Break up of BE Course Structure

Branch: Civil Engineering. **Year: Third.**

Semester: Fifth

SL. NO.	COURSE NO.	SUBJECT	PERIOD			EVALUATI			
Theory			L	T	P	Sessional Examination			
						TA	CT	Total	
1.	HU 501	Economics & Principles of Management.	3	1		30	20	50	1
2.	CE 512	Design of Structures-I.	3	1		30	20	50	1
3.	CE 513	Environmental Engineering-I.	3	1		30	20	50	1
4.	CE 514	Transportation Engineering-I.	3	1		30	20	50	1
5.	CE 515	Geotechnical Engineering.	3	1		30	20	50	1
6.	CE 516	Concrete Technology.	3	1		30	20	50	1
7.	CE 517	General Proficiency.							5
Practical/Drawing/Design/Mini Project									
8.	CE 513 L	Environmental Engineering-I.			3	30	20	50	
9.	CE 514 L	Transportation Engineering-I.			3	30	20	50	
10.	CE 515 L	Geotechnical Engineering.			3	30	20	50	
11.	CE 516 L	Concrete Technology.			3	30	20	50	
Total			18	6	12				

Total marks: 1150 Total Periods: 36

Total Credits: 34

TA: Teachers assessment. *CT: Class Test.*

ESE: End Semester Examination.

HU 501 : ECONOMICS AND PRINCIPLES OF MANAGEMENT

Part A: Economics

Theory: 50 Sessional: 25

1. Economics: Meaning, nature and scope.
2. Consumer behavior and demand analysis: Alternate theories on consumer behavior; Derivation of the demand function. Demand and revenue analysis. Demand forecasting.
3. Producer behavior: Production function. Production analysis and input demand. Cost Analysis. Estimation of cost functions. Managerial uses of cost functions.
4. Price and output determination; Price concepts; pricing under different objectives; Profit and break even analysis. Differential pricing; Alternative market models; Market structure and Government intervention.
5. Investment analysis: time value of money. Cash flows and measures of investment worth; Investment analysis.
6. Money: Why money matters. Value of money- Quantity theory of Money; Index numbers. Interest rate determination.

7. The financial system: The Central Bank, Stock Exchange and the market for securities, Money market instruments.
8. International trade: Theories of international trade. The World Trading Environment Multilateralism and Bilateralism.
9. Emerging Economic and business environment.

Recommended Books:

1. Samuelson and Nordlhaus: Economics. Irwin McGraw Hill.
2. Gupta, G.S, Managerial Economics.
3. H.Davis Managerial Economics.
4. Sengupta A.K. and Agarwal M.K. Money Market Operations in India; Skylark Publications, New Delhi.

Part B: Principles of Management

Theory: 50 Sessional: 25

1. Management: concepts, status and functions. Role of management. Management skills. Effective versus successful managerial activities. Motivation - Early and contemporary theories on motivation- implication for managers and applications.
2. Group behaviour and Group dynamics: Foundations of group behaviour. Defining and classifying groups; stages of Group development; group interaction; External conditions; Group member resources; Group structure; Group processes; tasks and decision making.
3. Leadership- Leadership theories. Recent approach to leadership and contemporary issues in leadership.
4. Organisational Dynamics: Organisational change and stress management. Human factors in industry- fatigue and symptoms. Fatigue control.
5. Human Resource policies and Practices: Selection practices, Training and Development programmes; Performance Evaluation; Union — Management interface; Managing diversity in organisations.
6. Investment analysis: Time value of money. Cash flows and measures of investment worth; Investment analysis.
7. Projects and Project evaluation: Economic and financial evaluation of projects. Economic and social cost benefit analysis.

Recommended Books:

1. Essentials of management- J.L. Marcis.
2. Organisational Behaviour. Concepts, Controversies and Applications - Stephen P. Robbins.
3. Gupta, G.S, Managerial Economics.

CE 512: DESIGN OF STRUCTURE-I

Theory-100 marks.
Sessional-50 marks.
Time- 3 Hours.

1. Properties of concrete and reinforcing steel, stress-strain characteristics, shrinkage and creep phenomenon. I.S. Specification.
2. Methods of Design: Elastic theory and Limit state theory.
3. Analysis and design of Sections in flexure by elastic and limit state methods: Singly and Doubly R.C. Section, T and L sections.
4. Analysis & design sections for shear and bond. Anchorage and Splicing of reinforcement, detailing of reinforcement.
5. Design of Simple and continuous beams.
6. Design of axially and eccentrically loaded short and long column.
7. Design of one-way and two-way slab, continuous slab.
8. Design of footing: Isolated and combined footing; strip footing.
9. Retaining wall: Cantilever and counterfort types with and without surcharge.

CE513: ENVIRONMENTAL ENGINEERING–I

Marks: Theroy – 100.
Sessional – 50.
Time – 3 hrs.

Introduction: water supply system, its objectives and components.
Water quantity: various demands of water, design period, population forecasting, percapita consumption – recommended rates, factors affecting consumption, variation of demand and its impact an design of water supply system, fire demand.

Water quality: Impurities of water and water born diseases, water analysis physical, chemical and bacteriological, sampling method, water quality standards.
Sources of water: surface and subsurface sources and their characteristics, rain water harvesting, impounding reservoir storage requirements, wells –different types, well components, construction, development and sanitary protection of wells, ground water recharge.
Intake works and conveyance of water: River, reservoir and channel intakes, selection of intake, rising main – type of conduits and its joints, pumps – types and selection of pumps.
Treatment of water: Method, purposes, sequence of treatments, aeration, sedimentation – plain and with coagulation, coagulants and their dosage, feeding units, mixing basins and flocculation units, sedimentation tanks and their design, filtration –principle, type of filters, slow and rapid sand filters, pressure, diatomite and multimedia filters.
Other treatments of water: Disinfection, necessity of chlorinating- clorine dose, break point chlorination, feeding units, Ozenisation, hardness and softening of water, lime process, lime and soda ash process, base exchange process, removal of taste and odour, iron and manganese
Distribution system: Service reservoir necessity, types and estimation of capacity, system of supply, continuous and intermittent, distribution system, layout and design of distribution system, equivalent pipe method, Herdy –cross method, method of sections, circle method, maintenance of distribution system, detection of leakage and wastage and their prevention, gates and valves in distribution system.
Plumbing of buildings for water supply: Services connection, system of water supply in buildings. Fixture units, plumbing system, detection and remedies of defects in plumbing system .
Water pollution: Causes, effects and preventive measures.

CE513 L: ENVIRONMENTAL ENGINEERING–I (PRACTICAL)

Marks-50.

Laboratory test for Water-

P^H-Value, Alkalinity, Acidity, Suspended matter, Hardness, Total solid, Chloride, Sulphate, Calcium, Magnesium, Nitrate, Sodium, Potasium and Conductivity.

CE 514: TRANSPORTATION ENGINEERING – I

Theory – 100.
Sessional – 50.
Time – 3 hrs.

Introduction: Mode of transportation- advantages and limitations. Transportation plan- System approach, goals and objectives; 20-year road development plans of India, Classification of roads.
Geometric design: Design vehicle, design speed, capacity, horizontal and vertical alignment; super-elevation, widening on curves, gradients, sag curve and valley curve, sight distance, right-of-way, roadway width, curbs, camber and intersections. Highway safety; road accidents and traffic regulatory signs and road markings.
Highway alignment and survey: Requirements of an ideal alignment, Factors controlling alignment, Engineering surveys-Map study, Reconnaissance, Preliminary surveys, Final location and detailed surveys.
Road making materials: Tests on aggregate and bituminous binder, I.S. and I.R.C. specifications, strength of soil subgrade-C.B.R. test, Plate load test.
Pavement design: Types of pavement, Factors to be considered in design.
Design of flexible pavement-standard methods, I.R.C. guidelines.
Design of rigid pavement- Structural components of rigid pavement, Standard methods of design, IRC guidelines.
Traffic Engineering: Definition, traffic studies and analysis; traffic volume, speed and delay study, origin and destination study, traffic capacity, parking study, accident study. Traffic control devices- signs, signals, makings and island. Road intersections-intersection at grade e.g., channelized, unchannelized and rotary, grade separated intersections. Design of parking facility.

CE 514 L : TRANSPORTATION ENGINEERING

Marks-50.
Time – 4 Hrs.

LABORATORY WORK: -

1. Compaction test.
2. C.B.R. test.
3. Sieve analysis.
4. Impact test.
5. Abrasion test.

6. Water Absorption test.
7. Crushing test. (Crushing strength test)
8. Flakiness Index test.
9. Elongation Index test.
10. Specific Gravity test.

CE 515: GEOTECHNICAL ENGINEERING

Theory – 100
Sessional - 50
Time – 3 hrs.

Soil deposits based on origin, soil map of India, index properties, phase –relationships, particle size distribution, consistency and plasticity, fabric and structure, sensitivity & thixotropy, clay minerals – montmorillonite, elite & kaolinite, identification and classification of soils, classification of rocks, ROD, RMR system.

Effective strees principle, capillarity in soils.

Permeability of soil – Darcy's law, permeability – laboratory and field determination, quick condition, permeability of stratified deposits, factors affecting permeability.

Seepage through soils, Laplace equation, flownet –its construction and uses , seepage through homogeneous earth dam with and without filters .

Compaction of soils, compaction test, optimum moisture content and zero air void line field methods of control of compaction, methods of compaction of various types of deposits in field.

Compressibility and consolidation of soils – introduction to the process of consolidation (spring analogy), e-p curves, methods of estimating preconsolidation pressure, over consolidation ratio, Terzaghi's theory of one dimensional consolidation, consolidation test and determination of C_v, m_v and C_c, primary and secondary consolidation, compression characteristics of clays and settlement analysis.

Shear strength of soils, stress at a point, Mohr's stress circle, Mohr- coulomb failure criteria, definition of stress path, shear testing of soil, direct shear, triaxial, unconfined compression vane shear, undrained and drained strengths, shear characteristic of sand normally loaded and over consolidated clays, Skempton's pore pressure parameters, choice of test conditions and shear parameters

Stability of slopes:
Finite and infinite slopes, concept of factor of safety, Swedish method, Friction circle method, Taylor's stability number & chart, effect of submergence, steady seepage and sudden drawdown conditions.

