B.TECH DEGREE COURSE IN SAFETY & FIRE ENGINEERING

(2012 Admissions)

SCHEME OF EXAMINATIONS

B.TECH DEGREE COURSE IN SAFETY & FIRE ENGINEERING

Scheme of Examinations (2012 admissions)

SEMESTER I&II (Common to all branches)

Code No.	Subject	L Hrs/wk	T Hrs/wk	P Hrs/wk	C	Int	Univ	Total
1101	Engineering Mathematics –I	2	1	-	4	50	100	150
1102	Engineering Physics	3	-	-	4	50	100	150
1103	Engineering Chemistry	3	-	-	4	50	100	150
1104	Engineering Mechanics	3	1	-	5	50	100	150
1105	Engineering Graphics	1	-	3	5	50	100	150
1106	Basic Civil and Mechanical Engineering	2	-	-	4	50	100	150
1107	Basic Electrical and Electronics Engineering	2	-	-	4	50	100	150
1108	Computer Programming	1	-	-	3	50	100	150
1109	Environmental Studies and Technical Communication	2*	-	-	3	50	100	150
11 L1	Electrical and Mechanical Workshop	-	-	3	4	100	-	100
11 L2	Computer Programming Laboratory	-	-	2	2	100	-	100
11 L3	Language Laboratory	-	-	1	1	100	-	100
	TOTAL	**19**	**2**	**9**	**44**			

* 1 hour / week each for Environmental Studies and Technical Communication.

SEMESTER III

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P Hrs/ Wk	C	Int.	Univ.	Total
CE/CS/EB/EC/EE/ EI/FT/IT/ME/SE 1301	Engineering Mathematics –II	3	1	0	3	50	100	150
SE 1302	Principles of Chemical Engineering	3	1	0	3	50	100	150
SE 1303	Engineering Fluid Mechanics and Machinery	3	1	0	3	50	100	150
SE 1304	Principles of Safety Management	3	1	0	3	50	100	150
SE 1305	Safety in Construction	3	1	0	3	50	100	150
SE 1306	Elements of Machine Drawing	3	1	0	3	50	100	150
SE 13 L1	Fluid Mechanics & Machinery Laboratory	0	0	3	2	100	-	100
SE 13 L2	Safety Engineering Laboratory	0	0	3	2	100	-	100
	TOTAL	**18**	**6**	**6**	**22**			

SEMESTER IV

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P Hrs/ Wk	C	Int.	Univ.	Total
CE/CS/EB/EC/ EE/EI/FT/IT/ ME/SE 1401	Engineering Mathematics –III	3	1	0	3	50	100	150
SE 1402	Transfer Operations in Chemical Engineering	3	1	0	3	50	100	150
SE 1403	Strength of Materials	3	1	0	3	50	100	150
SE 1404	Fire Engineering Fundamentals	3	1	0	3	50	100	150
SE 1405	Electrical Technology and Safety	3	1	0	3	50	100	150
SE 1406	Occupational Health and First Aid	3	1	0	3	50	100	150
SE 14 L1	Strength of Materials Laboratory	0	0	3	2	100	-	100
SE 14 L2	Electrical Technology Laboratory	0	0	3	2	100	-	100
	TOTAL	**18**	**6**	**6**	**22**			

SEMESTER V

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P Hrs/ Wk	C	Int.	Univ.	Total
CE/CS/EB/EC/ EE/EI/FT/IT/ ME/SE 1501	Engineering Mathematics -IV	3	1	0	3	50	100	150
SE 1502	Reaction Engineering and Chemical Technology	3	1	0	3	50	100	150
SE 1503	Principles of Engineering Design	3	1	0	3	50	100	100
SE 1504	Planning and Design of Fire Protection Systems	3	1	0	3	50	100	100
SE 1505	Manufacturing Processes	3	1	0	3	50	100	100
SE 1506	Chemical Process Safety	3	1	0	3	50	100	100
SE 15 L1	Chemical Engineering Laboratory	0	0	3	2	100	-	100
SE 15 L2	Fire Safety Training	0	0	3	2	100	-	100
	TOTAL	**18**	**6**	**6**	**22**			

SEMESTER VI

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P Hrs/ Wk	C	Int.	Univ.	Total
SE 1601	Legal Aspects of HSE	3	1	0	3	50	100	150
SE 1602	Process Instrumentation and Control Engineering	3	1	0	3	50	100	150
SE 1603	Hazard Control in Manufacturing	3	1	0	3	50	100	150
SE 1604	Structural Fire Safety	3	1	0	3	50	100	150
SE 1605	Environmental Engineering and Management	3	1	0	3	50	100	150
SE 1606 E	Elective I	3	1	0	3	50	100	150
SE 16 L1	Machine Shop	0	0	3	2	100	-	100
SE 16 L2	Environmental Engineering & Management Laboratory	0	0	3	2	100	-	100
	TOTAL	**18**	**6**	**6**	**22**			

SE 1606 E ELECTIVE –I

E1 Power Plant Engineering
E2 Safety in Petroleum and Petrochemical Industries
E3 Food and Biosafety
E4 Fault Detection and Diagnosis

SEMESTER VII

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P Hrs/ Wk	C	Int.	Univ.	Total
SE 1701	Hazard Identification and Risk Assessment	3	1	0	3	50	100	150
SE 1702	Transportation Systems and Safety	3	1	0	3	50	100	150
SE 1703	Principles of Industrial Management	3	1	0	3	50	100	150
SE 1704	Life Safety in Building Fire	3	1	0	3	50	100	150
SE 1705 E	Elective II	3	1	0	3	50	100	150
SE 17 L1	Fire Engineering Laboratory	0	0	3	2	100	-	100
SE 17 L2	Industrial Hygiene Laboratory	0	0	3	2	100	-	100
SE 17 L3	Computational Laboratory	0	0	2	1	50	-	50
SE 17 L4	Seminar	0	0	2	2	100	-	100
	TOTAL	**15**	**5**	**10**	**22**			

SE 1705 E ELECTIVE –II
E1 Fire Dynamics
E2 Reliability Engineering
E3 Automobile Engineering and Safety
E4 Industrial Ecology

SEMESTER VIII

Code No.	Subject	L Hrs/ Wk	T Hrs/ Wk	P Hrs/ Wk	C	Int.	Univ.	Total
SE 1801	Human Factors Engineering	3	1	0	3	50	100	150
SE 1802	Advanced Safety Engineering and Management	3	1	0	3	50	100	150
SE 1803	Disaster Management	3	1	0	3	50	100	150
SE 1804 E	Elective III	3	1	0	3	50	100	150
SE 18 L1	Project	0	0	14	8	300	-	300
SE 18 L2	Viva Voce	0	0	0	2	-	100	100
	TOTAL	**12**	**4**	**14**	**22**			

SE 1804 E ELECTIVE –III
E1 Fluid Power Systems
E2 Explosives Technology and Safety
E3 Total Quality Management
E4 Introductory Design of Structures

1101 ENGINEERING MATHEMATICS I

Module I
Ordinary differential equations:

First order differential equations - exact differential equations, Bernoulli's equations--Methods of solution and Simple applications.

Linear differential equations of higher orders with constant co-efficients-Methods of solution of these equations. Cauchy's linear differential equations. Simultaneous linear differential equations- Simple applications of linear differential equations in engineering problems –Electrical Circuits, Mechanical Systems.

Module II
Infinite series : Integral test, comparison test, ratio test, Cauchy's root test, Raabe's test, seies of positive and negative terms, concept of absolute convergence, alternating series, Leibniz test(No proofs for any of the above tests)

Power series : Taylor and Maclaurin series of functions, Leibniz formula for the nth derivative of the product of two functions (No proof),use of Leibniz formula for the determination of co-efficients of the power series.

Module III
Partial differentiation: Partial differentiation-Concept of partial derivative - Chain rule- Total derivative-Euler's theorem for homogeneous functions, Differentials and their applications in errors and approximations, Jacobians - Maxima minima of functions of two variables(Proof of the result not required)-Simple applications.

Co-ordinate systems: Rectangular co-ordinates-Polar co-ordinates-In plane and in Space-Cylindrical polar co-ordinates-Spherical polar co-ordinates.

Module IV
Integral calculus:
Application of definite integrals: Area, Volume, Arc length, Surface area.
Multiple integrals : Evaluation of double integrals-Change of order of integration. Evaluation of triple integrals-Change of Variables in integrals.
Applications of multiple integrals. Plane Area, Surface area &Volumes of solids

References:

1. S.S.Sastry, Engineering Mathematics -Vol1, PHI publishers
2. Erwin Kreyzig, Advanced Engineering Mathematics, Wiley Eastern
3. T.Veerarajan, Engineering Mathematics, TMGH Publishers
4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers

Type of Questions for University Exam.
Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)
Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1102 ENGINEERING PHYSICS

Module 1

Laser-introduction--spontaneous and stimulated emission-principle of laser- properties of laser-Einstein coefficients and the analysis of lasing conditions- Basic components of a laser-Different types of lasers-construction,working and applications of Ruby laser-Neodymium YAG laser- He-Ne laser- semiconductor laser-Applications of laser in medicine, industry, science and communication.

Holography-basic principle-Comparison with ordinary photography-Recording and reconstruction of holograms-applications.

Fibre optics - Basic structure of an optical fibre - step-index fibre and graded index fibre- propagation of light in an optical fibre-acceptance angle and acceptance cone- Numerical aperture of a step-index fibre-Numerical aperture of a graded index fibre-modes of propagation-step index monomode fibre-Multimode stepindex fibre-Graded multimode fibre-Attenuation in optic fibres-fibre losses-material loss,scattering loss,absorption loss,leaky modes- dispersion in optical fibres- Applications.

Module II

Crystallography – Space lattice- Basis- Unit cell- Unit cell parameters- Crystal systems- Bravais lattices-Three cubic lattices-sc, bcc, and fcc- Number of atoms per unit cell- Co-ordination number- Atomic radius-Packing factor- Relation between density and crystal lattice constants- Lattice planes and Miller indices-Separation between lattice planes in sc- Bragg's law- Bragg's x-ray spectrometer- Crystal structure analysis.

Liquid crystals- Liquid crystals, display systems-merits and demerits- Metallic glasses- Types of metallic glasses (Metal-metalloid glasses, Metal-metal glasses) – Properties of metallic glasses (Structural, electrical,magnetic and chemical properties).

Shape memory alloys- Shape memory effect, pseudo elasticity

Module III

Introduction to nanoscale science and technology- nanostructures-nanoring, nanorod, nanoparticle, nanoshells- Properties of nanoparticles- optical, electrical, magnetic, mechanical properties and quantum confinement- Classification of nanomaterials- C60, metallic nanocomposites and polymer nanocomposites-Applications of nanotechnology.

Superconductivity-Introduction--transition temperature-Meissner effect-properties of super conductors.Types of superconductors-type 1 and type 2- AC Josephsons effect- DC Jospehsons effect- Flux quantisation-Squid-High temperature superconductors-Applications of super conductivity.

Special Theory of Relativity - Michelson-Morley experiment. Einstein's postulates. Lorentz transformation equations (no derivation). Simultaneity. Length contraction. Time dilation. Velocity addition. Relativistic mass. Mass energy relation. Mass less particle.

Module IV

Quantum mechanics-Introduction-origin of quantum theory-black body radiation and photo electric effect (brief ideas only)-matter waves- wave packet-uncertainty principle-(two forms)Time dependent Shrodinger equation for a free particle-Particle in force field and time dependent Schrodinger equation-Time independent schrodinger equation-Physical intrepretation of wave function-application -Particle in a Box (one dimensional) –Energy eigen values and wave functions **Ultrasonics**-piezo electric effect-Magnetostriction effect-production of ultrasonics-properties of ultrasonics- ultrasonic diffractometer and determination of velocity of ultrasonics in a liquid-Application of ultrasonics in non destructive testing - Accoustics of building-reverberation- Absorption Coefficient- Sabines formula for reverberation time(Derivation)-Accoustic intensity-loudness-decibel-phon-conditions for good acoustics(Qualitative study).

