata McGraw Hill Publishing Company Ltd., New Delhi.
   4. B. K. Sarkar, *"Thermal Engineering"*, Tata McGraw Hill Publishing Company Ltd., New Delhi.
   5. J. Selwin Rajadurai, *"Thermodynamics and Thermal Engineering"*, New Age International Publishers, New Delhi.
   6. Ahmadul Ameen, *"Refrigeration and Air Conditioning"*, Prentice-Hall of India Pvt. Ltd., New Delhi.

PR245 - Machine Drawing and Computer Aided Design (MD&CAD)
(Theory: 2 hours/week; Practical: 2 hours/week; Total Credits-3)

1. **INTRODUCTION:**
    Introduction to machine drawing, Computer aided design (CAD), Computer aided drafting and documentation (CADD)

2. **CONVENTIONS**:

    Conventional representations of standard machine parts along with their actual drawings; Conventional Representation for Surface Finish, Welded Joints; Conventional Representation of Spur, Helical, Bevel and Worm and Worm Wheel and Thread Profiles *(To be dealt-with in practical)*

3. *MACHINE PARTS:*

    (A) Screwed Fastenings: Locking Arrangement of Nuts, Foundation Bolts. (B) Pipe Joints: Flanged, Socket and Spigot Joints, Hydraulic, Union Joints, Expansion Joints and Stuffing Box. (C) Riveted Joints: Single and Double Riveted Butt and Lap Joints (D) Keys, Cotter Joints, Pin Joints; Types of Keys, Cotter and Cotter Joints; Pin or Knuckle Joint. *(To be dealt-with in practical)*

4. **COMPUTER AIDED DRAFTING AND DOCUMENTATION** (CADD) with CAD packages

5. **Assembly and detail drawing** with complete dimensioning, tolerancing, materials and surface finish *(To be dealt-with in practical classes)*

6. **Introduction to Computer aided geometric modelling** with CAD software including solid modelling and assembly modelling

TERM WORK:
The term work shall consist of record of CAD assignments, drawing sheets and sketchbook based on the above syllabus. Project based lab session including sketching and geometric modelling using a software package

Text Books:

1. Machine Drawing -N.D. Bhatt & V.M. Panchal, Charotar Publishing House, 2001
2. Machine Drawing –Siddheswar, Kannaiyah, and Shastry VVS, TMH
3. Machine Drawing with AutoCAD – G. Pohit and G. Ghosh, Pearson Education, 2005
4. Tutorials, manuals and documentation of CAD software

Reference Books:

1. Luzadder W. J., Fundamentals of Engineering Drawing, PHI, 1990
2. James Bethune, Engineering graphics, Pearson Education
3. P.S. Gill, Machine Drawing - S. K. Kataria and Sons, Delhi, 2002
4. Narayana KL, Kannaiah P, Venkata Reddy K, Machine Drawing, New Age International, 2000
5. Dhawan R. K, A text book of Machine Drawing, S. Chand & Co, New Delhi, 2005
6. Junnarkar ND, Machine Drawing, Pearson Education, 2005
7. Radhakrishnan, CAD/CAM/CIM, New Age International Publication, 2003

8. B R Sachdeva, Blue print reading, TMH
9. Farazdak Haideri, Machine design and CAD, Nirali Publications, Pune
10. R V Mali and B S Chaudhari, Mechanical Engineering Drawing, Vrinda Publications, Jalgaon
11. McMahon, CAD/CAM
12. Frederick E. Giesecke, Engineering graphics, PHI

PR246 - COMMUNICATION SKILL
(Practical: 2 hours/week; Total Credits-1)

Objective: The main objective of this course is to prepare the engineering students for future career, further studies through development of listening, reading ,writing and speaking skills.

Methodology: The course may be dealt with in following ways: -
1. Discussion by tutor about theoretical nature of different aspects of Communication Skill.
2. Practice of it by the students as pronunciation, public speaking and organizing meeting etc.
3. Intervention by the tutor for corrective measures.
4. Understanding and grasping and then reporting by the students.

Contents: What is communication- need, importance, types, and objectives. Communication process & barriers. Principles of effective communication, Personality Development, SOWT Analysis, Stress Management, Building Positive Attitude, etc.
1. Modes of communication.
2. Practice of effective communication through eye contact, voice modulation, audience awareness, presentation plan and verbal & non-verbal Communication.
3. Face to face conversation with body language.
4. Understanding guidelines for telephonic conversation, making and receiving calls, telephonic messages.
5. Interviews Skills for employment – Preparing -Group Interview, Lunch / Dinner Interview,Telephonic Interview, self and reporting for sample questions on educational background, co-curricular activities, extra curricular activities, experience, and general knowledge, miscellaneous.
6. Technical Guidelines for Communication
   - Hyphenated words, Use of Apostrophe, Abbreviations, Units , etc.
7. Meetings: understanding role and importance of procedure, chairmanship, participation, and physical arrangements, rules for successful meeting- experience sharing and reporting.
8. Group Discussions, Seminars and Conferences- Understanding different aspects- experience sharing and reporting.
9. Practice of public speaking with use of audio – Visual and Graphic aids, experience sharing and reporting.
10. Paragraph writing – Understanding principles, general hints writing and analyzing (practising paragraph writing on 3-5 topics)
11. Understanding the principles and practice of – office drafting, circular, notices, memos, and telex/telegraph/email messages. Application resumes, sales enquiry, reply order, complaint Reports, feasibility report, analytical report, progress report, project report, inspect of damage and losses etc.
12. Preparation of notices, agenda, minutes etc.

13. Grammar – Articles, Tenses, The Preposition, Choice of Words and Phrases,Words commonly Misspelt, Confusing words and Expressions, etc.
14. Phonetics – Pronunciation, Articulation of sounds structure of syllable stress, rhythm, connected speech, intonation, clarity and pitch.
15. Use of integrated skills of communication.

TERM WORK AND REPORTING:
Term work will be in the form of Report containing minimum 10-12 exercises based on separate topics as mentioned in the syllabus.
 The assessment will be made by the concerned teacher or an internal examiner appointed by the Principal of the College.

Reference Books:
1. Developing Communication Skill by Krishna Mohan and Meera Banerjee, McMillan Publishers.
2. Communication Skill – B.V. Pathak, Nirali Prakashan.
3. Writing Correct English – Readers Digest Publication.
4. Communication Skills for Engineers - Sunita Mishra, C. Murlikrishna.
5. Professional Communication Skills-- S. Chand.
6. Developing Communication Skills-- Krishna Mohan, Meera Banerji.
7. Communicative Grammar and Composition-- Rajesh K. Lidiya.

Note: Exercises on Chapter No. 1, 2, 3 and 7 are desirable and one each on other topic is essential.

PR 247 – TERM SESSIONALS - II
(2 credits)
The term sessionals shall consists of a bonafide work carried out by the each student in terms of any of the following components:
- Software development
- Term paper
- Reporting of the recent advances in the specific area
- Course project
- Fabrication of prototypes
- Concept developing and its appeal
- Product development activities and so on

 This component with out the structured contact hours is considered as a knowledge application activity across the semester by use of combination of courses of study
 Every student is required to prepare the journal for the activity and submit in the department as per the schedule given for the same.

Evaluation of term sessionals will be carried out at the end of the semester (during the slot provided for practical examinations) by appointment of panel of external examiners (2/3 members) and a faculty representative from the department.