CE 515 L : GEOTECHNICAL ENGINEERING

Marks-50.
Time – 4 Hrs.

LABORATORY WORK: -

1. Liquid Limit test by Cone Penetrometer Apparatus.
2. Liquid Limit test by Casagrande Apparatus.
3. Plastic limit.
4. Sieve analysis.
5. Moisture content by oven dry method.
6. Moisture content by Infrared moisture meter method.
7. Dry Density by sand replacement method.
8. Dry Density by core cutter method.
9. Direct shear test.
10. Unconfined compression test.
11. Compaction test.

12. Permeability test.
13. Consolidation test.

CE 516 : CONCRETE TECHNOLOGY

Theory-100.
Sessional-75.
Time-3 hrs.

1. Concrete as a Building and its ingredients:

i. Cement: Manufacture of Portland Cement, its composition, Hydration of cement, physical and chemical properties, concept of strength development. Gel Space Ratio, Powers Law, Gel Structure.
ii. Testing of Cement fro Physical and chemical properties as per BIS specifications.
iii. Different types of cement such as Slag cement, Portland Pozzolona cement and high Alumina cement, their characteristics, composition, use and properties.
iv. Aggregates and testing of Aggregates.
Classification, source, physical and mechanical properties. Testing of Aggregates forphysical and mechanical properties.
v. Water.

2. Production of Fresh Concrete:

i. Proportioning of concrete, operations involved in concrete production, Workability, Factors Affecting workability, Measurement of workability. Problem of Segregation and bleading and Laittance.
ii. Properties of hardened Concrete:
Strength and durability, Factors affecting strength and durability of concrete.

3. Concrete Mix Design: Principle and methods, Statistical Quality control. Concrete Rheology,
Meturity concept, IS method for concrete Mix Design.

4. Introduction to special concretes:

(a) Admixtures in concrete.
(b) Special concrete as lightweight concrete. High Density Concrete, Sulphur impregmented concrete, Polymer concrete, Lime concrete constituents and uses.
(c) High strength concrete.
(d) Fibre Reinforced Concrete.

5. Material testing and instrumentation:
Conventional vs. Non-Destructive testing. Methods & Principles of NDT.

Laboratory work:

1. Testing of cement.
Standard consistency, setting time (initial and final), fineness, soundness and compressive strength test (3 days, 7 days and 28 days).
2. Testing of Aggregates.
   (a) Fine aggregate.
   Sieve analysis for zoning and fineness modulus (FM), Bulking of sand, Absorption and moisture content, specific gravity.
   (b) Coarse aggregate.
   Sieve analysis for grading, absorption and moisture content, specific gravity flakiness index, Elongation index, Impact value, Crushing value and Abrasion value.
3. Compressive strength test of concrete, workability test of fresh concrete.
4. Concrete Mix design by IS method.

References:

1. Rai Mohan and Jai Singh M.P. "Advances in Building Materials and Construction-CBRI Roorkee".
2. "Civil Engineering Materials" "Technical Teachers" Training Institute Chandigarh, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Spence RJS and Cook DJ-'Building Materials in Developing Countries' John Wiley and Sons.
4. Shetty M.S. "Concrete Technology, Theory and Practices". S. Chand & Company Ltd., New Delhi.
5. Neville A.M., Properties of Concrete, Pitman Publishing Company.
6. Gambhir M.L. "Concrete Technology"- Tata McGraw Hill Publishing Company Ltd., New Delhi.
7. Gambhir M.L. "Concrete Manual"- Dhanpal Rai & Sons, Delhi.

5th Semester BE(ME)

SL.No	Course No	SUBJECT	PERIOD			EVALUATION SCHEME			
Theory			L	T	P	Sessional/Exam. TA | CT | Total	ESE	Subject Total	Credit

1	HU 501	Economics & Principle of Management	3	1	0	30	20	50	100	150	4
2	ME 522	Mechanism & Dynamics of Machines	3	1	0	30	20	50	100	150	4
3	ME 523	Applied Thermodynamics – I	3	1	0	30	20	50	100	150	4
4	ME 524	Heat Transfer – I	3	1	0	30	20	50	100	150	4
5	ME 525	Instrumentation	3	1	0	30	20	50	100	150	4
6	ME 526	Machine Design - I	3	0	3	30	20	50	100	150	4
7	ME 527	General Proficiency							50	50	2
Practical/ Drawing/Design											
8	ME 522L	Mechanism & Dynamics of Machines	0	0	2	30	20	50		50	2
9	ME 523L	Applied Thermodynamics – I	0	0	3	30	20	50		50	2
10	ME 525L	Instrumentation	0	0	3	30	20	50		50	2
11	ME 524L	Heat Transfer – I	0	0	3	30	20	50		50	2
Total			18	4	14					1150	

Total marks : 1150 **Total Periods: 36**

Total Credits : 34

TA : Teachers Assessment *CT: Class test* *ESE : End Semester examination*

ME 522: MECHANISMS AND DYNAMICS OF MACHINES(3-1-2)

Theory: 100 Sessional: 50 Laboratory: 50 Time: 3Hours

Chapter – I: Kinematic analysis of plane motion:

Velocity diagram, Acceleration diagram, Coriolis component of acceleration, Analytical method of kinematic analysis.

Chapter – II: Kinematic synthesis of linkages:

Introduction, number synthesis, basic features, analytical methods, graphical methods.

Chapter – III: Mechanisms:

Mechanism, Mobility, Inversion, Test for 4 bar mechanism by Grashoff's law, Straight line mechanism, Oscillatory mechanism, Quick return mechanism, Steering mechanism, Spatial mechanism – Hook's joints.

Chapter IV: Gyroscopic action in machines:

Gyroscopic action and force, method of analysis, Gyroscopic action in certain machine elements, use of gyroscopic principles in instruments.

Chapter V: Balancing of rotating masses, Two plane balancing, Balancing of reciprocating masses, Graphical solution, Balancing of single cylinder and multi-cylinder engines, Firing order, Balancing of rotors, Field balancing, Balancing instruments.

Books:

1. Theory of machines by T. Bevon
2. Theory of mechanism and machines by Ghosh & Mallick, Tata McGrow Hills
3. Theory of Machines by J. Lal , Metropolitan Books Ltd.
4. Theory of Machines and Mechanisms (3rd edition) by J.J.Uicker,Jr;G.R.Pennock & J.E.Shigley, Oxford University Press.
5. Theory of Machines by V.P.Singh,
6. Theory of Machines by A. Shariff

ME523: APPLIED THERMODYNAMICS – I(3-1-3)

Theory: 100 Sessional: 50 Lab:50 Time: 3Hours

1. **Availability:** Available and unavailable energy, Available energy referred to a cycle, Availability in non-flow or closed system (Non-cyclic), Availability of steady-flow systems, Helmohltz and Gibb's functions, Irreversibility and loss in availability, Effectiveness.
2. **Boiler:** Classification of boilers, mountings, accessories, evaporation capacity, equivalent evaporation, boiler efficiency, selection of a boiler, boiler feed water treatment and boiler troubles.
3. **Basic steam power cycles:** Carnot and Rankine cycles, Modified Rankine cycle, Regenerative and Reheat cycles.
4. **Steam nozzles:** Expansion of steam through nozzles, velocity and pressure variation in nozzles, Critical pressure ratio, mass flow rate and maximum mass flow rate, Representation of heat drop in nozzles in Mollier diagram, Nozzle efficiency.
5. **Steam turbines:** Classification, Flow of steam through impulse and reaction turbines, Velocity diagrams, Reheating, Bleeding, Reheat factor, Compounding and governing of steam turbines, Back pressure turbines, Pass out turbines.
6. **Steam condensers:** Function of steam condenser, Elements of a condenser plant, vacuum production, Delton's law of partial pressure, Classification of condensers, Sources of air leakage in condensers and their effects, Removal of air from the condesers, Vacuum efficiency and condenser efficiency, Determination of cooling water, Cooling towers and cooling ponds.

Books:

1. A course in thermodynamics and heat engines by Domkundwar, Kothendaraman, Khajuria and Arora, Dhanpat Rai and Sons.
2. Thermal Engineering by Rajput, Laxmi Publications.
3. Elements of heat engines by Patel, Karamchandani
4. A text book of thermal engineering by Khurmi, Gupta, K Chand Publications.