References:

1. S. Mani Naidu, A Text book of Engineering Physics, Pearson, 2010
2. M.C. Santosh Kumar, Engineering Physics, Nalpat Publishers.
3. B. Premlet, Advanced Engineering Physics, Phasor Books, Kollam.
4. A.S. Vasudeva, Modern Engineering Physics, S. Chand & Co.
5. Prabir K. Vasu and Hrishikesh Dhasmana, Engineering Physics, Ane books Pvt. Ltd., 2010.
6. S.O. Pillai & Sivakami, Applied Physics, New Age International (P) Ltd., Second Edition 2008.
7. G.S. Raghuvanshi, Engineering Physics, Prentice Hall of India.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1103 ENGINEERING CHEMISTRY

Module I

Solid state chemistry: Fundamentals, Bonding in solids, Born-Haber cycle, Point defects, Methods to improve reactivity of solids, Free electron theory, Band theory, Fermi level in semiconductors, Molecular field theory of magnetic materials.

Spectroscopy: Molecular energy levels-Types of molecular spectra- Electronic spectra (Classification of electronic transitions- Beer Lamberts law, Vibrational spectra (mechanism of interaction and application), Rotational spectra (Determination of bond length and application). NMR spectra (Basic principle, chemical shift, spin-spin splitting)

Solid surface characterisation: Electron spectroscopy for chemical analysis, Chemical shift, BET isotherm, Thermodynamics of adsorption.

Module II

Electrochemistry: Fundamentals, Electrode potential, Nernst's equation, Types of electrodes, Salt bridge, E.M.F measurement. Concentration cells, Calculation of E.M.F of a concentration cell.

Acids and bases, Arrhenius concept, Bronsted-Lowry concept of acids and bases, Lewis concept, Buffer solutions, pH measurement, Polarisation, Overvoltage.

Power generation: Secondary cells, Fuel cells, Photovoltaic effect, Solar cells.

Corrosion and its control: Theories of corrosion - Galvanic series- Types of corrosion - Factors affecting corrosion and different methods of corrosion control.

Chemical Kinetics: reaction rate, rate constant, rate law, reaction order, first order, second order, pseudo-first order reactions, integrated rate laws, half-life of a reaction and its relation to rate constant. Molecularity, simple unimolecular and bimolecular reactions. Arrhenius equation.

Module III

Chemical Thermodynamics: Fundamentals, Molecular interpretation of internal energy, enthalpy and entropy, Heat of reaction, Kirchhof's equation, Trouton's rule, Entropy changes accompanying different processes, Nernst heat theorem, Third-law.

Free energy: Dependence on pressure and temperature, Gibbs-Helmholtz equation, Free energy changes and equilibrium constant, chemical potential, Fugacity, Thermodynamics of biochemical reactions.

Phase Rule: Terms involved in phase rule and examples, Application of phase rule to one component water system, Application of phase rule to two-component systems.

Module IV

Engineering materials:

Polymers- Classifications- Mechanism of polymerisation (Addition, free radical, cationic, anionic and coordination polymerisation)- Thermoplastics and thermosetting plastics-Compounding of plastics-Moulding techniques of plastics (Compression, Injection, Transfer and Extrusion moulding)-Preparation, properties and uses of PVC, PVA, Nylon, PET - Silicon polymers- Biodegradable plastics. Elastomers- structure of natural rubber- vulcanisation- synthetic rubbers (Buna-S, Butyl rubber and Neoprene).

Lubricants- Introduction-Mechanism of lubrication- solid and liquid lubricant- Properties of lubricants-Viscosity index- flash and fire point- cloud and pour point- aniline value.

Refractories: Classification – Properties of refractories.

Cement- Manufacture of Portland cement- Theory of setting and hardening of cement.

References:

1. Peter Atkins, Julio de Paula, Elements of Physical Chemistry, Oxford University Press, 2005.
2. John E. McMurry and Robert C. Fay, Chemistry, 5th Edition, Pearson, 2008.
3. O. G Palanna, Engineering Chemistry, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2009.
4. R.N. Goyal, Harmendra Goel, Textbook of Engineering Chemistry, 2nd Edition, Ane Books Pvt. Ltd., 2011.
5. R Gopalan, D Venkappayya, Sulochana Nagarajan, Textbook of Engineering Chemistry, 2nd Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.
6. Shashi Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai & Co, New Delhi, 2003.
7. Kochubaby Manjooran, Modern Engineering Chemistry, Kannantheri Publication, Kochi.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1104 ENGINEERING MECHANICS

A) STATICS

Module I

Concurrent forces in a plane: Principles of statics. Composition and resolution of forces. Equilibrium of concurrent forces in a plane. Method of projection. Method of moments. Friction.

Parallel forces in a plane: Two parallel forces. General case of parallel forces in a plane. Centre of parallel forces and centre of gravity, Pappus theorems, centroids of composite plane figures and curves. Distributed forces in a plane.

Module II

Properties of areas: . Moment of inertia of a plane figure with respect to an axis in its plane. Polar moment of inertia. Product of inertia. Principal axes. Mass moment of inertia of material bodies.

General case of forces in a plane: Composition of forces in a plane. Equilibrium of forces in a plane. Plane trusses - Method of joints. Method of sections. Plane frames : Method of members. **Principle of virtual work:** Equilibrium of ideal systems, stable and unstable equilibrium.

B) DYNAMICS

Module III

Rectilinear translation: Kinematics of rectilinear motion. Differential equation of rectilinear motion. Motion of a particle acted upon by a constant force, by a force as a function of time and by a force proportional to displacement. Simple harmonic motion. D'Alembert's principle. Momentum and impulse. Work and energy, ideal systems, conservation of energy. Impact.

Module IV

Curvilinear translation: Kinematics of curvilinear translation. Differential equations of motion. Motion of a projectile. D'Alembert's principle in curvilinear motion. Moment of momentum. Work and energy in curvilinear motion.

Rotation of a rigid body: Kinematics of rotation. Equation of motion of a rigid body rotating about a fixed axis. Rotation under the action of a constant moment. Compound pendulum. General case of moment proportional to the angle of rotation. D'Alemberts principle of rotation. Resultant inertia force in rotation. Principle of angular momentum in rotation. Energy equation for rotating bodies.

References:

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Book Company.
2. Beer F. P. and Johnston E. R, Mechanics for Engineers (Vol. 1- Statics and Vol.2 -Dynamics), Tata McGraw Hill.
3. Merriam H. L. & Kraige L. G, Engineering Mechanics (Vol. 1- Statics and Vol.2 -Dynamics), John Wiley and Sons.
4. Biju N, Engineering mechanics, Educational Publications.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1105 ENGINEERING GRAPHICS

Module I

Introduction to engineering graphics. Drawing instruments and their use. familiarisation with current Indian Standard Code of Practice for general engineering drawing.

Scales- plain scale ,vernier scale, diagonal scale.

Conic sections- Construction of ellipse, parabola, hyperbola - construction of cycloid, involute, archimedian spiral and logarithmic spiral- drawing tangents and normals to these curves.

Module II

Introduction to orthographic projections- plane of projection- principles of first angle and third angle projections, projection of points in different quadrants.

Orthographic projection of straight lines parallel to one plane and inclined to the other plane- straight lines inclined to both the planes- true length and inclination of lines with reference planes- traces of lines.

Projection of plane laminae of geometrical shapes in oblique positions.

Module III

Projection of polyhedra and solids of revolution- frustum, projection of solids with axis parallel to one plane and parallel or perpendicular to other plane- projection of solids with axis inclined to both the planes- projection of solids on auxiliary planes.

Section of solids by planes inclined to horizontal or vertical planes- true shape of sections.

Module IV

Development of surface of cubes, prisms, cylinders, pyramids and cones

Intersection of surfaces- methods of determining lines of intersection - intersection of prism in prism and cylinder in cylinder.

Module V

Introduction to isometric projection- isometric scales, isometric views- isometric projections of prisms, pyramids, cylinders, cones and spheres.

Introduction to perspective projections : visual ray method and vanishing point method- perspective of circles- perspective views of prisms and pyramids.

References:

1. K.C. John. Engineering Graphics, PHI Learning
2. P.I. Varghese and K.C. John, Engineering Graphics, JET Publishers
3. N.D.Bhat , Elementary Engineering Drawing, Charotar publishing house
4. P.S.Gill , Geometric Drawing, B.D Kataria &Sons, Ludhiana
5. P I Varghese , Engineering Graphics, VIP Publishers.

University Examination Question Paper pattern

Two questions of 20 marks each from all the five modules. Answer one question from each module. (5x20 = 100 marks)

1106 BASIC CIVIL AND MECHANICAL ENGINEERING

PART- A: BASIC CIVIL ENGINEERING

Module I

Engineering Materials: Cement - varieties and grade of cement and its uses. Cement mortar- Steel- types of steel for reinforcement bars, steel structural sections. Brick- varieties and strength, tests on bricks.

Aggregates- types & requirements. Concrete- grades of concrete as per IS code, water cement ratio, workability, mixing, batching, placing, compaction and curing.

Construction : Foundation- types of foundations- isolated footing, combined footing, raft, pile & well foundations- Foundation for Machinery

Module II

Super structure: Brick masonry, English bond and Flemish bond, Stone masonry-Ashlar masonry- Rubble masonry. Roofing- Steel trusses, roofing for industrial buildings

Surveying: Principles, instruments, ranging and chaining of survey lines, errors in chaining, field work, field book, selection of survey stations, reconnaissance.

Leveling: Leveling instruments, different types, temporary adjustments, mean sea level, reduced level of point, booking of field notes, reduction of levels by height of collimation method.

References:

1. S.C. Rangawala, Engineering Materials, Charotar Publishing House, Anand.
2. Roy M. Thomas, Fundamentals of Civil Engineering, Educational Publishers,Ernakulam
3 Surendra Singh, Building Materials, Vikas Publishing Company, New delhi.
4 S.C. Rangawala, Building Construction, Charotar Publishing House, Anand.
5. P. Kanetkar, Surveying and Levelling, Volumes 1 and 2, United Book Corporation, Poona.

PART A - Type of Questions for University Exam. (Maximum Marks: 50) (To be answered in separate answer book)

Q 1 Four short answer questions of 5 marks each with two questions from each modules. (4x5 = 20 marks)

Q 2. to Q.5 : Two questions A & B of 15 marks from each moduls with option to answer either A or B. (2 x 15 = 30 marks)

PART – B: BASIC MECHANICAL ENGINEERING

Module I

Thermodynamics: Thermodynamics systems – open, closed and isolated systems, equilibrium state of a system, property and state, process, cycle, Zeroth law of thermodynamics- concept of temperature, temperature scales. First law – internal energy, enthalpy, work and heat, Different processes, isobaric, isochoric, isothermal and adiabatic processes Second law – Kelvin-plank and Claussius statements, Carnot Cycle.

Internal Combustion Engines: Air standard cycles – Otto and Diesel cycles, working of two stroke and four stroke Petrol and Diesel engines, Carburatted and MPFI engines, fuel pump, fuel injector, ignition system, cooling system, lubricating system.

Module II

Refrigeration and Air conditioning: Vapour compression and vapour absorption refrigeration systems, summer, winter and comfort air conditioning.

Manufacturing processes – Casting (sand and die casting processes), Forging (open &closed die forging), Rolling, Extrusion, Welding (resistance, arc and gas), brazing and soldering

Elementary ideas of **simple reaction and impulse turbines**, compounding of turbines.

Transmission of power: Belt drives (open and closed), Chain drives.