ME524: HEAT TRANSFER – I(3-1-3)

Theory: 100 Sessional: 50 Laboratory: 50 Time: 3hours

1. INTRODUCTION Concept of modes of Heat Transfer

2. CONDUCTION HEAT TRANSFER General 3-D differential equation for heat conduction, Boundary conditions and their types.

3. ONE DIMENTIONAL STEADY STATE HEAT CONDUCTION System with or without heat generation: slab, cylinder, sphere, Concept of thermal resistance and electrical analogy, Variable thermal resistance and electrical analogy, Composite systems: slab, co-axial cylinder, concentric sphere, Critical radius of insulation, Fins

4. ONE DIMENTIONAL UNSTEADY STATE HEAT CONDUCTION Lumped system analysis , Response time of a temperature measuring instrument, Mixed boundary condition

5. RADIATION HEAT TRANSFER Nature of thermal radiation, emissive power, Absorption, Reflection and Transmission, Concept of a black body, Intensity of radiation, Laws of black body radiation, Radiation to and from real surfaces

6. RADATIVE HEAT EXCHANGE BETWEEN SURFACES Radiation between two black bodies, Radiation shape factor (View factor) and its properties. Shape factors for different geometries, Radiation between two infinite parallel places, Radiation between two infinitely long concentric cylinders, Radiation between grey bodies, Electric network analogy for thermal radiation, Radiation shields, Radiation combined with convection

7. DIFFUSION MASS TRANSFER: Concentrations, Velocities and Fluxes, Fick's law of diffusion, the diffusion co-efficient, Species conservation equation and the boundary equation, Steady state molecular diffusion

Books:

1. Heat transfer, a basic approach by M N Ožišik , McGow Hills.
2. Heat and Mass Transfer by R C Sachdeva, Wiley Eastern.
3. Heat transfer, by P.S. Ghoshdastidar, Oxford University Press

ME525: INSTRUMENTATION (3-1-3)

Theory: 100 Sessional: 50 Laboratory: 50 Time: 3hours

1. Definition of Instrumentation.
2. Dynamic characteristics of instruments and instrumentation system, Linear and non-linear systems, Electrical networks, Mechanical systems, Analogous systems, Thermal systems, First and Second order systems.
3. Measurement of linear displacement and linear displacement transducer (i) Resistance potentiometer, (ii) Strain gauge, (iii)Variable inductance transducers, (iv) Linear variable differential transducers(LVDT), (v) Capacitive transducers, (vi) Piezo electric transducers.
4. Measurement of rotary displacement and rotary displacement transducers (i) Resistance potentiometer, (ii) Strain gauge, (iii) Rotary variable differential transducers, (iv) Capacitive transducers, (v) Shaft encoder.
5. Strain gauges: Measurement of strain and applications of strain gauges.
6. Measurement of pressure with secondary transducers (i) Resistive , (ii) Inductive , (iii) Capacitive, (iv) Piezo-electric transducers.
7. Measurement of torque (i) Strain gauges, (ii) Torque meters, (iii) Inductive torque transducers, (iv) Digital method, (v) Magneto-stricture transducers.
8. Measurement of linear velocity (i) Moving magnet type transducer , (ii) Moving coil type transducer, (iii) Seismic type velocity transducers.
9. Measurement of angular velocity: (i) AC and DC tachometer generators, (ii) Drag cup rotor AC, (iii) Photo-electric tachometer, (iv) Stroboscopic methods.
10. Measurement of vibrations: (i) Seismic transducers, (ii) LVDT accelerometers, (iii) Piezo-electric accelerometers.
11. Measurement of temperature: (i) Platinum resistance thermometers, (ii) Thermocouples, (iii) Thermistors, (iv) Optical pyrenometers.
12. Measurement of flow: (i) Turbine meter, (ii) Electro-hydro-dynamic flow meters, (iii) Hot wire anemometer.
13. Measurement of sound using microphone.
14. Measurement of thermal conductivity; (i) Gas analyzer (ii) Using thermistors.
15. Cathode ray oscilloscope: observation of wave forms, measurement of voltage and current, Lissajous patterns for measurements of phase and frequency.
16. Signal conditioning; (i) AC amplifiers, (ii) operational amplifiers and specifications, (iii) Charge amplifiers, (iv) Amplitude modulations and demodulations , (v) Different types of filters, (vi) Wheatstone bridge, (vii) Inductive transducers and AC bridges, (viii) Blumlein bridges, (ix) Integration and differentiations (x) Analog- Digital and Digital- Analog conversion techniques.
17. Introduction to display devices.
18. Recorders : (i) Analog recorders, (ii) Strip chart recorders, (iii) Galvanometers type recorders, (iv) Null-type recorders, (v) X-Y recorders, (vi) Ultra-violet recorders, (vii) Magnetic tape recorders, (viii) Frequency method recorders, (ix) Pulse duration modulation recorders, (x) Direct recording, (xi) Digital tape recording .
19. Control systems and components: (i) Linear approximation and non-linear system, (ii) Servo-motors, (iii) AC tachometer, (iv) Amplidyne, (v) AC position control system, (vi) Stepper motors.

References:

1. A course in Electrical, Electronics measurements and Instrumentation-A.K.Shawney.

2. Automatic control systems-Benjamin and Rao.
3. Control system Engineering- I.J.Nagrath and M.Gopal.

ME 526: MACHINE DESIGN I (3-0-3) (For ME & IPE)

Theory -100 marks Sessional-50 marks Time 4hours

Unit I: Introduction General considerations and procedure for designing, types of Loads, Designed stress and factor of safety, stress concentration, selection of materials, codes for design-BIS codes, Failure theories, Fits and Tolerance.

Unit II:Joints a) Detachable joints: Design of threaded fasteners, thread forms and threaded fastener types and materials, bold tightening and initial tension, Power screws.

b) Permanent Joints: Riveted joints and welded joints – eccentric loading.

Unit III:Shafting Design of shaft subjected to bending, torsion, axial and combined loading, keys, cotter and Knuckle joint.

Unit IV: Coupling Rigid and Flexible coupling.

Unit V:Power Transmission Element Belt and Chain Drives, design of Flat and V-belts.

Unit VI:Bearing Journal Bearing, Mechanism of fluid film lubrication, fluid viscosity, Petroff's Equation.

Books: 1. Machine Design by Black and Adams (TMH)
2. Design of machine elements by M F Spott
3. Design of machine elements by B V Vandari (TMH)
4. Machine Design by Hall
5. Machine Design by Khurmi and Gupta
6. Machine Design by Bahl and Goel
7. Machine Design by Shigley.

Break up of B.E. Course Structure

Branch: Electrical Engineering Year: Third
Semester: Fifth

Sl No.	Course No.	Subject	Period			Evalu		
	Theory		L	T	P	Sessional Examination		
						TA	CT	Tota
1.	HU 501	Economics & Principles of Management	3	1		30	20	50
2.	EE 541	Digital Systems	3	1		30	20	50
3.	EE 542	Control System-I	3	1		30	20	50
4.	EE 543	Power Electronics	3	1		30	20	50
5.	EE 544	Electric Power System-I	3	1		30	20	50
6.	EE 545	Electrical Machines-II	3	1		30	20	50
7.	EE 546	General Proficiency						

		Practical/Drawing/Design						
8.	EE 541	Digital Systems			3	25	25	50
9.	EE 542	Control System-I			3	25	25	50
10.	EE 543	Power Electronics			3	25	25	50
11.	EE 547	Electrical Machines-I			3	25	25	50
TOTAL			18	6	12	280	220	500

Total Marks: 1150 **Total Periods: 36**

Total Credits: 34

TA: Teachers' Assessment *CT: Class Test*

ESE: End Semester Examination

EE 542 : Control System – I(EE/I

L T P

3 - 1 - 3

Max. Marks = 100

Sessional = 100

1. **Elementary Concepts: of control systems**: Open loop and closed loop systems. Examples of modern control systems, Definition of linear, non-linear, time-invariant and time variant, continuous and discrete control system.

2. **Models of physical systems:** Formulation of differential equations for dynamic systems. Mechanical and Electrical systems. Transfer functions of a linear system. Block diagrams and reduction techniques, Signal flow graphs. Mason's formula. Standard test signals - step, ramp, parabolic and impulse. Impulse response.

3. **Introduction to control system components:** error detectors, servo motors, techno-generators and servo amplifiers. Determination of transfer functions.

4. **Time domain analysis:** Poles, Zeros and characteristic equations, Relation between S-plane root locations and transient response. Performance specifications in time domain such as overshot, rise time, settling time and steady state error. Transient response of second order systems. Derivative and Integral Control and their effect on the performance of the 2^{nd} order system. System types and error constants. Generalized error co-efficients. Transient response of higher order systems (out line only). Roth's stability criterion, scopes and limitations of Routh's criterion.

5. The root locus technique: Introduction, Rule for construction. System analysis and design (out line only) using root locus.

6. Frequency Domain analysis: Logarithmic plots, polar plots, log-magnitude Vs phase plots.

Nyquist stability criterion, Stability analysis. Relative stability. Close loop frequency response. Experimental determination of transfer functions. M and N circle.

Books:

1. Automatic Control System – Kuo
2. Modern Control Engineering – Ogata
3. Control System Engineering - Nagrath and Gopal

4. Control System Components – Gibson and Teylor

EE 541: DIGITAL SYSTEMS (EE/IE)

L T P
3 1 3
Max. Marks = 100
Sessional Marks = 50
Laboratory Marks = 50

1. **Number system**: Number base conversion, Binary numbers, octal and hexadecimal numbers, complements, signed binary numbers, Binary codes, floating point numbers and arithmetic.

2. **Boolean algebra and logic gates:** Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms-SOP & POS. Logical operations, truth tables, logic gates, logic levels and pulse waveforms, pulsed operation.

3. **Simplification of Boolean functions:** The map method- the Karnaugh map, minimal SOP & POS, Don't care conditions, multiple output minimization, tabular method, Quine-Mcclusky method, determination and selection of prime implicants.

4. **Combinational Logic:** (Logic synthesis): Introduction, universal property of NAND and NOR gates, AND-OR networks, NAND & NOR networks, EX-OR networks, design and analysis of combinational logic.

5. **Functions of combinational logic:** Adders & substractors, parallel binary adders, magnitude comparator, code conversion, decoders & encoders, Multiplexer & demultiplexers, parity generators & checkers. Read only memories PLA & PAL

6. **Synchronous sequential logic: Introduction:** S-R, J-k, D and T Flip Flops, Excitation table, Triggering of F/Fs & Latches, One shot Astable multivibrator.

7. **Registers, Counters and Memory Units:** Registers: - Shift – Registers, Ripple Counters, Synchronous Counters. Ring Counters, Timing Sequences, Design Procedure, Random Access Memory, Memory Decoding.

8. **Digital integrated Circuit:** Introduction, special characteristics (Fan-Out, Power dissipation, Propagation delay, figure of merit, noise level) Introduction to TTL, ECL, MOS, and CMOS circuit.

Books:

1. Digital Design – M. Marris Mano.
2. Logic Design Theory – NN Biswas
3. Digital Fundamental – TL Floyd
4. Digital Electronics- R.P.Jain.

EE 545: Electrical Machine - II L T P

3 1 0
Max. marks = 100
Sessional = 50

1. **Synchronous Machines:**
Construction and principles of operation of synchronous generators and motors. Ventilation and cooling, Armature windings, winding factors, emf equation. Armature reaction, leakage reactance, synchronous reactance, and impendence of non-salient pole machines. Short circuit and open circuit tests, short circuit ratio, M M F in salient and non-salient pole machines. Calculation of regulation by synchronous impedance method. MMF method and ASA method.

Introduction to two-reactance theory, locus diagram of synchronous impedance, slip test, damper winding and oscillation of synchronous machines, Synchronization, power angle diagram and synchronizing power. Determination of sub-transient and transient react races and time constants of synchronous machine by different methods. Determination of sequence impedances of synchronous machine. Parallel operation.
Synchronous motor: Phasor diagram, effect of varying excitation, effect of load variation, V-curve, O-curve, power angle diagram and stability, Hunting, Two-reaction theory of salient-pole motor, Starting. Use as synchronous phase modifiers.

2. A.C. commutator motors:
Construction and functions of the commutator.
3-phase commutator motor: Effects of voltage injection into the rotor circuit of a polyphase induction motor. Construction and operation of the Schrage motor. Effects of brush movement.
1-phase commutator motors: Universal and repulsion motors: Construction and principle of operation, Starting methods, Speed control, Improvement of commutation and power-factor by compensation.

3. Single phase induction motors:
Construction, Rotating and cross field theories, Equivalent circuit, Speed-torque characteristic, Starting methods.

4. Reluctance motors:
Construction and principle of operation, Synchronous and sub-synchronous operation, Effects of frequency and rotor resistance, Types of reluctance motor, Speed-torque characteristic.

5. Stepper motor:
Construction and principle of operation, Types, Characteristics, Selection and Application.

6. Servomotors:
Construction and principle of operation of AC and DC servomotors. Types, Damping in AC servomotors, Application.

REFERENCES:

1. Theory of Alternating Current Machinery: Langsdorff, A.S. MC-Graw Hill.
2. Electrical Machines: Nagrath I.J. and Kothari D.P. Tata MC-Graw Hill
3. Electrical Machines: Mukherjee P.K. and Chakravarty S. Dhanoat Rai.
4. Advanced Electrical Technology: Cotton H.
5. The Performance and Design of AC Commutator Machines: Taylor E.O. Wheeler.
6. Fractional and Sub-fractional H.P. Electric Motors: Veinott G.C. and Martin J.E. MC-Graw Hill

EE 544: ELECTRIC POWER SYSTEM – I

L T P
3 1 0
Theory Marks =100
Sessional Marks = 50

1. **General Introduction**: Introduction to power system, Single line diagram.
2. **Distribution:** Different systems and their comparison based on relative copper efficiencies, Concentrated and distributed loads in radial distributors fed at one and both ends. Ring mains. Stepped distributors, sub mains, feeders. Design of distributors, feeder and distribution substation.
3. **Line constants**: Resistance – Conductor materials. ACSR expanded ACSR, hollow and bundle

Conductors. Use of standard wire tables.
Inductance- Inductance of solid cylindrical conductor, composite conductor. Concept of G.M.D. Inductance of single conductor with ground return, 2-conductor single phase line, inductance of three phase single circuit and double circuit lines with symmetrical and unsymmetrical spacing. Skin effect and proximity effect. Bundle conductors. Internal impedance of conductor. Bessel real and Bessel imaginary.
Capacitance- Capacitance of isolated conductor, 2-conductor single phase line, three phase single circuit and double circuit lines with symmetrical and unsymmetrical spacing. Method of image and effect of ground. Charging current.

4. Performance of Transmission Lines: Performance of short- length and medium- length lines: Nominal- T and Nominal- pi representation. Performance of long transmission lines. Interpretation of the long- line equations. SIL. Ferranti effect. Generalized line constants and their application. Receiving- end, sending- end and universal Power-circle diagrams. Calculation of synchronous phase modifier capacity (SPM).line regulation. Maximum power limits. Efficiency of transmission line.

5. Mechanical design: Supporting structure for overhead lines. Towers(A,B,C,D and DE types), Disposition of conductors, spacing between conductors, length of span, calculation of sag and tension for equal and unequal suspension levels. Stringing chart, sag template, vibration and vibration damper.

6. Insulators: Different types of insulators. Leakage path, wet flashover and dry flashover distances, potential distribution over a string of suspension insulators, Methods of equalizing the potential. String efficiency.

7. Cables: Insulating materials. Construction of single core and multi-core cables, Armouring, laying and jointing.
H.V cables: pressure cables- oil filled and gas filled cables. Stress and capacitance of single core cable, most economical size of conductor. Capacitance and inter-sheath grading. Dielectric stress in bushing insulator. Capacitance and stress in 3 core cable, sheath effects, sheath current, insulation resistance, breakdown voltage and mechanism of breakdown. Thermal characteristics of cables.

8. Corona: Corona discharge, disruptive corona voltage and visual critical voltage, factors effecting corona, corona power loss, empirical laws, line design based on corona, advantages and disadvantages of corona, radio interference, inductive interference between power and communication lines

REFERENCES:

1. Electrical Power—S.L.Uppal.
2. Electrical Power System---C.L.Wadha.
3. Electrical Power System's design—M.V. Despande.
4. Switchgear principles—P.H.J.Crane.
5. Switchgear and Protection—S.S. Rao
6. Switchgear and Protection-- M.V. Despande.

EE 543: POWER ELECTRONICS (EE/IE)

L T P
3 1 3
Theory Marks= 100
Sessional Marks=50
Lab=50
Time=
3 hours.

1. **Operational Amplifier:** Features of an ideal, OP- AMP and typical applications, definitions of important terms including voltage and current off – sets, common- mode range, common – mode rejection ratio, power supply rejection ratio, slew rate, Zener diode voltage reference and voltage/ current sources in OP- AMP.

2. **Regulated D.C. Power supplies**: Requirements and principles Constant voltage and current regulators, use of ICs,
Line regulation, introduction to switching regulators.

3. **Semiconductor Power Devices:** Introduction, power diodes, power transistors and SCRs and their operations, GTOs, Triacs and other types of thyristors, their characteristics,

ratings, mounting and cooling. Series and parallel connections of SCRs. Triggering and control.

4. **Converter Operation with SCRs:** Single phase half- wave, full- wave and bridge circuits, three- phase half wave and bridge circuits, six- phase with interphase transformer, fully controlled and half- controlled circuits. Effects of load and source inductance. Dual converter and cycloconverter operating modes. Line commuted inverters, firing and control circuits for different operations.

5. **Forward commutation and Forced**: Commutated inverters: Forced commutation circuits, parallel, series and bridge (single- phase and three- phase) inverters, McMurray and McMurray- Bedford inverter circuits, Voltage and current source inverters. Output voltage control harmonics eliminations. Firing circuits for inverters.

6. **Choppers:** Principles of operation, classification, DC, AC, and multi- quadrant choppers, Morgan's, Jones, and Mazda's choppers. Application.

7. **Applications of SCRs**: SCR battery chargers, replacement of electromechanical devices by SCRs.

References:

1. Gray, P.E.&c.L.Scurle: Electronic Principles- Wiley Eastern.
2. Grabane, A.B.:Analog integrated Circuit Degign- Van Nortrand.
3. Ramamoorthy, m.: An Introduction to Thyristors and their Applications- East West Press.
4. Rashid, M.H. Power Electronics, Circuits, Devices and Applications- Prentice Hall of India.
5. Sen, P.C.: Power Electronics- TMH.
6. Dubey et al; Thyristorised Power Controllers- Wiley Eastern..

Branch: Chemical **Year**: Third **Semester**: Fifth

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
Theory			L	T	P	Sessional Exam			ESE	Subject Total	Credit
						TA	CT	Total			
1	HU 501	Econ & Prinpl of Mngmnt	3	1		30	20	50	100	150	4
2	CH 582	Chemical Reaction Engineering-I	3	1		30	20	50	100	150	4
3	CH 583	Mechanical Operations	3	1		30	20	50	100	150	4
4	CH 584	Chemical Engineering Thermodynamics	3	1		30	20	50	100	150	4
5	CH 585	Process Utilities	3	1		30	20	50	100	150	4
6	CH 586	Process instrumentation	3	1		30	20	50	100	150	4
Practicals											
7	CH 582L	Chemical Reaction Engg Lab			3	30	20	50		50	2
8	CH 583L	Mechanical Operations Lab			3	30	20	50		50	2
9	CH 584L	Chemical Engineering Thermodynamics Lab			3	30	20	50		50	2
10	CH 586L	Process instrumentation Lab			3	30	20	50		50	2
11	CH 587	General Proficiency							50	50	2
Total			18	6	12						

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

TA: teachers assessment ***CT: Class Test*** ***ESE: End Sem Exam***

CH584 Chemical Engineering Thermodynamics

L – T -P
3- 1- 2
Time : 3 hrs
Theory :100 Marks
Sessional : 50 Marks
Practicals: 50 Marks

Introduction :- Conservation of energy and first law of thermodynamics, application to steady state flow process, enthalpy, internal energy, equilibrium state, Phase rule, reversible vs irreversible process, heat capacity and specific heat.

Heat Effects: - Heat capacities of gases as a function of temperature, heat capacities of solids and liquids, concept of Cp_m, heat effects accompanying phase changes of pure substances, standard heats of reactions, formation, combustion, effects of temperature on the standard heat of reaction, heat effects of Industrial reactions.

Second law of thermodynamics:- Second law of thermodynamics, thermodynamic temperature scale, ideal gas temperature scale, concept of entropy, entropy change and irreversibility, single and multistage compressor: various types and applications.

Thermodynamics Properties of fluids:-Relationships among thermodynamics properties – work function and free energy, thermodynamics properties of single phase and two-phase systems, effects of temperature and pressure on various properties and their evaluation, types of thermodynamics diagrams, generalized correlations of thermodynamic properties of ideal gas mixtures.

Phase_ Equilibria :-Criteria of equilibrium, the Fugacity, Duhem's theorem, vapor –liquid equilibrium idealization, phase diagram for miscible systems, immiscible systems, partially miscible systems, testing of vapor –liquid equilibrium data, Gibbs –Duhem equation **Chemical _Equilibra** :-Criteria of chemical equilibrium, equilibrium conversion Xet equilibrium constant, effect of temperature and pressure on K. evaluation of K by conditions, construction of equilibrium conversion charts. Calculation of Xe for exothermic, endothermic, reversible, irreversible reactions.