References:

1. P.K. Nag, Engineering Thermodynamics, Tata McGraw Hill
2. J.P. Holman, Thermodynamics, Mc Graw Hill
3. Rogowsky, Elements of Internal combustion Engines, Tata McGraw Hill
4. Gill, Smith & Ziurys, Fundamentals of Internal Combustion Engines, Oxford & IBH
5. Stoecker, Refrigeration and Air Conditioning, Tata McGraw Hill
6. Raghavan : Material Science and Engineering, Prentice Hall of India

PART B - Type of Questions for University Exam. (Maximum Marks: 50) (To be answered in separate answer book)

Q 1 Four short answer questions of 5 marks each with two questions from each modules. (4x5 = 20 marks)

Q 2. to Q.5 : Two questions A & B of 15 marks from each moduls with option to answer either A or B. (2 x 15 = 30 marks)

1107 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

PART- A: ELECTRICAL ENGINEERING

Module I

Resistance : Circular wires – Wire Tables – Temperature Effects – Types of Resistors – Colour Coding and Standard Resistor Values – Conductance – Ohmmeters – Metric Units –The Memristor. **Ohm's Law, Power and Energy** : Ohm's Law – Plotting Ohm's Law – Power – Energy – Efficiency – Circuits Breakers, GFCI's and Fuses – Applications .

Series dc Circuits: Series Resistors – Series Circuits – Power Distribution and Series circuit – Voltage Sources in a Series – Kirchoff's Voltage Law – Voltage Division in a Series Circuit – Interchanging Series Elements – Notation – Voltage Regulation and the Internal Resistance of Voltage Sources. **Parallel dc Circuits:** Parallel Resistors – Parallel Circuits – Power Distribution in a Parallel Circuit – Kirchhoff's Current Law – Current Divider Rule – Voltage Sources in Parallel – Open and Short Circuits.

Capacitors: The Electric Field – Capacitance – Capacitors, **Inductors:** Magnetic Field – Inductance.

Module II

AC Fundamentals: Sinusoidal Alternating Waveforms - Sinusoidal ac Voltage Characteristics and Definitions – Frequency Spectrum – The Sinusoidal Waveform – General format for the sinusoidal Voltage of current – Phase Relations – Average Value – Effective (rms) Values – ac Meters and Instruments. Elementary Concepts of Energy Meter Watt Meter, Volt Meter and Ammeter.

The Basic Elements and Phasors: Response of Basic R,L and C Elements to a Sinusoidal Voltage or Current – Frequency Response of the Basic Elements – Average Power and Power Factor – Complex Numbers – Rectangular Form – Polar Form – Conversion between Forms.

Series and Parallel ac Circuits: Impedance and the Phasor Diagram- Series Configuration – Voltage Divider Rule – Frequency Response for Series ac Circuits –Admittance and Susceptance – Parallel ac Networks – Current Divider Rule – Frequency response of Parallel Elements. **Introduction to 3 phase Systems:** StarΔ Connection

Elementary Concepts of Generation, Transmission, and Distribution: Various Levels of Power Transmission – Conventional Sources of Electrical Energy, Hydro, Thermal, Nuclear and Diesel Power Station - Introduction to Primary and Secondary distribution - Basic Concepts of Transformers - Principle of Operation – Applications to Power Systems.

PART- B: ELECTRONICS ENGINEERING

Module III

The Diode - Biasing the Diode, Voltage - Current Characteristic of a Diode, Diode Models, **Diode Applications -** Half Wave and Full Wave Rectifiers, Power supply Filters and Regulators, **Special Purpose Diodes -** Zener Diodes- Applications, Varactor Diodes, Optical Diodes-Other Types of Diodes. **Bipolar Junction Transistors (BJTs) -** Transistor Structure - Basic Transistor Operation, Transistor characteristics and parameters, Transistor as an Amplifier, Transistor as a Switch.

Module IV

Sensors-Temperature, light, force and sound sensors; **Actuators** – Heat, Light, force and sound actuators. **Electronic measurements** - measurements of voltages and currents, voltmeter, ammeter, multimeter, CRO (Block level treatment only)

Introduction to Electronic Communication systems: Modulation and Demodulation, Analog communication system, Electromagnetic frequency spectrum, Bandwidth and information capacity, Principles of Amplitude and angle modulation, Bandwidth requirements of angle modulated waves.

Optical communication: Fundamental concepts, Block diagram of an optical fibre communications system.

Cellular Telephone: Fundamental concepts, Frequency reuse, Block diagram of a simplified cellular telephone system, Roaming and handoffs

Satellite communication: Block diagram of Satellite system link models – Uplink, Transponder Downlink.

References:

1. Boylestad, *Introductory Circuit analysis*, Pearson Education, 12/e, 2012.
2. Thomas L. Floyd, Electronic Devices, Pearson Education Inc. 7th edition.
3. Neil Storey, Electronics A systems approach, Pearson Education Inc. 2011 Wayne Tomasi, *Electronic Communication Systems: Fundamentals through Advanced,* Pearson Education Inc. 5th edition.
4. Wayne Tomasi, *Electronic Communication Systems: Fundamentals through Advanced,* Pearson Education Inc. 5th edition

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40)

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60)

1108 COMPUTER PROGRAMMING

Module I

Basics of Computer and Information Technology:

Digital Computer System (CPU, Memory, I/O devices)- Working of a digital computer- Hardware and Software : Definition - Categories of Software, Application of Computers – Role of Information Technology – Internet Services

Problem Solving Methodology:

Program - Programming Process (Problem statement, Analysis, Design a solution, Implement/Coding the solution, Test the solution, Iteration through the phases to refine/correct the program)- Design tools (Algorithm, Flow-chart, Pseudo-code)- Develop algorithms for simple problems.

Module II

Programming Languages:

Types and generation of programming languages- Compiler – Interpreter-Linker –Loader –Execution of Program

Basics of C:

Character set-Identifier- Keywords- Constants –Data Types- Variables and declaration –Operators and Expressions – Operator precedence and associativity – Expression Evaluation (Simple Examples) - Input and output functions – Simple computational problems involving the above constructs.

Module III

Control Statements:

Selection, Conditional operator, Iteration (for, while, do-while), Branching (switch, break, continue, goto), Nesting of control statements- Problems using control statements.

Arrays and Strings:

1D and 2D arrays –Searching (Linear and Binary) - Sorting (Bubble, Selection) – Matrix manipulation programs – Strings and basic operations on strings – Strings functions - Programs on string manipulation

Functions:

Definition – Calling – Declaration – Parameter Passing (by value and by reference) – Recursion – Library functions –Programs based on functions

Module IV

User defined data types:

Structure – Union - Enumerated data type - Programs involving structure and union.

Pointers:

Declaration, Initialization – Pointers and arrays – Pointers and structures – Pointers and functions – Command line arguments – Dynamic memory allocation – Operations on pointers – Programs involving the above concepts

Files:

File concept – File pointer – File handling operations (open, close, read, write etc) on sequential and random access files. Programs on file manipulations using fgetc(), fgets), fseek.

References:

1. Pradip Dey and Manas Ghosh, Computer Fundamentals and Programming in C, Oxford.
2. Samarjit Ghosh, All of C, PHI Learning
3. Byron Gottfried , Programming with C , 2nd edition, TMH publication.
4. B.W. Kernighan and D.M. Ritchie, The C Programming Language, Pearson Education.
5. R G Dromey , How to solve it by Computer, Prentice Hall
6. D.E. Knuth, The Art of Computer Programming – Volume 1,2 &3, Addison Wesley.
7. Yashwant P. Kanetkar, Let Us Use C, 8th Edition (Paperback).
8. Sukhendu Dey , Complete Knowledge in C, Narosa
9. Varghese Paul, Computer Fundamentals , EPD.

Type of Questions for University Exam.

Q 1.Eight short answer questions of 5 marks with two questions from each of the four modules. (8x5 = 40 marks)

Q 2. to Q.5 : Two questions A & B of 15 marks from each modules with option to answer either A or B. (4x15 = 60 marks)

1109 ENVIRONMENTAL STUDIES AND TECHNICAL COMMUNICATION

PART – A: ENVIRONMENTAL STUDIES (1 hour / week)

Module I

Natural resources - issues related to the use and over exploitation of forest resources, water resources, mineral resources, food resources, energy resources and land resources- role of an individual in conservation of natural resources - equitable use of resources for sustainable life styles.

Concept of an ecosystem - structure and function - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - structure and functions of a forest ecosystem and an aquatic eco system.

Definition of biodiversity - genetic, species and ecosystem diversity - biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Threats to biodiversity, Conservation of biodiversity.

Module II

Environmental Pollution - Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, marine pollution, thermal pollution and nuclear hazards - Causes, effects and control measures of urban and industrial solid wastes -Role of an individual in prevention of pollution - An overview of the various environmental legislations in India - Issues involved in enforcement of environmental legislation. Disaster Management: Floods, earth quake, cyclone and landslides. Role of public awareness in disaster management.

The concept of sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, water shed management - Resettlement and rehabilitation of people; its problems and concerns - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies - Population growth and problems of population explosion – Environment and human health – Human rights – Value education – Role of Information Technology in environment and human health - Environmental ethics: issues and possible solutions.

References:

1. Rajagopalan. R, Environmental Studies: From Crisis to Cure, Oxford University Press, 2005
2. Erach Bharucha, Textbook of Environmental Studies and Ethics, Universities Press (India), Hyderabad, 2005.
3. Jayashree A. Parikh, V.M. Balsaraf, P.B. Dwivedi, Environmental Studies, Ane Books Pvt. Ltd., 2010.
4. Anindita Basak, Environmental Studies, Pearson, 2009.
5. Gouri Suresh, Environmental Studies and Ethics, I.K. International Publishing House Pvt. Ltd., New Delhi, 2007.
6. S.P. Misra, Essential Environmental Studies, 3rd Edition, Ane Books Pvt. Ltd., 2011.
7. Benny Joseph, Environmental Science & Engineering, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
8. Meenambal T , Uma R M and K Murali, Principles of Environmental Science and Engineering, S. Chand & Company Ltd, 2005

PART – B: TECHNICAL COMMUNICATION (1 hour / week)

This is a practice oriented, need based, and functional – communicative course. It is intended to develop the student's skill of communication in listening, speaking, reading and writing. The student is advised to cultivate the habit of reading newspapers, magazines and books in a free, extensive manner to consolidate the skill already achieved. A more inter-active process of teaching/learning is called for in order to achieve effective communication.

Questions at the class tests and semester end examination will be largely problem solving and application oriented in nature.

Module I

Communicative Grammar: Time, tense and aspect; Verbs of state and event; Use of preposition; Expressing emotions and attitudes: Hope, anticipation of pleasure, disappointment, approval, disapproval, surprise.

The sounds of English: (it is not a course in phonetics. Technical terms will not be used except when absolutely necessary.)

Length of vowels-long and short vowels

/ | /, / 3 : /, /a :/, / : /, /U : / | / / 2 /, /,/ ʌ /, / O /, / U / - Consonants : / f, v, o, o, s, z, ʒ/ - Stress pattern - Intonation: failing and rising.

Oral Communication: starting and ending a conversation; telling and asking people to do things; expressing opinions and ideas, decisions and intentions, offers and invitations, feelings, right and wrong, numbers and money.

Purpose and audience; dealing with customers and clients; face-to-face discussions; interviews; group discussions; meetings and attending meetings; checking understanding; raising questions; giving and receiving feedback; using body language; leading and directing discussions; concluding discussions; using graphics in oral presentations

Reading Comprehension and reference skills: skimming and scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; comprehending graphics in technical writing.

Reading strategies; reading speed; reading between the lines for hidden meaning; interpreting graphics; using a dictionary; using an index; using a contents list to find information; choosing the right reference source.