BOOKS:

1. Smith , J.M. and Van Ness, H.C. , Introduction to Chemical Engg. Thermodynamics, McGraw-Hill
2. K V Narayanan, a Text book of Chemical Engg Thermodynamics, Prentice Hall India.
3. Dodge, Chemical Engg. Thermodynamics, McGraw-Hill.
4. Wilson and Ric, Principles of Chemical Engg. Thermodynamics, McGraw-Hill.

Practicals:

1. Experiment on chemical Equation

2. Experiments on 1st and 2nd law of thermodynamics
3. Determination of heat of reaction.

CH 582 CHEMICAL REACTION ENGINEERING-I

L-P-T
3-2-1
Theory : 100 marks
Sessional : 50 marks
Practicals: 50 marks
Time : 3 hrs

1. Rate of reactions, differential & integral rate laws, order and molecularity of reactions, Activation energy.

2. Interpretation of batch reactor data :
Integral and differential methods of analysis of data for constant volume variable volume cases, zero order, first order, second order auto catalytic reactions, reversible and irreversible reactions, half-life period, series and parallel reactions.

3. Introduction to reactor design :Mass and energy balance around a volume element, single ideal reactors under steady state conditions, development of design expression for batch, tubular and stirred-tank Reactor.

4. Reactor design or single reactions (with reference to 1st. and 2nd. order reactions), comparison of single reactions, general graphical representation.

Multi reactor systems – plug flow reactors in series, mixed flow reactors in series, combination reactors, recycle reactors and autocatalytic reactors.

Practicals (Sessional) :

1. Differential and integral method of analysis of Reaction, etherification of Butanol with acetic acid.

2. Determination of rate constant for saponification of ethyl acetate with NaOH in batch reactor.

Books

1. Chemical Reaction Engineering by Levenspiel, Wiley Eastern.
2. Elements of Chemical Reaction engineering, Fogler, 3rd Ed.,Prentice hall
3. Chemical Engineering Kinetics by D.M. Smith, McGraw Hill Publication.
4. Reaction Kinetics for Chemical Engineers by Wales, McGraw Hill Publication.

CH 583: MECHANICAL OPERATIONS

L – T – P
3 – 1 – 2
Time :3 hrs.
Theory : 100 marks; Sessional : 50 marks; Practicals: 50 Marks

1. **PARTICULATE SOLIDS** : Particle characterization – particle size distribution and mean particle size; Particulate solid in bulk-agglomeration, angle of repose and friction, flow of solids in hoppers, flow of solids through orifices, conveying of solids, measurement of solid flow rate; Classification of solid particles – gravity settling, centrifugal separators, sieves, magnetic separators, electrostatic separators, floatation.

2. **SIZE REDUCTION OF SOLIDS:** Mechanism of size reduction, Energy for size reduction – energy utilization, Methods of operating crushers, Nature of materials to be crushed, Types of crushing equipments-Coarse crushers, Intermediate crushers, Fine crushers, Vibration mills, Colloid mills, Fluid energy mills.

3. **MOTION OF PARTICLES IN A FLUID:** The drag force on a spherical particle – total force on the particle – effect of motion of the fluid – terminal falling velocities, Non-spherical particles – effect of shape& orientation on drag – terminal falling velocities, Motions of bubble and drops, Acceleration motion of a particle in the gravitational field, Motion of particles in a centrifugal field.

4. **SEDIMENTATION:** Gravitational sedimentation – Fine suspensions – Coarse suspensions – Solids flux in batch sedimentation – The Kynch theory of sedimentation – thickner, Centrifugal separation – behavior of liquids in centrifuge basket – fluid pressure – sedimentation in a centrifugal field – separation of two immiscible liquids – centrifugal equipment.

5. **FLUIDISATION**: Characteristics of fluidized systems – properties of gas – solids and liquid – solids systems – effect of fluid velocity on pressure gradient – minimum fluidizing velocity, Liquid-solid system-bed expansion-liquid and solid mixing,Gas-solid systems-bed characteristics-properties of bubbles in the bed-gas and solid mixing, Mass and heat transfer between fluid and particles, Application of the fluidized solids techniques-fluidized bed catalytic cracking-application in chemical industries-fluidised bed combustion.

6. **PNEUMATIC AND HYDRAULIC CONVEYING:** Pneumatic conveying-vertical and horizontal, Hydraulic conveying-homogenous flow-horizontal transport of settling suspensions-vertical transport-industrial applications.

7. **GAS CLEANING**.:Gravity separators, centrifugal separators, inertia or momentum separators, fabric filters, electrostatic precipitators, liquid washing, Agglomeration and coalescence.

8. **FILTRATION:**The theory of filtration – relation between thickness of cake and volume of filtrate-flow of liquid through the cloth-flow of filtrate through the cloth and cake combined, compressible filter cakes, Filtration practice-The filter medium-blocking filtration, effect of particle sedimentation on filtration-delayed cake filtration-preliminary treatment of slurries before filtration-washing of filter cake,Filtration equipment,Filtration in a centrifuge, Filtration calculations.

9. **MIXING AND AGITATION**: Agitation of liquids – Purpose of agitation-agitation equipment-Impellers-Flow patterns in agitation vessels-circulation rate- velocity gradients in agitated vessels-power correlations for specific impellers-effect of system geometry-calculation of power consumption.

Practicals:

1. Study of crushers and grinders
2. Verification of Rittinger's law
3. Experiment on batch sedimentation
4. Differential and cumulative screen analysis
5. Determination of screen effectiveness.
6. Experiment on plate and frame filter Press
7. Determination of minimum fluidization velocity

BOOKS :

1. Introduction to Chemical Engineering by Badger & Banchero.
2. Unit Operation in Chem. Engg. By MCcabe & Smith.
3. Chemical Engineering Vol I & II by Coulson & Richardson.
4. G G Brown: Unit Operations, CBS Publishers and Distributors

CH 586 PROCESS_ INSTRUMENTAION

L – T -P
3- 1- 2

Time : 3 hrs
Theory :100 Marks;

Sessional : 50 Mark; Practicals: 50 Marks

1. Fundamental : Elements of instruments, static characteristics, Dynamic characteristics, Application of Laplace transform in instrumentation . Response of 1st order and 2nd order instruments.
2. Temperature measuring instruments:-Like bimetallic , Vapour pressure , thermocouples, automatic potential recorders, resistance thermometers, radiation pyrometers, optical pyrometers, photoelectric pyrometers, thermsitors, response of these instruments.

3. Composition measuring instruments:-Spectroscopic methods , thermal conductivity cells, co-analysis, Fuel gas analysis , humidity measurement, moisture in paper, pH meter, oxygen analysis , polarography, colorimetry, combustible gas analysis.

4. Measurement of pressure and vacuum :-Menometers, pressure Spring , Mcleod gauge, Pirani Gauge, Ionization gauge, Thermocouple gauge, Liquid seals, responses of these instruments.

5. Viscosity & Sp. Gravity measurement:-Level measuring devices . Flow measuring devices , measurement of displacement, measurement of density.

Practicals:
1. Determination of time constant of a first order system
2. Calibration of flow measuring devices.
3. Composition analysis using spectrophotometer.
4. Study of conductivity meter and pH meter.
5. Experiment on humidity measurement.

BOOKS :

1. Donld P. Eckman – Industrial Instrumentaion.
2. A. Suryanarayana, Instrumentation & Process Control , Khanna Publishers, New Delhi.
3. R. K. Jain , Mechanical and Industrial Measurements, Khanna Publishers, New Delhi.

CH 585 PROCESS_UTILIIES

L – T -P
3- 1- 0
Time : 3 hrs

Theory :100 Marks; Sessional : 50 Mark

1. Importance of process utilities in chemical industries and plants. Introduction to the use of various utilities.

2. Water as a utility in process industries, conservation and recycle of water, cooling tower, spray pond.

3. Compressed air systems. Vacuum systems, boosters, air receivers, piping network, air leaks, and lubrication and oil removal.

4. Refrigeration systems and their characteristics, use of cryogenic temperatures.

5.Air condition and ventilation systems and their characteristics, air water systems, introduction to humidification and dehumidification equipments, air blending and exhaust.

6.Generation distribution and utilization of steam, steam economy and hanling steam engines, boiler and performance characteristics.
7.Internal combustion engine sycles – otto, Diesel, sual , Rankine cycles and their characteristics and performances.

8.Fire and safety in chemical industry :

(a) Chemical hazards, classification and threshold limits
(b) Chemical as a cause of poising and occupational disease.
© Engineering control of chemical plant hazards , ventilllation and lighting , maintenance of pressure vessels, storage , handling and transportation of chemicals , electrical systems, instrumentation , fore prevention , personnel protection devices , maintenance procedure , laboratory safety, effluent disposal and checking of spillage.
(d) Properties of important flammable liquids and gases and their classification , threshold limits and maimum permissible concentration of these chemicals. Concept of spontaneous combustion with remedial measures.
e) Rules and Acts governing explosive and flammable materials . Colour codes for safety color codes for pipe lines and gas cylinders. An exposure to Indian standards.

BOOKS :

1. Heat Engines – Pandya and Shaha
2. Heat Engines – Patel and Karamchandani (Vil II, III)
3. Air conditioning & Refrigeration – Stephen & Elonka
4. Efiicient use of Steam – HMSO, London.

Theory *: 6 X 100 = 600*
Sessional **: 6 X 50 = 300**

Practicals **: 4 X 50 = 200**
General Proficiency **:50**
Total **:1150**

Branch: ETE **Year**: Third year

Sl. No.	Course No.	Subject	Periods			Evaluation Scher				
			L	T	P	Sessional Marks			ESE	
						TA	CT	Total		
1	ET 562	Digital Electronic Circuits	3	1		30	20	50	100	
2	EE 543	Control System-I	3	1		30	20	50	100	
3	ET 564	Instrumentation & Electronic Measurements	3	1		30	20	50	100	
4	ET 565	Analogue Communication	3	1		30	20	50	100	
5	ET 566	Power Electronics	3	1		30	20	50	100	
6	HU 501	Economics and Principles of Management	3	1		30	20	50	100	
Practicals/Drawing/Design										
7	ET 562L	Digital Electronic Circuits			3	30	20	50		
8	ET 564L	Instrumentation &			3	30	20	50		

		Electronic Measurements								
9	ET565L	Analogue Communication			3	30	20	50		
10	EE 543L	Control System-I			3	30	20	50		
11		General Proficiency							50	
Total			18	6	12					

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

TA: teachers assessment ***CT: Class Test*** ***ESE: End Semester Exam***

ET 562 Digital Electronic Circuits
Theory: 100
Sessional: 50
Time: 3 hours

Number System and Codes: Positional number systems - decimal, binary, octal and hexadecimal. Number base conversion. Representation of negative binary numbers. Codes - BCD, Gray, ASCII extended BCD.

Boolean algebra and logic circuits: Axioms and basic theorems of Boolean algebra. Truth table, logic functions and their realization. Logic gates, standard representation (canonical forms) of logic functions - SOP and POS forms. Min terms and max terms.

Simplification of logic functions: Karnaugh map of 2, 3 and 4 variables. Simplification by algebra and by map method. Function simplification when functions are incompletely specified. Synthesis using AND, OR and INVERT and then to convert to NAND or NOR implementation.

Logic families: The TTL family. Brief idea about ECL and CMOS logic families Gate properties fan-in, fan-out, propagation delay and power-delay product.

Combinational logic circuit design: Combinationa! logic circuits and building blocks. Binary adders and subtractors. Encoders, decoders, multiplexers, demultiplexers, comparators, parity generators etc. Realization of logic functionsthrough decoders and multiplexers.

Introduction to sequential circuits: Flip-flops - truth table and state table. The S-R, J-K, T and D flip-flop. Race condition. Sequential circuits, clock, counters and registers. Ripple counter, synchronous counters, up/down counters, modulo-N counter. Design of counters - state diagram.

Some functional devices: SSI, MSI LSI and V LSI devices. RAM and ROM - their uses. Some commonly used digital ICs.

EE 543 Control System I

Theory: 100

Sessional: 50
Time: 3 hours

Elementary concepts: Open loop and closed loop systems. Examples of modern control systems. Definition of Linear, Nonlinear, Time Invariant and Time Variant, Continuous and discrete control systems

Models of Physical Systems: Formulation of differential equations for a dynamic system. Mechanical and electrical systems. Transfer functions of a linear system. Block diagrams and reduction technique, signal flow graphs. Mason's formula. Standard test signal's _step, ramp, parabolic and impulse. impulse response.

Introduction to control system components: Error detectors, servo motors, techogenerators and servo amplifiers. Determination of transfer functions.

Time domain analysis: Poles, zeros and characteristics equations, relation between S plane root locations and transient response. Performance specifications in time domain such as overshoot, rise time, setting and steady state error. Transient response of second order systems. Derivative and integral control and their effect on the performance of the second order systems. System types and error constants. Generalized error coefficients. Transient response of higher order systems(outline only). Routh's satiability criterion, scopes and limitations of Routh's criterion.

The root locus technique: Introduction. Rule for contruction. System analysis and design(outline only) using root locus.

Frequency domain analysis: Logarithmic plots, polar plots, Log magnitude vs phase plots.
Nyquist stability criterion, stability analysis, Relative stability. Closed loop frequency response. Experimental determination of transfer functions. M and N circle.

Textbooks and references

1. Automatic Control System- Kuo.
2. Modern Control Engg.- Ogata.
3. Control system Engg.- Nagrath & Gopal.

ET 564 Instrumentation & Electronic Measurements
Theory: 100
Sessional: 50
Time: 3 hours

Review: Quick review of electromagnetic indicating instruments and potentiometers. Limitations of such instruments.

Bridges:The principles of bridges. The basic Wheatstone bridge, Kelvin's bridge, Anderson's bridge and the Hey's bridge.

Operational Amplifiers:Basic circuits. Enhancing the performance of traditional measuring instruments with the help of Op- Amps. Increasing input resistance, range and accuracy. High frequency instruments build around precision rectifiers. Measurements of important electrical parameters. Four quadrant multipliers and the measurement of power.

DA/AD Converter: Effect of resolution and non-linear behaviour on accuracy of measurement. Working of R-2R ladder DA converter. AD conversion - successive approximation type, dual slope integrating type and flash converter.

Analog Multiplexing: Analog switches, sample and hold circuit. Multiplexing of multiple signals.

The Oscilloscope:The principle and the important components of an analogue scope. Time base and deflection fundamentals. Delayed time base. Multiple channels and the various mode of display. Concepts of digital scopes. The use of the oscilloscope for: measuring voltage and current waveforms, frequency and phase measurements, displaying electrical and magnetic characteristics of materials.

Use of Microcomputers: Use of microcomputers for transient measurements. RMS calculation, linearization of thermocouple signals. The IEEE-488 standard.

Measurement and error:Statistical analysis, probability of errors. System of units and standards of measurement.

Text Books/references:

1. William David Cooper- Electrical Instrumentation and Measurement Techniques. Prentice Hall of India Private Limited.
2. Golding and Widdis- Electrical Measuring Instrument and Measurement. ELBS.
3. E.O. Doeblin – Measurement Systems.
4. Ralph Morison – Instrumentation Fundamentals and Applications, John Wiley & Sons.
5. D. Patronobis – Sensors and Transducers, Wheeler Publications.

ET 565 Analog Communication
Theory: 100
Sessional: 50
Time: 3 hours

Spectra and Noise: Review of Fourier series and transform; energy/power-type signals, auto-/cross-correlation functions, spectral density; thermal noise, time average noise statistics, band-limited white noise.

Amplitude Modulation: Need for modulation. Types of analog CW modulation. Linear CW modulation schemes. Double Sideband Large Carrier (DSB-LC), Double Sideband Suppressed Carrier (DSB-SC), Single-Sideband (SSB), VesigialSideband (VSB). Generation and detection. AM broadcasting.

Angle Modulation: Phase Modulation (PM), Frequency Modulation (FM),Bessel functions and FM spectral analysis, Narrowband FM and Wideband FM, frequency division multiplexing (FDM). Generation and detection of PM and FM. Stereophonic FM broadcasting.

Radio Receivers: TRF receivers. Superheterodyne receivers. Image frequency. Image rejection ratio. Receiver sensitivity and selectivity. Phase locked loops. Synchronous detection.

Noise: Sources and characteristics of different noise. Concept of white Gaussian noise. Noise calculations: noise temperature, noise bandwidth and noise figure. Effect of noise on amplitude modulation systems, effect of noise on angle modulation, comparison of different analog communication systems. Envelope detection and threshold effect. Performance of exponential modulation schemes in presence of noise. Output S/N ratio. Threshold effect in FM. Pre-emphasis/de-emphasis filtering. Comparison of CW modulation systems.

Pulse Modulation: Review of sampling theorem and practical sampling of PAM, PWM and PPM signals. Generation and detection.

Text Books/references:

1. S. Haykin, *Communication Systems*, 4th ed., John Wiley & Sons, 2001 (2 copies on reserve, K5101.H37 2001).
2. J.G. Proakisand M. Salehi, *Communication System Engineering*, 2nd ed., Prentice Hall, 2002 (2 copies on reserve, TK5101.P75 2002).
3. B. Sklar, *Digital Communications: Fundamentals and Applications*, 2nd Ed., Upper Saddle River, N.J., Prentice-Hall PTR, 2001 (1 copy on reserve, TK5103.7 .S55 2001).

ET 566 Power Electronics

Theory: 100

Sessional: 50
Time: 3 hours

SCRs: Basic theory of operation. Characteristics. Ratings. Protection- Series and parallel operation. Methods of firing and commutation. Firing circuits.

Triacs and Diacs: Basic theory of operation. Characteristics. Ratings. Protection. A.C. load control using Triacs and Diacs.

Line Commutated Controlled Converter:2 pulse, 3 pulse and 6 pulse configurations. A. C. phase control.

Choppers: Principles Class; fications and basic chopper circuits.

Inverters: Series, parallel and bridge inverters. Voltage control of inverters.

Control of Electric Motors: Phase control of D.C. shunt and series motors. Speed control of induction motors using SCRs. Slip power recovery scheme.

High Frequency Heating: Principles of Operation and application of induction and dielectric heating. High frequency sources.

Text Books/references:

1. G. M. Chute and R. D. Chute -Electronics in Industry, McGraw-Hill.

2. M. Ramamoorthy - An Introduction to Thyristors and their Applications, East-West Press.
3. P. C. Sen - Power Electronics, Tata McGraw-Hill

Branch: Instrumentation Engineering Year: Third
Semester: Fifth

Sl No.	Course No.	Subject	Period			Evalu		
	Theory		L	T	P	Sessional Examination		
						TA	CT	Tota
1.	HU 501	Economics & Principles of Management	3	1		30	20	50
2.	EE 541	Digital Systems	3	1		30	20	50
3.	EE 542	Control System-I	3	1		30	20	50
4.	EE 543	Power Electronics	3	1		30	20	50
5.	IE 551	Instrumentation System Components-I	3	1		30	20	50
6.	IE 552	Electronic Instrumentation	3	1		30	20	50
7.	IE 553	General Proficiency						
Practical/Drawing/Design								
8.	EE 541	Digital Systems			3	25	25	50
9.	EE 542	Control System-I			3	25	25	50
10.	EE 543	Power Electronics			3	25	25	50
11.	EE 551	Instrumentation System Components-I			3	25	25	50
TOTAL			18	6	12	280	220	500

Total Marks: 1150 **Total Periods: 36**
Total Credits: 34

TA: Teachers' Assessment *CT: Class Test*
ESE: End Semester Examination

IE 552: Electronic Instrumentation

L T P
3 1 0
Max. Marks=100
Sessional = 50

Basic principle of analog electronic instruments: peak, rms and average-reading type voltmeter, Q-meter and distortion meter, vector impedance meter, vector voltmeter..