Module II

Written Communication: note making and note taking; summarizing; notes and memos; developing notes into text; organization of ideas: cohesion and coherence; Preparing notes – writing business letters and E-mail messages. Organizing a meeting, preparing an agenda, chairing a meeting, drafting motions and resolutions, writing minutes.

Paragraph writing: Paragraph writing – Topic sentence, cohesion and coherence- sentence liners (so, but, however etc), ordering information in space and time; short essays: description and argument; comparison and contrast; illustration; using graphics in writing: tables and charts; diagrams and flow-charts; maps, plans and graphs. Preparation of a business report-writing a business proposal - format, length,structure. Spelling rules and tips; writing a rough draft; editing and proof reading; writing the final draft; styling text; filling in complex forms; standard letters; Writing a curriculum vitae (both chronological & functional) along with an application for a job; Public relation – Concept and relevance – PR in a business organization-handing the media; writing a report; writing leaflets and brochures; writing references; essay writing: expository writing; description of processes and products; classification; the instructional process; arguments and presentation of arguments; narrating events chronologically.

References :

1.John Seely, Oxford Guide to Writing and Speaking, Oxford University Press.
2.C. Muralikrishna and Sunita Mishra, Communication Skills for Engineers, 2nd Edition, Pearson, 2011.
3.Meenakshi Raman and Sangeetha Sharma, Technical Communication: Principles and Practice, Oxford University Press, 2004.
4.Krishna Mohan and Meenakshi Raman, Effective English Communication,Tata Mc-GraHill,2000.
5.William Sanborn Pfeiffer, T.V.S. Padmaja, Technical Communication – A Practical Approach, Pearson, 2007.
6.R.C. Bhatia, Business Communication, 2nd Edition, Ane Books Pvt. Ltd., 2008.
7.Krishna Mohan and Meera Banerji, Developing Communication Skills, Mac Millan India Ltd, 2000.

University Examination Pattern

The question paper will have two parts. Part A and Part B will have a weightage of 50 marks each and they will have to be answered in separate answer books.

Question Paper Pattern for Part A (Environmental Studies)

Q I. – 6 short type questions of 3 marks each, with three questions from each module (6 x3 = 18)

QII. – 2 questions A and B of 16 marks from Module I with choice to answer one. Both A and B should have a minimum of two sub – sections.

QIII - 2 questions A and B of 16 marks from Module II with choice to answer one. Both A and B should have a minimum of two sub – sections.

Question Paper Pattern for Part B (Technical Communication)

Q I – 10 short answer questions of 2 marks each, with five questions from each module. The questions shall be problem solving and application oriented in nature. (10x2 = 20 marks)

QII. – 2 questions A and B of 15 marks from Module I with choice to answer one. Both A and B should have a minimum of two sub – sections. The questions shall be problem solving and application oriented in nature.

QIII - 2 questions A and B of 15 marks from Module II with choice to answer one. Both A and B should have a minimum of two sub – sections. The questions shall be problem solving and application oriented in nature.

11 L1 ELECTRICAL AND MECHANICAL WORKSHOP

ELECTRICAL WORKSHOP

1. One lamp controlled by one switch 2. Series and parallel connections of lamps.
3. Stair case wiring.
4. Hospital Wiring.
5. Godown wiring.
6. Fluroscent lamp.
7. Connection of plug socket.
8. Different kinds of joints.
9. Transformer winding.
10. Soldering practice.
11. Familiarisation of CRO.

MECHANICAL WORK SHOP

Preliminary exercises for beginners in all the following shops. Specific models may be designed by the teachers.

1) Fitting Shop.
2) Sheet Metal Shop
3) Foundry Shop
4) Welding Shop
5) Carpentry Shop

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

11 L2 COMPUTER PROGRAMMING LABORATORY

Application packages

Word

1. To create an advertisement in Word.
2. To illustrate the concept of mail merging in word.

Spread Sheet

3. To create a spread sheet to analyse the marks of the students of a class and also to create appropriate charts.

Power Point

4. To create the presentation for the department using Power Point.

C Programming Basics

Operators & Expressions

5. To write a simple menu driven calculator program using switch statement

IO Formatting

6. To write a program to print Pascal's triangle.

Decision Making

7. To write a program for electricity bill preparation.

Looping

8. To write a program to print the *sine* and *cosine* series.

Arrays

9. To write a program to perform Matrix multiplication.
10. To write a program to prepare and print the sales report.

String

11. To write a program to perform string manipulation manipulations function like *string concatenations, comparison, find the length and string copy* without using library functions.
12. To write a program to arrange names in alphabetical order.

Functions

13. To write a C program to calculate the mean, variance and standard deviation using functions.
14. To write a C program to perform sequential and binary search using functions.

Recursion

15. To write a program to print the Fibonacci series and to calculate the factorial of the given number using functions.

Structures

16. To print the mark sheet of n students using structures.

Pointers

17. To write a program using pointers to access the elements of an array and count the number of occurrences of the given number in the array.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

11 L3 LANGUAGE LABORATORY

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Objectives:

1. To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.

SYLLABUS :

The following course content is prescribed for the **English Language Laboratory** sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
4. Oral Presentations- Prepared and Extempore.
5. 'Just A Minute' Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
9. Telephoning Skills.
10. Giving Directions.

Note : 50 % marks is earmarked for continuous evaluation, and 50% marks for end semester examination to be conducted by two examiners. A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1301ENGINEERING MATHEMATICS 1I

Module I

Matrices and Vector spaces: Rank of matrix, Echelon and normal form, Solutions of linear systems of algebraic equations, Eigen values and Eigen vectors, Cayley Hamilton theorem (non proof).

Vector Spaces – Subspaces, - Linear Independence of vectors-Linear span-Dimension and Basis. Linear transformations.

Module II

Fourier series and Fourier integrals: Forier series of Periodic functions- Euler formulae for Fourier coefficients-functions having period 2π, arbitrary period-even and odd functions-half range expansions, Fourier integral, Fourier cosine and sine transformations, linearity property, transform of derivatives, convolution theorem (no proof)

Module III

Laplace transforms: Linearity property, transforms of elementary functions, Laplace transforms of derivatives and integrals, differentiation and integration of transforms, convolution theorem (no proof) use of Laplace transforms in the solution of initial value problems, unit step function, impulse function - transform of step functions, transforms of periodic functions.

Module IV

Vector calculus: Scalar and Vector point functions-Gradient and directional derivative of a scalar point function-Divergence and Curl of a vector point functions-their physical meanings.

Evaluation of line integral, surface integral and volume integrals, Gauss's divergence theorem, Stoke's theorem (No Proof of these theorem), conservative force fields, scalar potential.

References:

1. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics: Narosa Publishers.
2. C.R.Wilie & L.C.Barrett, Advanced Engineering Mathematics, Mc-Graw Hill
3. Larry C Andrews, Ronald C Philips, Mathematical Techniques for Engineers & Scientists, PHI Publishers
4. M.C.Potter, J.L.Goldberg, Advanced Engineering Mathemartics, Oxford Unversity Press.
5. B.S.Grewal, Higher Engineering Mathematics:, Khanna Publishers.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1302 PRINCIPLES OF CHEMICAL ENGINEERING

Module I

Material balance

Introduction to chemical engineering, basic chemical calculations-mole concept, methods of expressing composition-mole fraction, weight fraction, volume fraction, concentration of liquid solutions- molarity, molality, normality, ppm. Ideal gases and gas mixtures- ideal gas law, Amagat's law, Dalton's law, Henry's law, average molecular weight, density of gases, partial pressure and partial volume calculations. Material balance involving chemical reactions and not involving chemical reactions, simple calculations involving recycle, bypass and purge streams.

Module II

Energy balance

Energy balance- heat capacity, specific heat and enthalpy, heat capacity of gases at constant pressure, heat capacity of gaseous mixtures, latent heats, enthalpy changes accompanying chemical reactions- standard heat of formation and standard heat of combustion, standard heat of reaction.

Module III

Chemical Engineering Thermodynamics

Chemical thermodynamics, fundamental concepts and definitions- types of thermodynamic systems and properties- closed, open and isolated system- intensive and extensive properties- path and state functions, first law of thermodynamics, second law of thermodynamics, entropy, change in entropy, Maxwell relations, heat capacity in terms of entropy, equation of state of gases, the principle of corresponding states, compression and expansion of fluids – Joule Thomson expansion. Gibbs free energy change, equilibrium constant, effect of temperature on equilibrium constant.

Module IV

Mechanical Operations

Soilds : Properties of solids, methods of size analysis-differential and cumulative, screening, screening equipment, effectiveness of screens. Size reduction of solids, types of equipment - jaw crushers, gyratory crushers, hammer mills, ball mill, power requirement, laws of crushing. Handling of solids – principle of operation of belt conveyers, bucket elevators and pneumatic conveyers.

Fluids : Flow of solids through fluids – maximum settling velocity. Sedimentation – Laboratory batch sedimentation, calculation of area and depth for continuous thickeners. Principle of centrifugal separation. Filtration : equipments for filtration - plate and frame filter press, rotary drum filter, constant pressure and constant rate filtration, filter media, filter aids.

References :

1. W.L. McCabe, J.C. Smith & Peter Harriott, *Unit Operations of Chemical Engineering*, McGraw-Hill
2. K.V. Narayanan, *Stoichiometry and Process Calculations*, Prentice-Hall of India Pvt. Ltd.
3. K.V. Narayanan, *A Text Book of Chemical Engineering Thermodynamics*, Prentice Hall of India Pvt Ltd.
4. W.L.Badger & J.T. Banchero, *Introduction to Chemical Engineering*, Tata McGraw-Hill
5. Christe J. Geankoplis, *Transport Process and Unit Operations*, Prentice Hall India Pvt Ltd.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1303 ENGINEERING FLUID MECHANICS AND MACHINERY

Module I

Scope of fluid mechanics – Dimensions and units – Definition of fluid - Fluid properties – density, specific weight, pressure, viscosity, surface tension and capillarity, compressibility – Rheological classification of fluids.. Fluid Statics – Pressure at a point – Basic equation of fluid statics – Hydrostatic equations for incompressible and compressible fluids – Hydrostatic force on a submerged plane and curved surfaces – Buoyancy and equilibrium of floating bodies – Absolute and gauge pressure – Pressure measurement by manometers and pressure gauges.

Module II

Fluid Kinematics and Fluid Dynamics - continuum Lagrangian and Eulerian approaches – Classification of fluid motions – path line, stream line, streak line, stream tube, one, two and three dimensional flow, velocity field – acceleration of fluid particle in a velocity field- Continuity equation (one and three dimensional differential forms)- equation of stream line – stream function – velocity potential function – circulation – flow net – fluid dynamics – equations of motion – Euler's equation along a streamline – Bernoulli's equation – applications – venturi meter, orifice meter, pitot tube.

Dimensional analysis – Buckingham's Pi theorem – applications – similarity laws and models.

Module III

Incompressible Fluid Flow – Viscous flow – Navier – Stoke's equation (statement only) – Shear stress, pressure gradient relationship – laminar flow between parallel plates – Laminar flow through circular tubes (Hagen Poiseulle's) – Hydraulic and energy gradient – flow through pipes – Darcy-weisbach equation – pipe roughness – friction factor – Moody's diagram – minor losses – flow through pipes in series and in parallel – power transmission.

Boundary layer flows, boundary layer thickness, boundary layer separation – drag and lift coefficients. Flow through fixed and fluidized beds.

Module IV

Hydraulic machines : definition and classification – exchange of energy – Euler's equation for turbo machines – head and specific work – components of energy transfer – degree of reaction.

Hydro turbines : definition and classification – Francis turbine – Kaplan turbine – working principle – work done – specific speed – efficiency – performance curve for turbines.