Operational Amplifiers: Characteristics & Circuit Configurations. Instrumentation amplifiers and their applications.

Active filters and their design considerations-: low pass, band pass and high pass filters.

Function generators: square wave, triangular, saw tooth type pulse and square wave generators. Sweep frequency generator.

Analogue and digital data acquisition systems: Interfacing transducers to electronic control and measuring systems.DC and AC signal conditioning circuit, Analog to Digital (A/D) and Digital to Analog (D/A) converters.

PLL, voltage to frequency and frequency to voltage converters: Lock-in amplifier and its application, digital frequency meter, wave and spectrum analyzers harmonic distortion analyzer, heterodyne harmonic analyzer.

Strip-chart recorder, x-y recorder.

Books:

1. Electrical and Electronic Instrumentation: Swahney, A.K.
2. Modern Electronic Instrumentation and Measurement Techniques: Helfric AD and Cooper WD, PHI, 1992
3. Instrumentation, Measurement and Feedback :Jones BE,
4. Op-Amp and Integrated Ckts:Gayakwad RA,PHI,N.Delhi
5. Electronic Instrumentation : Kalsi, TMH

IE 551: Instrumentation Systems Components – I

L T P
(3 1 3)
Max. Marks = 100
Sessional Marks= 50
Lab Marks= 50

Transducers: classification. Resistance transducers. Resistance potentiometers. RTD and thermistors. Strain gauges and their application in pressure, force and torque measurements. Load Cells. Hot wire anemometers and associated circuits.

Inductive transducers: Types of inductance transducers and their principles of operation. LVDT and phase sensitive detectors. Variable reluctance type transducers. Push-pull arrangement and reduction of non-linearity. Associated circuits.

Capacitive transducers:Air gap and dielectric type. Capacitance Bridge. Capacitance microphone and associated circuits.

Piezoelectric transducers-: principle of operation, frequency response and Applications.

Elastic transducers: springs, bellows, diaphragms and Bourdon tube.
Combination of elastic and electric transducers.

Thermocouple: Characteristics, installation and compensation. Measuring Circuits.

Magnetostrictive transducers: applications in flow measurements. Different types of flow transducers and their principles of operation.

Transducers for acceleration, vibration and shock

Digital transducers.

References/Books:

1. Measurement Systems: Application and Design: Doebelin E O, TataMcGraw

2. Transducers and Instrumentation: Murthy DVS, PHI New Delhi

3. Sensors and Transducers: Patranabis D, Wheeler, 1996.

4. Instrumentation, Measurement and Feedback: Jones, BE, TMH

Theory : 6 X 100 = 600
Sessional : 6 X 50 = 300

Practicals : 4 X 50 = 200
General Proficiency :50
Total :1150

Branch: CSE **Year**: Third year

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
			L	T	P	Sessional Marks			ESE	Total marks	Cred
						TA	CT	Total			
1	ET 572	Digital systems	3	1		30	20	50	100	150	4
2	CS 573	Formal Languages & Automata Theory	3	1		30	20	50	100	150	4
3	CS 574	Systems Programming	3	1		30	20	50	100	150	4
4	CS 575	Software Engineering	3	1		30	20	50	100	150	4
5	CS 576	Principles of Programming Language	3	1		30	20	50	100	150	4
6	HU 501	Economics and Principles of Management	3	1		30	20	50	100	150	4
Practicals/Drawing/Design											
7	ET 572L	Digital systems			3	30	20	50		50	2
8	CS576L	Principles of Programming Language			3	30	20	50		50	2
9	CS575L	Software Engineering			3	30	20	50		50	2
10	CS 574L	Systems Programming			3	30	20	50		50	2
11		General Proficiency							50		
Total			18	6	12						

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

TA: teachers assessment ***CT: Class Test*** ***ESE: End Sem Exam***

ET 572 Digital Systems
Theory: 100
Sessional: 50
Time: 3 hours

Number representation : Signed magnitude, One's and two's complement numbers.

Binary Arithmetic: Addition, subtraction, multiplication and division. Fixed and floating point arithmetic.

Boolean Algebra and switching circuits: Boolean algebra, Boolean expressions, logic functions, SOP and POS, function minimization - Carnaugh map and algorithms. Logic gates. Design and analysis of combinational circuits, address generation, code converters, parity generator. Sequential circuits. Flip-flops, counters, registers, decoders, encoders, multiplexers.

Logic families:TTL, CMOS and ECL. RAM, ROM, E-PROM, EEPROM, PAL, PLD and PGA. Schmitt trigger and timing circuits.

Current trends in digital design: ASIC, FPGA and CPLD.

Books / References:

- M. Morris Mano — Digital Design. Prentice Hall of India
- P. Malvino an4 D. K. Leach— Digital Principles and Applications. Tata-McGraw-Hill.
- M. Morris Mano — Digital Logic and Computer Design. Prentice Hall of India.

CS 573 Formal Language and Automata Theory
Theory: 100 marks
Sessional: 50 marks
Time: 3 hours

Alphabets, languages and grammars.

Finite automata: regular expressions and regular languages.

Context free languages: pushdown automata, DCFLs, LL(K), LALR grammars.

Context Sensitive Languages: Linear Bounded Automata.

Turing Machines: Recursively enumerable languages, operation on formal languages and their properties.

Decision query on languages.

Undecided problems.

Books / References:

1. Introduction to Automata Theory, Languages & Computation – J. E. Hopercroft and J. D. Ullman, Published by Narosa.

2. Introduction to Languages and The Theory of Computation – J. C. Martin, McGraw Hill International Edition.

CS 574 System Programming
Theory: 100 marks
Sessional: 50 marks
Time: 3 hours

Overview : Definition and classification of system software.

Assemblers : Assembly language, Assembly process, Assembler data structures, Assembler macros and macroprocessors.

Linkers and loaders : Basic concepts, Static and Dynamic linking, shared libraries, loaders, overlays. Case study of UNIX linking system, Windows DLL, OLE, ActiveX.

Debugger : Types, features, case study : sdb/dbx.

Editors : Types, Structure, case study of vi, sed and wordstar.

Unix Utilities: Make, RCS, sed, grep, awk, etc.

Compiler Principles.

Books:

1. Dhandhere, System programming and operating systems, Tata McGraw Hill.
2. System Software, Beck,
3. Sumitabha Das, Unix System V.4 Concepts and Applications, TMH.
4. Linux Manuals.
5. Windows Manuals.

CS 575 Software Engineering
Theory: 100 marks
Sessional: 50 marks
Time: 3 hours

Introduction: Life cycle models

Function oriented software design: Structured analysis and structured design.

Object Oriented Design: User interface design, GUI design primitives, Window management system and the X-Windows system.

Coding and Testing: Coding standard and unit testing.

Software requirements, analysis and specification: Informal and formal specification.

Project management: Estimation, scheduling, risk management and configuration management.

Software reliability and quality assurance: Reliability metrics and growth modeling, ISO-9000, SEI and CMM.

Software maintenance and CASE tools.: Text Books / References:

1. An Integrated Approach to Software Engineering by Jalote. Narosa Publishing House
2. Software Engineering by R. S. Pressman, McGraw Hill
3. Software Engineering by R. Mall, PHI.

CS 576 Principles of Programming Languages
Theory: 100 marks
Sessional: 50 marks
Time: 3 hours

Introduction to various programming paradigms and their implementation issues.

Imperative Programming
Block structure, scoping rules, parameter passing etc. in languages like C, PASCAL and FORTRAN.

Objective Oriented Programming
Abstraction, hiding, objects, classes, inheritance etc. in languages like C^{+++} and Modular JAVA.

Functional Programming
Functions, Recursion, types, polymorphism, storage allocation in languages like LISP, ML Scheme.

Logic Programming
Horn clauses, SLD resolution etc. in languages like PROLOG.

Introduction to Concurrent Programming
Expressing parallelism, communication, synchronization etc. in languages like Ada, CSP and Linda.

Introduction to mathematical foundations and semantics of programming languages.

Books / References:

1. Programming Languages – Concepts and Constructs, Ravi Sethi.
2. Programming Languages – Design and Implementation, T. W. Pratt.
3. The Study of Programming Languages by Stansifer.

BRANCH: **INDUSTRIAL & PRODUCTION ENGG. (5TH Semester)**

SL.No	Course No	SUBJECT	PERIOD			EVALUATION SCHEME					
Theory						Sessional/Exam.			ESE	Subject Total	Credit
			L	T	P	TA	CT	Total			
1	HU 501	Economics & Principle of Management	3	1	0	30	20	50	100	150	4
2	ME 525	Instrumentation	3	1	0	30	20	50	100	150	4
3	ME 526	Machine Design - I	3	0	0	30	20	50	100	150	4
4	IP 532	Fluid Mechanics and Machine	3	1	0	30	20	50	100	150	4
5	IP 533	Manufacturing Process - III	3	0	0	30	20	50	100	150	4
6	IP 534	Foundry & Welding Technology	3	1	3	30	20	50	100	150	4
7	IP 535	General Proficiency							50	50	2
Practical/ Drawing/Design											
8	ME 525L	Instrumentation	0	0	3	30	20	50		50	2
9	ME 526L	Machine Design – I	0	0	3	30	20	50		50	2
10	IP 532L	Fluid Mechanics and Machine	0	0	2	30	20	50		50	2
11	IP 533L	Manufacturing Process – III	0	0	3	30	20	50		50	2
Total			18	4	14					1150	

Total marks : 1150 **Total Periods: 36**
Total Credits : 34

TA : Teachers Assessment *CT: Class test* *ESE : End Semester examination*

ME525: INSTRUMENTATION (3-1-3)

Theory: 100 ; Sessional: 50; Laboratory: 50; Time: 3hours

Definition of Instrumentation.
Dynamic characteristics of instruments and instrumentation system, Linear and non-linear systems, Electrical networks, Mechanical systems, Analogous systems, Thermal systems, First and Second order systems.
Measurement of linear displacement and linear displacement transducer (i) Resistance potentiometer, (ii) Strain gauge, (iii)Variable inductance transducers, (iv) Linear variable differential transducers(LVDT), (v) Capacitive transducers, (vi) Piezo electric transducers.