Pumps : definition and classification – Centrifugal pump : working principle, velocity triangles, specific speed, efficiency and performance curves – Reciprocating pumps: working principle, indicator diagram and performance curves – cavitation in pumps – Rotary pumps : working principle of gear and vane pumps.

References:

1. Kumar, K.L., *Engineering Fluid Mechanics*, Eurasia Publishing House (P) Ltd, New Delhi (7th edition), 1995.
2. McCabe, W.L, Smith J.C and Harriot .P., "Unit Operations in Chemical Engineering", McGraw-Hill, Sixth Edition 2000.
3. Vasandani, V.P., *Hydraulic Machines – Theory and Design*, Khanna Publishers, 1992
4. Streeter, V.L. and Wylie, E.B, *Fluid Mechanics*, McGraw Hill, 1983.
5. Edward J. Shaughnessy Jr., Ira M. Katz, and James P. Schaffer., Introduction to Fluid Mechanics, Oxford University Press, 2005.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1304 PRINCIPLES OF SAFETY MANAGEMENT

Module I

Introduction-Safety -Goals of safety engineering. Need for safety. Safety and productivity . Definitions: Accident, Injury , Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. History of safety movement .Theories of accident causation

Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need , types, advantages

Module II

Accident prevention Methods- Engineering, Education and Enforcement.

Safety Education & Training -Importance, Various training methods, Effectiveness of training, Behaviour oriented training. Communication- purpose, barrier to communication.

House keeping: Responsibility of management and employees. Advantages of good house keeping. 5 s of house keeping.

Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.

Module III

Personal protection in the work environment, Types of PPEs, Personal protective equipment- respiratory and non respiratory equipment. Standards related to PPEs.

Monitoring Safety Performance : Frequency rate, severity rate, incidence rate, activity rate.

Cost of accidents-Computation of Costs- Utility of Cost data. Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis(JSA), Safety surveys, Safety audits. Safety Inventory Technique.

Module IV

Accident investigation –Why? When? Where? Who? & How? . Basics- Man- Environment & Systems .Process of Investigation –Tools-Data Collection-Handling witnesses- Case study.

Accident analysis –Analytical Techniques-System Safety-Change Analysis-MORT-Multi Events Sequencing-TOR.

References :

1. N.V. Krishnan, *Safety Management in Industry*, Jaico Publishing House, 1997
2. Ronald P. Blake, *Industrial Safety:*, Prentice Hall, New Delhi, 1973
3. David L. Goetsch, *Occupational Safety and health*, Prentice Hall
4. Ted S. Ferry, *Modern Accident Investigation and Analysis*, John Wiley & Sons
5. Willie Hammer, *Occupational Safety Management and Engineering*, Prentice Hall
6. Alan Waring, *Safety Management System*, Chapman & Hall
7. John V. Grimaldi and Rollin H.Simonds, *Safety Manage*ment, All India Traveller Book Seller, Delhi.
8. *Accident Prevention Manual for Industrial Operations* : National Safety Council, Chicago

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1305 SAFETY IN CONSTRUCTION

Module I

Introduction to construction industry and safety issues in construction – Human factors in construction safety management – Roles of various groups and stake-holders in ensuring safety in construction industry – Framing of contract conditions on safety and related matters – Relevance of ergonomics in construction safety.

Module II

Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Pneumatic caissons – Confined space – Temporary Structures. Familiarisation with relevant Indian Standards and the National Building Code provisions on construction safety.

Module III

Safety in material handling and equipments – Safety in storage & stacking of construction materials. Safety in the use of construction equipments vehicles – excavators, graders and dozers – cranes – hoists & lifts – other lifting gears wire ropes – chain-pulley blocks – mixers – conveyors – pneumatic and hydraulic tools in construction. Temporary power supply.

Module IV

Contract Labour (R&A) Act and Central Rules: Definitions, Registration of Establishments, Licensing of Contractors, Welfare and Health provisions in the Act and the Rules, Penalties, Rules regarding wages.
Building & Other Construction Workers (RE & CS) Act, 1996 and Central Rules, 1998: Applicability, Administration, Registration, Welfare Board & Welfare Fund, Training of Building workers, General Safety, Health & Welfare provisions, Penalties.

References:

1. K.N. Vaid (Ed.), *Construction Safety Management*, National Institute of Construction Management and Research, Bombay.
2. V.J. Davies & K. Tomasin, *Construction Safety Handbook,* Thomas Telford Publishing, London.
3. James B. Fullman, *Construction Safety, Security & Loss Prevention,* John Wiley & Sons
4. Linger L, *Modern Methods of Material Handling*
5. R.T. Ratay, *Handbook of Temporary Structures in Construction* , Mc Graw-Hill
6. National Building Code of India 2005, SP-7, Bureau of Indian Standards, New Delhi.
7. Relevant Indian Standards
8. Contract Labour Act and Central Rules
9. Building & Other Construction Workers (RE &CS) Act, 1996 and Central Rules.

Type of Questions for University Examination
Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B (4x15 = 60 marks)

SE 1306 ELEMENTS OF MACHINE DRAWING

Module I

Limits, fits & tolerances: IS 919 code, cylindrical fits, tolerance symbols,standard preferred sizes and fits, hole based dimensioning, symbology for form, location and runout, tolerancing for position, concentricity, location, roundness, perpendicularity and ronout.

(2 sheets).

Module II

Drawings of joints : Welded joints , types, welding symbols, drawing of welded machine parts with details of welding.

Brackets, blocks, base plate and crankshaft.

Pipe joints : Coupler joints, nipple joints, union, socket and spigot, integral flanged joints and hydraulic joints.

(6 sheets)

Module III

Screwed fastenings : Screw thread forms, vee and square threads, conventional representation of threads, hexagonal headed bolt and nut, square headed bolt, nut locking arrangements, various types of machine screws and set screws, foundation bolts, lock bolt bolt with square plate, ray bolt and Lewis foundation bolt.

(3 sheets)

Cotter and Pin joints : socket and spigot joints ,gib and cotter joint for rectangular rods, sleeve and cotter joints, knuckle joint.

(3 sheets)

References:

1) N.D.Bhatt :*Machine Drawing*, Charotar Publishing House, Anand
2) P.I. Varghese & K.C. John : *Machine Drawing*
3) P.S. Gill : *Geometric Drawing*, Kataria & Sons, Ludhiana
4) Parkinson : *First year engineering Drawing*, Pitman, London
5) K.R.Hert : *Engineering Drawing with problems and solutions*, ELBS

Type of Questions for University Examination

Module I: Two questions, each of 20 marks with option to answer one question.
Module II: Two questions, each of 30 marks with option to answer one question.
Module III: Two questions, each of 50 marks with option to answer one question.

SE 13 L1 FLUID MECHANICS AND MACHINERY LABORATORY

Study of pipe fittings, and study of devices used for measurement of pressure, velocity, rate of flow, metacentric height and radius of gyration of floating bodies.

Experimental verification of Bernoulli's theorem.

Steady flow through pipes - determination of friction factor and Reynold's number.

Determination of the loss coefficients for pipe fittings.

Hydraulic coefficients of mouth pieces, nozzles and orifices.

Calibration of Venturimeters, orifice meters, nozzle and bend meters.

Force due to impact of jets on vanes.

Performance characteristics of centrifugal pumps at constant speed.

Constant head characteristics of Francis turbine.

Performance of hydraulic ram.

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 13 L2 SAFETY ENGINEERING LABORATORY

1. Study of PPE's.
2. Assessment of the safety performance in an industry and preparation of report..
3. Accident investigation and Analysis – Exercises
4. Job safety analysis – Exercises
5. Safety audit of academic, administrative and residential buildings.
6. Safety audit of a laboratory.
7. Calculation of cost of accidents.
8. Preparation of work permits.
9. Safety assessment of a construction site.
10. Design and development of a training module on any topic of safety.

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

CE/CS/EB/EC/EE/EI/FT/IT/ME/SE 1401 ENGINEERING MATHEMATICS III

Module 1

Complex Analytic functions and conformal mapping: curves and regions in the complex plane, complex functions, limit, derivative, analytic function, Cauchy – Riemann equations, Elementary complex functions such as powers, exponential function, logarithmic, trigonometric and hyperbolic functions.

Conformal mapping: Linear factional transformations, mapping by elementary function like Z^2, e^z, sin z, cosz, sin hz, and Cos hz, Z + 1/Z

Module II

Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residue theorem, evaluation of real integrals using integration around unit circle, around the semi circle, integrating contours having poles, on the real axis.

Module III

Partial differential equations:

Formulation of partial differential equations.

Solutions of equations of the form F (p,q) = 0, F(x,p,q) = 0, F(y,p,q) = 0, F(z,p,q) = 0 F1(x,p) = F2 (y,q), Lagrange's form Pp+Qq = R

Linear homogeneous partial differential equations with constant co-efficient

Module IV

Vibrating string: one dimensional wave equation, D'Alembert's solution, solution by the method of separation of variables

One dimensional heat equation, solution of the equation by the method of separation of variables,

Solutions of Laplace's equation over a rectangular region and a circular region by the method of separation of variables.

References:

1. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publishers.
2. C.R.Wilie and L.C.Barrett Advanced Engineering Mathematics, Mc-Graw Hill.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wilsey Eastern.
4. Churchill R.V, Complex Variables & Applications, Mc-Graw Hill.
5. M.C.Potter, J.L.Goldberg. Advanced Engineering Mathematics, Oxford Unversity Press.
6. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1402 TRANSFER OPERATIONS IN CHEMICAL ENGINEERING

Module I

Importance of heat transfer in Chemical Engineering operations - Modes of heat transfer - Mean temperature difference. Concept of heat conduction - Fourier's law of heat conduction - one dimensional steady state heat conduction equation for flat plate, hollow cylinder, hollow sphere - Heat conduction through a series of resistances - Analogy between flow of heat
and flow of electricity.

Individual and overall heat transfer coefficients and the relationship between them.

Concept of heat transfer by convection - Natural and forced convection - Application of dimensional analysis for convection - Equations for forced convection under laminar, transition and turbulent conditions - Equations for natural convection -- Heat transfer from condensing vapours, heat transfer to boiling liquids.

Module II

Heat Exchangers: Parallel and counter flow heat exchangers - Log mean temperature difference - Single pass and multipass heat exchangers;plate heat exchangers; use of correction factor charts; heat exchangers effectiveness; number of transfer unit - Chart for
different configurations - Fouling factors and wilson's plot - Design of various types of heat exchangers.

Radiation: Concept of thermal radiations - Black body concept – Laws of radiation -concept of grey body – radiation between surfaces.

Evaporation: Types of evaporation - single effect and multiple effect evaporation - Design calculation for single and multiple effect evaporation.

Module III

Principles of mass transfer, Fick's law of molecular diffusion, diffusion in solids and liquids. Concept of mass transfer coefficients, mass transfer at fluids surfaces, correlation of mass transfer coefficients, theories of mass transfer and their applications, interphase mass transfer and over all mass transfer coefficients in binary systems.

Absorption - Equilibrium and operating line concept in absorption calculations; types of contactors, design of packed and plate type absorbers; Operating characteristics of stage wise and differential contactors, concepts of NTU, HTU and overall volumetric mass transfer coefficients.

Module IV

Distillation - relative volatility, simple distillation, steam distillation, distillation with reflux, principle of azeotropic and extractive distillation. McCabe Thiele method of calculation of number of theoretical stages, total, minimum and optimum reflux.

Introduction to drying-equilibrium moisture and free moisture, critical moisture content, bound and unbound water, rate of drying curves, drying equipments-tray dryers, tower dryers, rotary dryers, fluid-bed dryers, spray dryers.

Principle of liquid-liquid extraction, liquid-liquid equilibrium, equipment for liquid extraction - mixer settlers, spray towers, Bollmann extractor. **Solid- liquid extraction**- simple leaching, major equipments for solid -liquid extraction.