Measurement of rotary displacement and rotary displacement transducers (i) Resistance potentiometer, (ii) Strain gauge, (iii) Rotary variable differential transducers, (iv) Capacitive transducers, (v) Shaft encoder.
Strain gauges: Measurement of strain and applications of strain gauges.
Measurement of pressure with secondary transducers (i) Resistive , (ii) Inductive , (iii) Capacitive, (iv) Piezo-electric transducers.
Measurement of torque (i) Strain gauges, (ii) Torque meters, (iii) Inductive torque transducers, (iv) Digital method, (v) Magneto-stricture transducers.
Measurement of linear velocity (i) Moving magnet type transducer , (ii) Moving coil type transducer, (iii) Seismic type velocity transducers.
Measurement of angular velocity: (i) AC and DC tachometer generators, (ii) Drag cup rotor AC, (iii) Photo-electric tachometer, (iv) Stroboscopic methods.
Measurement of vibrations: (i) Seismic transducers, (ii) LVDT accelerometers, (iii) Piezo-electric accelerometers.
Measurement of temperature: (i) Platinum resistance thermometers, (ii) Thermocouples, (iii) Thermistors, (iv) Optical pyrenometers.
Measurement of flow: (i) Turbine meter, (ii) Electro-hydro-dynamic flow meters, (iii) Hot wire anemometer.
Measurement of sound using microphone.
Measurement of thermal conductivity; (i) Gas analyzer (ii) Using thermistors.
Cathode ray oscilloscope: observation of wave forms, measurement of voltage and current, Lissajous patterns for measurements of phase and frequency.
Signal conditioning; (i) AC amplifiers, (ii) operational amplifiers and specifications, (iii) Charge amplifiers, (iv) Amplitude modulations and demodulations , (v) Different types of filters, (vi) Wheatstone bridge, (vii) Inductive transducers and AC bridges, (viii) Blumlein bridges, (ix) Integration and differentiations (x) Analog- Digital and Digital- Analog conversion techniques.
Introduction to display devices.
Recorders : (i) Analog recorders, (ii) Strip chart recorders, (iii) Galvanometers type recorders, (iv) Null-type recorders, (v) X-Y recorders, (vi) Ultra-violet recorders, (vii) Magnetic tape recorders, (viii) Frequency method recorders, (ix) Pulse duration modulation recorders, (x) Direct recording, (xi) Digital tape recording .
Control systems and components: (i) Linear approximation and non-linear system, (ii) Servo-motors, (iii) AC tachometer, (iv) Amplidyne, (v) AC position control system, (vi) Stepper motors.

References:

4. A course in Electrical, Electronics measurements and Instrumentation-A.K.Shawney.
5. Automatic control systems-Benjamin and Rao.
6. Control system Engineering- I.J.Nagrath and M.Gopal.

ME 526: MACHINE DESIGN I (3-0-3) (For ME & IPE)

Theory -100 marks Sessional-50 marks Time 4hours

Unit I: Introduction General considerations and procedure for designing, types of Loads, Designed stress and factor of safety, stress concentration, selection of materials, codes for design-BIS codes, Failure theories, Fits and Tolerance.

Unit II:Joints a) Detachable joints: Design of threaded fasteners, thread forms and threaded fastener types and materials, bold tightening and initial tension, Power screws.

b) Permanent Joints: Riveted joints and welded joints – eccentric loading.

Unit III:Shafting Design of shaft subjected to bending, torsion, axial and combined loading, keys, cotter and Knuckle joint.

Unit IV: Coupling Rigid and Flexible coupling.

Unit V:Power Transmission Element Belt and Chain Drives, design of Flat and V-belts.

Unit VI:Bearing Journal Bearing, Mechanism of fluid film lubrication, fluid viscosity, Petroff's Equation.

Books:

1. Machine Design by Black and Adams (TMH)
2. Design of machine elements by M F Spott
3. Design of machine elements by B V Vandari (TMH)
4. Machine Design by Hall

5. Machine Design by Khurmi and Gupta
6. Machine Design by Bahl and Goel
7. Machine Design by Shigley.

IP 532 : FLUID MECHANICS AND MACHINES [3-1-2]

Theory100 -marks Sessional-50 marks Lab./Pract.50 marks Time 3 hours

Unit I Properties of Fluids and Fluid Statics Density, pressure, shear stress and velocity, compressibility, Gas laws, measurement of pressure – manometers, Buoyancy, metacentre, equilibrium of floating bodies ; Hydrostatic forces and centre of pressure on submerged bodies.

Unit II Fluid Kinematics Lagrangean viewpoint, Eulerian view point ; Streamline, Pathline, Streakline, Rotational and irrotational motion ; Stream function, Potential function and Vorticity ; Steady flow, Unsteady flow.

Basic laws : Continuity equation, Momentum equation Energy equation ; Bernoulli's equation ; Euler equation ; venturimeter ; orificemeter, pitot tube, pitot static tube.

Unit III Flow of Real fluids Reynold's number, Laminer flow, Hagen –poisseullie Equation, Turbulent flow. Darcy's Weisbach eaquation ; Basic of boundary layer theory, Losses in pipes. Dimensional analysis and similitude.

Unit IV Hydraulic Turbines Impact of jets on stationery and moving vanes ; Pelton Wheel, Francis turbine, Propeller and Kaplan turbine – construction, working principle, velocity triangle, governing mechanism and simple problems.

Unit V Pumps Centrifugal pump – construction, working principle, velocity triangle, Heads, NPSH, cavitation, simple problems. Reciprocating Pumps – construction, working principle, single-acting and double-acting pump, simple problems.

References :
1. Streeter and Wylie -- Fluid machanics, 6e, McGraw Hills inc.
2. Kumar, K.L. --- Fluid machanics
3. Lal, Gagadish --- Fluid machanics, Hydraulic Machines
4. Rajput, R.K. --- A text book of Fluid Mechanics

IP 533 : MANUFACTURING PROCESS III [3-0-3]

Theory100marks Lab/Pract.50marks Sessional50marks Time 3Hrs

Unit I: Plastic Deformation of Metals. Theory of plasticity – Stress tensor, principal stresses ;Mohr's Circle representation of stress states. Field criteria, Von mises strain energy criterion. Mechanical working of metals – Hot and cold working.

Unit II : Forging The process – forgeability and grain flow pattern. Different forging operations ; forging hammers and presses. Forging design – forging defects.

Unit III : Rolling The principle and concept ; hot and cold rolling – Rolling parameters and their effects – rolling forces. Rolling stud arrangement and roll passes – Break down passes. Tube rolling.

Unit IV : Extrusion and Drawing The Principle – hot and cold extrusion ; Types and methods and application – extruding tubes. Drawing of wire, rod and tubes.

Unit V : Press Work and Sheet metal operations Introduction – types of press and press safety devices – press working operation ; cutting and shearing, bending, forming, drawing, squeezing, embossing, coining and stretch forming.

Stock layout ; defects in sheet metal formed parts – metal Spining.

Unit VI :Manufacture of threads and gears – different methods and finishing operations.

Unit VII : Power Metallurgy. Introduction – Requirement and methods of working powders – the process. Primary and Secondary process – Typical applications.

Unit VIII : Coating of metal surfaces. Necessity – requirements of coating materials – organic and inorganic coatings.

Reference books :

1. A courses in workshop Technology, Vol. I ---------- B. S. Raghuwanshi.
2. Manufacturing Technology ------ P. N. Rao.
3. Theory of Metal Forming and Metal Cutting -------- K. P. Sinha and S. C. Prasad.

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IP 534 : FOUNDRY AND WELDING TECHNOLOGY [3-1-3]

Theory100 marks Sessional50 marks Lab/Pract.50marks Time 3Hrs

Unit I : Solidification of Casting Mechanism of solidification. Heat transfer between metal and mould ; importance of directional solidification and methods of obtaining it. Dissolved gases in molten metal and method of degassing.

Unit II : Casting design. Functional design of casting – dimensional design such as minimum section thickness, dimensional tolerance, surface finish etc. Simplification of foundry practice such as selection of proper and economical moulding material and processes, elimination of curing etc. Metallurgical design such as selection and optimum use of casting alloy.

Unit III : Analysis of Casting Casting defects – Salvages and Rectification ; inspection of casting, cleaning and quality control.

Heat Treatment and finishing operation on castings.

Unit IV : Special Casting Methods Permanent mould, slush and pressed casting ; die casting, centrifugal casting, investment casting and continuous casting. Application and economic study of the methods.

Unit V : Metals and their Weldability. Definition and concept of weldability – effect of alloying eliment on weldability. Weldability testing. Welding metallurgy temperature changes and their effect on mechanical properties ; residual stresses and distortion – heat treatment. Absorption of gasses by weld and their effects.

Unit VI : Modern Welding Developments. Submerged arc, shielded arc, atomic hydrogen thermit welding – brief study of the processes and applications.

Survey of principles and application of electro slag, electron beam. FIG, MIG, laser, Plasma and ultrasonic welding.

Unit VII : Welding of C.I., Carson steels, stainless steel, aluminium and its alloys and copper and its alloys. Welding of practices.

Unit VIII : Welding electrodes – Classification and coding. Testing and inspection of weld.

Reference books

1. Principles of Metal Casting ---------- Weins Resenthal.
2. Fundamental of Metal Casting Technology ------ P. C. Mukherjee.
3. Fundamental of Metal Casting -------- R. A. Flin.
4. Metallurgy for Engineers ------ R. C. Rollason.

5. Welding Technology -------- Keonigs and Larger.
6. Welding Engineering ------- Rossi.
7. Metallurgy of Welding -------- Udin et al.