References:

1. Binay K.Dutta , *Heat Transfer Principles and Applications*, Prentice Hall of India, 2001.
2. Robert E. Treybal , *Mass Transfer Operations*, Mc Graw Hill
3. W.L. McCabe, J.C. Smith & Peter Harriott, *Unit Operations of Chemical Engineering*, McGraw-Hill Book Co,
4. W.L.Badger & J.T. Banchero, *Introduction to Chemical Engineering*, Tata McGraw-Hill
5. Christe J. Geankoplis, *Transport Process and Unit Operations*, Prentice Hall India Pvt Ltd.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1403 STRENGTH OF MATERIALS

Module I : Simple Stress and Strain and Principal Stresses

Axial stress and strain, elasticity, Hook's law – stress-strain relationship of ductile and brittle materials, Factor of safety, Stepped bars , Bars of uniformly varying cross-sections - Lateral Strain, Poisson's ratio -Volumetric strain - Shear stress and shear strain - Elastic constants and their relationships - stresses in composite bars due to axial loading and temperature - Strain energy due to axial load - stresses due to impact and suddenly applied loads.

State of stress at a point - Normal and tangential stresses on a given plane - Principal stresses and their planes, plane of maximum shear - Mohr's circle of stresses.

Module II : Shear Force and Bending Moment

Relationship connecting intensity of loading, shearing force and bending moment; Shear force and bending moment diagrams for cantilever,simply supported and overhanging beams subjected to concentrated load and UDL - maximum bending moment and point of contraflexure.

Theory of simple bending-assumptions and limitations - Derivation of bending formula and its applications to engineering problems

Module III : Deflection of Beams and Thin and thick walled structures

Differential equation of the elastic curve. Slope and deflection of beams by method of successive integration, McCaulauy's method.

Hoop and longitudinal stresses in thin walled cylindrical and spherical shells subjected to internal pressure - Changes in dimension and volume; Thick Cylinders - Lame's equations , shrink fit , compound cylinders, wire wound cylinders.

Module IV: Torsion and Columns

Theory of torsion and assumptions - Torsion of solid and hollow circular shafts - Power transmission, strength and stiffness of shafts. Close and open coiled helical springs.

Theory of columns- buckling and stability, buckling of long columns, Euler's Formula, Long columns with different support conditions.

References :

1. Gere , M.J., " *Mechanics of Materials*" , Thomson Learning .
2. Subramanian, R., " *Strength of Materials*", Oxford University Press, 2005.
3. Popov,E.P., " *Analysis of Structures*, " Khairna Publishers, 1985.
4. Vazirani, V.N and Ratwani, MM, " *Mechanics of Materials*" , Prentice Hall , 1982.
5. Ramamurtham,S., "*Strength of Materials*" , Dhanpat Rai & Sons , 1974 .

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1404 FIRE ENGINEERING FUNDAMENTALS

Module I

Introduction- temperature, heat, specific heat, flash point, fire point, ignition, combustion; Ignition- pilot ignition, spontaneous ignition, ignition sources; Types of combustion-rapid, spontaneous, explosion;. Development of fire-incipient, smoldering, flame and heat stages; Diffusion flames-zones of combustion, smoldering combustion, characteristics of diffusion flame; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spillover, Boil over, Dust explosion, BLEVE, UVCE; Classification of fire based on material.

Module II

Product of combustion-flame, heat, smoke, fire gases; Flame and its characteristics, spread of flames in solids and liquids, linear and three dimensional fire propagation; spread of fire in rooms and buildings; Effect of heat exposure to human body, body burns. Smoke – constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, visibility in smoke, smoke movement in buildings, modeling of smoke movement; Smoke control in buildings-natural and mechanical ventilation, pressurization; Design principles of smoke control using pressurization technique; Principles of smoke vent design.

Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO_2, HCN, SO_2, NH_3, Nitrogen oxide.

Module III

Use, operation and maintenance of fire service equipments and accessories- Suction and delivery Hose, Hose reel, Hose fittings-coupling, adapters, branches, branch holders, radial branches, collecting heads, stand pipe, monitors, hydrants; Introduction to fire fighting vehicles and appliances-Pumps, primers, crash tenders, rescue tenders, hose laying tenders, control vans, hydraulic platforms; Ladders- extension ladders, hook ladder, turntable ladders, snorkel; Uses and maintenance of small gear and miscellaneous equipments used during fire fighting; Lamps and lighting sets; Ropes and Lines- Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches; General rope work.

Module IV

Fire stream-path, range; nozzles-types, calculation of discharge capacity, nozzle reaction, water hammer; Hydraulic and energy grade lines, pressure loss or gain because of elevation, back pressure; friction losses in pipes, fire hoses and fixtures, parallel and series connections; flow in pipes and fire hoses, branching lines; water relay techniques; Estimation of fire protection water requirements, pump capacity and other parameters relating to fire hydraulics.

Fire ground operations - preplanning, action on arrival and control, methods of rescue, methods of entry. Personnel safety. Control procedure and use of other safety equipment. Ventilation and salvage operations.

References:

1. Ron Hirst, "*Underdowns Practical Fire Precautions*", Gower Publishing Company Ltd., England, 1989.
2. HMSO, "*Manual of Firemanship 1 to 13",*
3. Jain V.K., "*Fire Safety in Buildings*", New Age International (P) Ltd., New Delhi, 1996
4. James F Cassey, "*Fire service hydraulics*"
5. Clark, W.E., "*Fire fighting principles & practices* "
6. Gupta R.S., "*A Hand Book of Fire Technology*",
7. Kevin Cassidy, "*Fire Safety and loss Prevention*",
8. N F P A, " *Fire Protection Hand Book",*
9. NSC, "*Accident Prevention Manual for Industrial Operation*"
10. Barendra Mohan Sen, "Fire protection and prevention the essential handbook"
11. M. Ya. Roytman, *"Principles of Fire Safety Standards for Building Construction"*

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1405 ELECTRICAL TECHNOLOGY AND SAFETY

Module I

Construction and Principle of operation of d.c machines – e.m.f equation of a generator – use of interpoles – characteristics of shunt, series and compound generators – starting and speed control – losses and efficiency.
Construction and Principle of operation of single phase transformers – e.m.f equation – phase diagrams – equivalent circuit – regulation – losses and efficiency.
Protective relays – Requirement of relay – types of protection – classification – distance relay, differential relay, state relays.

Module II

Synchronous machines – types – e.m.f equation – winding factors – armature reaction and leakage resistance. Synchronous motor – methods of starting – applications.
Induction Motors – Construction and principle of operation – equivalent circuit – Torque – slip characteristics – method of starting – applications.
Circuit breakers – function of switch gear – arc phenomenon – initialization of an arc – arc interruption – recovery voltage and restriking voltage – MCB and ELCB. Faults in power systems – causes – types.

Module III

Fuses – types – selection – advantages and disadvantages.
Grounding – neutral grounding – solid grounding – resistance grounding – arc suppression coil grounding. Equipment grounding for safety – grounding substation – grounding of line structure. Earthing
Effect of electric and magnetic fields – Human safety aspects – effect of current and voltage on human beings – typical V-I characteristics of skin – Electric shocks and their prevention.
Insulation – classes of insulation – FRLS insulation – continuity test.

Module IV

Safety during installation of plant and equipment. Safe sequences in installation – risk during installation. Safety during testing and commissioning. Test on relays – protection and interlock systems for safety.
Hazardous zones – classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus. Selection of equipments in hazardous area.
Electrical fires – hazards of static electricity . Safe procedures for electrical maintenance - Statutory requirements. Safety provisions in Indian Electricity Act & Rules.

References:

1. H. Cotton : *Electrical Technology,* Wheeler Publishing Company.
2. S.L. Uppal : *A Textbook of Electrical Engineering,* Khanna Publishers, Delhi..
3. NSC, Chicago : *Accident Prevention Manual for Industrial Operations*
4. M.G. Say : *Electrical Earthing and Accident prevention,* Newnes, London, 1954.
5. S. Rao, and H.L. Saluja : *Electrical Safety, Fire Engineering and Safety Management*, Khanna Publishers, Delhi.
6. *Indian Electricity Act & Rules*.

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1406 OCCUPATIONAL HEALTH AND FIRST AID

Module I

Concept and spectrum of health- functional units and activities of occupational health services- occupational and work related disease- Levels of prevention of diseases – notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax - Lead-Nickel, chromium and manganese toxicity- gas poisoning (such as CO, ammonia, coal and dust), their effects and prevention - Industrial toxicology – local and systemic and chronic effects, temporary and cumulative effects – threshold limit values, calculation of TLVs – carcinogens, mutagens, teratogens.

Instruments for Radiation detection and measurement. Early recognition of radiation hazard – personal monitoring devices, Medical support. Hazards associated with the following radiations and preventive measures- Laser, infra red, ultra violet and ELF.

Module II

Recognition, evaluation and control of physical hazards. Vibration –description and measurement of vibration. Vibration control methods. Effects of whole body vibration on human body and control measures.

Noise- noise measurement, evaluation, noise control methods -hearing loss – causes - Biological effects of noise exposure.

Thermal stress – heat disorders and health effects such as heat exhaustion, hear cramp etc. WBGT index, acclimatization. Ventilation systems - purpose of ventilation-general principles ventilation requirements. Physiological and comfort level . Natural ventilation - Dilution ventilation - Mechanical ventilation - Local exhaust ventilation - Ventilation measuring instruments. Fundamentals of hood and duct designs. Standards on ventilation.

Purpose of lighting. Advantages of good illumination. Lighting and the work. Sources and kinds of artificial lighting principles of good illumination. Design of lighting installation. Maintenance. Lighting and colour. Standards on lighting and illuminations.

Module III

Aims and Objectives. First Aid principles-Role of the first aider-sequence of action on arrival at scene. Vital signs-breathing -pulse. Introduction to the body-basic anatomical terms-body cavities-head- cranium - thorax-abdomen and pelvis. Biomechanics – Structure and functions of musculoskeletal systems, tendons, ligaments, facia, bone, muscles, joints and basic mechanisms.

The respiratory system-respiratory failure - asphyxia- abdominal thrust in Heimlich manoeuvre. Chest injuries-types-fractured ribs -pneumothrox- haemothrox.

The nervous system-functions-components -brain - cerebrum - cerebellum - medulla oblongata -cerebro - spinal fluid-spinal cord-autonomic nervous system. Unconsciousness-causes-level of consciousness-management of unconscious casualty-problems of unconsciousness. Fainting-recognition-management-aftercare. Diabetes -hypoglycaemia - hyperglycaemia- management. Seizures (epileptic fits, convulsions) features- management , stroke. Head injuries-fractures of the base-vault and sides of skull.

Module IV

The circulatory system-heat attack-chest compression- CPR. Shock -causes - signs and symptoms - management of shock.

Eye-eye injuries-foreign body in eye-eye trauma-corrosive chemical in eye-arc eye. Wounds-bleeding-classification-types of wounds-case of wounds-bleeding from special sites.

Fractures- classification of fractures-principles of immobilisation- sprains and dislocation. Broad and narrow fold bandages-hand bandages-slings.

The skin. Burns-rule of nines-pure thermal burns. Electric burns. Chemical burns. Radiation burns. Cold burns. Poisoning. Physical fitness. Lifting - casualty handling. Use of stretchers.

References:

1. *Encyclopaedia of Occupational Health and Safety* : Vol I & II - ILO
2. *Industrial Environment and its evaluation and control* :
3. Clayton & Clayton, *Patty's Industrial Hygiene and Toxicology* :
4. *Manual of first aid to the injured* : St. John Ambulance Association.
5. *First aid text book* : American National Red Cross
6. V.V. Yudenich, *Accident First Aid,* Mir Publishers, Moscow

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 14 L1 STRENGTH OF MATERIALS LABORATORY

Tension test on M.S rod

Torsion test on M.S specimen

Test on open coiled and close coiled helical springs

Flexure Test on wood

Determination of modulus of elasticity of concrete

Brinnel,Vickers and Rockwell hardness tests

Double shear test on M.S rod

Izod and Charpy impact tests

Compression test on concrete cubes, cylinders, Bricks, and concrete block units

***Note** : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass*.

SE 14 L2 ELECTRICAL TECHNOLOGY LABORATORY

1. Verification of Kirchoff's Laws
2. Verification of Superposition Theorem
3. Study of B.H. Curve on C.R.O
4. Measurement of power in an A.C. circuit by 3 ammeter and 3 voltmeter method
5. Load test on a d.c. series motor
6. Speed characteristics of d.c. shunt motor
7. Regulation of a Transformer
8. Load characteristics of a 3 phase induction motor
9. Study of protective relays and circuit breakers.
10. Study of insulation testing and ground testing.

***Note** : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.*

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CE/CS/EB/EC/EE/EI/FT/IT/ME/SE1501 ENGINEERING MATHEMATICS IV

MODULE 1

Probability distributions: random variables (discrete & continuous), Probability density, mathematical expectation, mean and variance of a probability distribution, binomial distribution, Poisson approximation to the binomial distribution, uniform distribution, normal distribution.

Curve fitting: method of least squares, correlation and regression, lines of regression.

Module II

Sampling distributions: Population and samples, the sampling distribution of the mean unknown(σ known), the sampling distribution of the mean (σ)the sampling distribution of the variance, point estimation, interval estimation, tests of hypotheses, null hypotheses and significance tests, hypothesis concerning one mean, type I and type II errors, hypotheses concerning two means. The estimation of variances: Hypotheses concerning one variance – Hypotheses concerning two variances.

Module III

Finite difference Operators: ∇, Δ E, δ, μ, $x^{(n)}$

Newton's Forward and Backward differences interpolation polynomials, central differences, Stirlings central differences interpolation polynomial. Lagrange interpolation polynomial, divided differences, Newton's divided differences interpolation polynomial.

Numerical differentiation: Trapezoidal and Simpson's rules, compounded rules, errors of interpolation and integration formulae. Gauss quadrature formulae (No derivation for 2 point and 3 point formulae)

Module IV

Numerical solutions of ordinary differential equations: Taylor series method, Euler's method, modified Euler's method, Runge-Kutta formulae 4^{th} order formula,

Numerical solution of boundary value problems: Methods of finite differences, finite difference methods for solving Laplace's equation in a rectangular region, finite differences methods for solving the wave equation and heat equation.

References:

1. Irvrin Miller & Freiend, Probability And Statistics For Engineers, Prentice Hall of India.
2. S.S.Sastry, Numerical Methods, PHI Publishers.
3. P.Kandaswamy.K.Thilagavathy, K.Gunavathy, Numerical Methods, S.Chand & Co.
4. A.Papoulis, Probability, Random Variables and Stochastic Processes, Mc-Graw Hill.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1502 REACTION ENGINEERING AND CHEMICAL TECHNOLOGY

Module I

Classification of reactions, variables affecting rate of reaction, definition of reaction rate. Kinetics of homogeneous reactions – concentration dependent term of a rate equation, temperature dependent term of a rate equation, theories of reaction – collision theory, transition theory, Arrhenius equation. Analysis of experimental reactor data, evaluation of rate equation, integral and differential analysis for constant variable volume system, fitting of data complex reaction mechanism.

Module II

Ideal reactors- Design for homogeneous systems, batch, stirred tank and tubular flow reactor, design of reactors for multiple reactions, combination reactor system, size comparison of reactors. Elementary ideas of non-ideal reactor performance, residence time distribution. Types of fermentors and bioreactors. Enzymes – mechanism of enzyme action, introduction to enzyme kinetics, Michaelis – Menten kinetics, methods of enzyme immobilization.

Module III

Inorganic chemical technology: Chlor- alkali industries-soda ash-caustic soda-chlorine-hydrochloric acid. Manufacture of sulphuric acid. Phosphorous industries - phosphoric acid-wet process phosphoric acid, electric furnace phosphoric acid, single super phosphate and triple super phosphate. Nitrogenous industries-ammonia, nitric acid, urea, ammonium sulphate, ammonium phosphate.
(Only the processes currently in use in industries need be covered)

Module IV

Organic chemical technology: Manufacturing processes for pulp and paper, sugar, industrial alcohol by fermentation-absolute alcohol, beers, wines, oils and fats, soaps and detergents, agrochemicals, introduction to polymers, synthetic rubbers- SBR, neoprene, urethane rubbers.
(Only the processes currently in use in industries need be covered)

Reference :

1. O. Levenspiel, *Chemical Reaction Engineering*, John Wiley & Sons,
2. M. Gopal Rao & M. Sittig (Eds), *Dryden's Outlines of Chemical Technology*, Affiliated East West Press
3. Michael L. Shuler and Fikret Kargi, *Bioprocess Engineering: Basic Concepts*, Prentice-Hall of India, 2002.
4. G.T. Austin (Ed), *Shreve's Chemical Process Industries*, McGraw Hill Book Company.
5. H. Scott Fogler, Elements of Chemical Reaction Engineering, Prentice-Hall of india, 2002.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1503 PRINCIPLES OF ENGINEERING DESIGN

Module I

Introduction to design- steps in design- design factors- practical considerations in design- theories of failure- stress concentration - consideration of creep and thermal stress in design.

Detachable joints- design of screws- thread standards- thread stress- pre-loading of bolts- external load with pre-load -fatigue and shock loading- Types of keys- types of pins- design of cotter and pin joint.

Module II

Riveted Joints-stresses in riveted joints- design of riveted joints subjected to central & eccentric loads- boiler and tank joints - structural joints.

Welded joints-types of welded joints- design of welded joints subjected to axial, torsion and bending loads.

Module III

Springs- stresses in helical spring- deflection of helical compression and extension Spring- springs subjected to fatigue loading- concentric and helical torsion spring - critical frequency of springs- leaf springs- design of automotive leaf springs.

Power Shafting- Design for static loads- combined stresses- design of shaft for strength and deflection- axial load on shaft.

Module IV

Design of cylindrical and spherical vessels for internal and external pressures- design of heads and enclosures- tall vessels- supports for vessels- non standard flanges- pipeline design. Design of storage tanks.

Reference:

1. Joseph Edward Shingley, *Mechanical Engineering Design*
2. V.I. Doughite, *Design of Machine elements*
3. J. Myatt , *Machine Design*
4. L.E. Brownell and B.H. Young, *Process Equipment Design*
5. M.V. Joshi, *Process Equipment Design,*
6. IS 2825:1969 - Code for unfired pressure vessels (**to be permitted for examination**)
7. Design Data Books (**to be permitted for examination**)
    1 Prof. B.R. Narayana Iyengar & Dr. K. Lingaiah
    2 PSG Tech.
    3.Prof. Mahadevan

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1504 PLANNING AND DESIGN OF FIRE PROTECTION SYSTEMS

Module I

Fire detection- Need and importance of automatic fire detection system, principle of detection, classification of detectors; Heat detectors – fixed temperature, rate of rise , thermistor rate of rise and rate compensated type detectors; Smoke detectors- optical and ionization type, photo electric light scattering and light obstruction type detectors; Flame detectors – infra red and ultra violet detectors; Flammable gas detection- Pellistor and laser detectors; Testing of fire detection devices as per relevant Indian standards specifications; Comparison of detectors; Performance characteristics of detectors; Lag time associated with fire detection.

Module II

Principles of Fire Extinguishments-extinction of premixed flames, diffusion flames and burning metals, fire triangle, fire tetrahedron; Basic concept of fire fighting with water, carbon dioxide, powders, foams, inert gases halons; Need for halon replacement and halon substitutes; Extinguishant performance- flame extinguishing concentration, inerting concentration, fire trials.

First aid fire protection – fire bucket, sand bucket, fire blanket, fire pails & water barrels, hose reels; Description, working principle, method of operation of different types of portable fire extinguishers-water type, foam type, dry powder type, CO_2 type, vapourizing liquid type; Care, inspection, and maintenance of portable extinguishers as per relevant Indian standards specifications;

Module III

Automatic water sprinkler system- requirement and source of water supply, automatic pumps; Automatic sprinkler heads-Quartzoid type, fusible link type, modern types; mounting and protection of sprinkler heads; Sprinkler pipe works-standard and staggered lay out, hangers; Control valves for wet and dry installations; deluge valve. Drenchers; High velocity and medium velocity spray system; Principles of water sprinkler system design as per relevant standards (ISI).

Module IV

Fixed fire fighting system using CO_2, Dry chemical powder, and Foam - concept of total flooding and local application, advantages and disadvantages of each system; Basic system components; Design principles of fixed fire fighting systems for total flooding and for local application as per relevant standards (ISI).

Fire alarm system- classification of alarm system as per NBC; Manually operated system; Automatic alarm system; Component and features of Local system, Auxiliary system, Remote station system, Central station system and Proprietary system

References :

1. Ron Hirst, "*Underdowns Practical Fire Precautions*", Gower Publishing Company Ltd., England, 1989.
2. Jain V.K., "*Fire Safety in Buildings*", New Age International (P) Ltd., New Delhi, 1996
3. Clark, W.E., "*Fire fighting principles & practices* ",
4. HMSO : *Manual of Firemanship, No. 4 to 7.*
5. Kevin Cassidy, "*Fire Safety and loss Prevention*",
6. N F P A, " *Fire Protection Hand Book",*
7. Hubert Walker, "*Preventive maintenance/Apparatus*",
8. Ervin L.W., "*Fire fighting apparatus and procedures"*,
9. *Fire services manual Vol 1 & Vol 2*
10. Barendra Mohan Sen, "Fire protection and prevention the essential handbook"
11. Relevant IS codes

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1505 MANUFACTURING PROCESSES

Module I

Engineering Materials:- Classification , Properties - mechanical, thermal, chemical and technological. Iron and Steel-Processes and Classifications. Non-ferrous metals, processes, properties and use. Heat treatment of steels- purposes and methods. Processess-annealing, normalising, hardening, tempering.

Module II

Welding :-Introduction, weldability, types of welding- Gas welding, Arc welding - submerged arc, TIG, MIG. Resistance welding, Solid state welding, Electron beam welding, Laser beam welding. Oxygen cutting. Heat affected zones, Weld defects, Inspection of welded joints.

Module III

Metal Casting:- Pattern- pattern materials, types of patterns, pattern allowance, Moulding sands- properties and classification. Core and core sands. Moulding process. Special casting methods- die casting, centrifugal casting, investment casting, slush casting. Casting defects and inspection.

Module IV

Metal Forming:- Mechanical working of metals. Hot working, cold working. Methods and process of rolling, forging, and extrusion.

Machining:- Metal cutting, Orthogonal and Oblique cutting, Cutting tool materials. Classification of machine tools - lathe, shaper, milling machine, drilling machine and grinding machine . Advanced machining methods- ECM, EDM, USM, AJM.

References:

1.S. Kalpakjian and S.R. Schmid, *Manufacturing Engineering and Technology*, Pearson Education Asia

2.P.C. Sharma, *A Text Book of Production Technology*, S. Chand & Co, New Delhi.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1506 CHEMICAL PROCESS SAFETY

Module I

SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS :-Design principles – Process design development – types of designs, feasibility survey, preliminary design, flow diagrams, piping and instrumentation diagram, batch versus continuous operation, factors in equipment scale up and design, equipment specifications - reliability and safety in designing – inherent safety – engineered safety - safety during startup and shutdown – safety checks in the design of the equipments – reactor safety - safety in erection and commissioning of chemical plants - non destructive testing methods – pressure and leak testing – emergency safety devices – scrubbers and flares – new concepts in safety design and operation- Pressure vessel testing standards– Inspection techniques for boilers and reaction vessels.

Module II

SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS:- Properties of chemicals – Material Safety Data Sheets – the various properties and formats used – methods available for property determination. Operational activities and hazards –standards operating procedures – safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems – effects of pressure, temperature, flow rate and humidity on operations – corrosion and control measures- condition monitoring - control valves – safety valves – pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.

Module III

SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES :-Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief – relief valve sizing calculations - storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation – pipe line transport – safety in chemical laboratories. Safety provisions like level and flow indicators – alarms, trips – protection of stills, columns and towers from lightening – colour coding for pipe lines and cylinders.

Module IV

CHEMICAL REACTION HAZARDS : Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testing strategies, Self – heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening, Case studies. Stability and sensitivity tests, Classification of materials with explosive potential, Hazard prediction by thermodynamic calculations, Prevention and control of explosions and detonations – diluting a release, purging and inerting, venting, explosion relief, flame arrestors, explosion suppression, Classification of hazardous areas.

References :

1. Ralph King and Ron Hirst, *King's Safety in the Process Industries*, Arnold, London, 1998
2. Industrial Environment and its Evolution and Control :NIOSH
3. Accident Prevention Manual for Industrial Operations :Vol. I & II NSC Chicago
4. Sax N Irvin, *Dangerous properties of industrial materials*

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 15 L1 CHEMICAL ENGINEERING LABORATORY

1. Sieve Analysis – To analyse a given sample using a set of standard sieves and thus to determine the specific surface area, the volume surface mean diameter and the mass mean diameter by differential analysis and cumulative analysis.

2. Study of the working of Plate and frame filter press.

3. Free settling – To find out the drag coefficient of a falling sphere in a fluid and verification of Stoke's law.

4. Sedimentation – To study batch sedimentation of a slurry and to determine the area of the continuous thickener.

5. Heat transfer from steam to air – Determination of overall heat transfer coefficient.

6. Verification of material balance equation and Rayleigh's equation for simple distillation.

7. Steam distillation.

8. Leaching – leaching a mixture of salt and sand.

9. Study of the kinetics of chemical reaction in a batch reactor.

10. Adsorption isotherms.

11. Frequency response of first and second order systems.

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 15 L2 FIRE SAFETY TRAINING

The following techniques of fire fighting shall be demonstrated to the students by experienced fire services professionals. Strenuous physical exercises are not expected from the students.

1. Fire Service Signals – Line signals, Hand signals.

2. Hose drills – laying one hose, connection and disconnection couplings.

3. Hydrant drills – laying one line from hydrant, adding one length of hose, removing the length of hose, replacing a burst into two, dividing one length in to two, removing one line, one collecting two line into one, removing the collecting breaching, getting a branch to work from floors.

4. To study the use of ropes and lines in fire service - Types and construction, material used in construction of ropes and lines. Different types of lines used in fire service for different purposes like rescue, lifting, lowering. Care and maintenance of ropes and lines.

5. Rescue drills – The fireman's lift, fireman's drag, fireman's hand stretchers.

6. Training in the use of different types of fire extinguishers.

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 1601 LEGAL ASPECTS OF HSE

Module I

Factories Act– Definitions, Preliminary, Inspecting staff, Health, Safety, Provisions relating to hazardous processes, Welfare, Working hours of adults, Employment of young persons, Special provisions.
Dock Workers (Safety, Health and Welfare) Act and Regulations (in brief) - Definitions, Powers of inspectors, Power of Govt. to direct inquiry, Obligation of dock workers. Duties of Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee.

Module II
Workmen's Compensation Act: Definitions, Employer's liability for compensation, Calculation of amount of compensation. **ESI Act and Rules**: Applicability, Definitions and Benefits.
Public Liability Insurance Act and Rules- Definitions, Calculation of amount of relief, Environmental Relief Fund, Advisory Committee, Powers of District Collector, Extent of Liability, Contribution to Relief Fund.

Module III
Explosives Act: Definitions, Categories of Explosives, General Safety Provisions, Use of Explosives, Grant of license, Notice of Accidents, Inquiry into ordinary and more serious accidents, Extension of definition to other explosive substances. Important technical provisions in the **Explosives Rules**, **SMPV Rules** and **Gas Cylinder Rules**.
Petroleum Act & Rules - Definitions, Control over Petroleum import, transport, storage, production, refining and blending, Need for license, exemption, Notice of Accidents and Inquiries.

Module IV

Water Act- Definitions, Powers and Functions of Boards, Provisions regarding prevention and control of water pollution, Power to make rules, Rules on Consent for Establishment and Operation. **Air Act** - Definitions, Power & Functions of Boards, Prevention & Control of Air Pollution, Consent as per Air Pollution Rules. **Environment (Protection) Act and Rules**- Definitions, general powers of central government, prevention, control and abatement of environmental pollution, standards for emission, prohibition and restrictions on siting and operation of industries. **MSIHC Rules**- Definitions, Duties of Authorities, Notification of Major Accidents Safety Reports, Safety audit, MSDS, On-site & Off-site Emergency Plan, Giving safety information to public.

References:
1. Factories Act, 1948 with amendments of 1976 & 1987.
2. Dock Workers (SHW) Act, 1986; Rules, 1990 & Regulations, 1990.
3. Bare Acts and concerned Rules on social security.
4. Explosives Act and related Rules.
5. Petroleum Act and Petroleum Rules.
6. Environmental Acts & relevant Rules as above.

Type of Questions for University Examination
Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1602 PROCESS INSTRUMENTATION AND CONTROL ENGINEERING

Module I

Elements of measurement – Fundamental standards, Quality of measurement, Meaning of measurement, Errors in measuring instruments, Precision and accuracy, Calibration principle, Static and dynamic characteristics of measuring instruments.

Measurement of temperature – Bimetallic and pressure thermometers, Thermocouples, Resistance thermometers, Pyrometry, Calibration.

Pressure and vacuum measurement – Manometers, Measuring element, Absolute pressure measurement, Static accuracy of pressure gauges.

Module II

Flow measurement - Orifice installation, Pitot tube, Area flow meters, Open channel meters.

Level measurement – Direct method, Measurement of level in open and pressure vessels.

Measurement of pH and humidity.

Recording Instruments, Indicating and signaling instruments, Signal transmission, and codes.

Module III

Open loop and close loop systems – Transfer function modeling – block diagram representation of mechanical, thermal and liquid level systems.

Transient response analysis – Time response of first and second order system for impulse and step inputs – Effect of damping factors on transient response – Characteristics of proportional, integral, derivative, PI, PD and PID controllers.

Frequency response method of analysis – polar plot – Bode Plot.

Module IV

Introduction to stability – Definition via impulse response function – Routh-Hurwitz stability criterion – Nyquist stability criterion.

Control system components – error detectors – modulators and demodulators – Hydraulic controllers – Pneumatic controllers – PLC.

Introduction to computer control in chemical process industry.

Comparison between discrete data, digital and analogue control systems. Introduction to digital signal processing.

References :

1. D Patranabis, *Principles of Industrial Instrumentation*, Second Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1996.
2. George Stephanopolous, *Chemical Process Control : An Introduction to Theory and Practice*, Prentice Hall of India Pvt. Ltd, 1990.
3. Eckman D P, *Industrial Instrumentation*, Wiley Eastern Ltd, New Delhi, 1990.
4. Ogata, K., *Modern Control Engineering*, Prentice Hall, 1995.
5. Benjamin C. Kuo., *Digital Control Systems*, Oxford University Press, 1992.
6. Stefani R.T, Shahian B, Savant J.C and Hostetter G. H, *Design of Feedback Control Systems*, Oxford University Press, 2002.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1603 HAZARD CONTROL IN MANUFACTURING

Module I

Introduction - Classification of Engineering Industry –Manufacturing Processes

Hot Working-Foundry operations-furnace and equipments, hazards, safe methods of operation. Forging operations , heat radiation, maintenance of machines , shop equipments and hand tools - safe work practice. Operations in hot and cold rolling mills.

Module II

Machinery safeguard-Point-of-Operation , Principle of machine guarding - breakdown of machine guarding - types of guards and devices.

Cold Working-Safety in Power Presses, primary & secondary operations - shearing -bending - rolling – drawing.

Metal Cutting- safety in turning , boring , milling, planning and grinding. Maintenance of machine tools - hazards and prevention.

Module III

Welding and Cutting-Safety Precautions of Gas welding and Arc Welding, Cutting and Finishing. Gas Cylinders and Equipments. Heat Treatment and Surface Treatment- Furnaces and Salt baths-operations and maintenance -safety in handling and storage of salts- disposal of effluents - health precautions, exposure to hazardous fumes, source of fumes, ventilation and fume protection.

Module IV

Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling Equipments-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks , clamps .

References:

1. *Accident Prevention Manual for Industrial Operations* : National Safety Council, Chicago
2. Roland P. Blake, *Industrial Safety*
3.N C Balchin, *Health and Safety in Welding and Allied process*, Jaico Publishers
4. S. Kalpakjian and S.R. Schmid, *Manufacturing Engineering and Technology*, Pearson Education Asia

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1604 STRUCTURAL FIRE SAFETY

Module I

Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behaviour of non-structural materials on fire- plastics, glass, textile fibres and other house hold materials; Determination of combustibility by fire tube method; Brief description on non-combustibility test and classification of flame spread rate of materials as per relevant standards (BIS).

Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings..

Module II

Experimental determination of fire resistance – types of furnaces; Approximate methods for calculating the fire resistance of structural elements- Schematic diagrams, influencing factors; Concept of static, thermal engineering and experimental methods for the calculation of fire resistance; Principle of the calculation of the fire resistance limits of structures-coefficient of fire resistance, fire duration; Approximate calculation of the required fire resistance for a building.

Module III

Fire area- calculation of building fire area, subdivision of fire areas in Industrial, Residential and Public buildings; Fire separation between building-principle of calculation of safe distance.

Design principles of fire resistant walls and ceilings; Fire resistant screens-solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures;

Fire doors- Low combustible, Non combustible and Spark-proof doors; suspension of doors; Air-tight sealing of doors; Specification, test and performance criteria of Plate, Metal covered and Rolling type fire doors as per relevant standards (ISI).

Module IV

Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements – Wooden, Steel, RCC, and Plastic structures;

Reparability of fire damaged structures- Assessment of fire severity, Assessment of damage to concrete, steel, masonry and timber structures, Assessment of feasibility of repair; Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

References:

1. Roytman M. Ya., "*Principles of Fire Safety Standards for Building Construction*", Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975
2. Smith E.E. and Harmathy T.Z.(Editors), "*Design of Buildings for fire safety*", ASTM Special Publication 685, American Society for Testing and Materials, Boston, U.S.A., 1979.
3. E.Gorden Butcher E. G. and Parnell A. C., "*Designing of fire safety*", John Wiley and Sons Ltd., New York, U.S.A., 1983
4. Marchant E.W., "*A Complete Guide to Fire and Building*",
5. Adam and Charles Black, "*Fire safety in Buildings*",
6. HMSO, "*Fire protection in factory building*",
7. BIS, "*IS-12777- Fire safety-flame-spread of products- Method for classification*, Bureau of Indian Standards, New Delhi, 1989.
8. BIS, "*IS 3614 (Part-1) – Specification of fire check doors-part 1: Plate, metal covered and rolling type*" Bureau of Indian Standards, New Delhi, 1966.
9. BIS, "*IS 3614 (Part-2) – Specification of metallic and non-metallic fire check doors-part 2: Resistance test and performance criteria*, Bureau of Indian Standards, New Delhi, 1992.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1605 ENVIRONMENTAL ENGINEERING AND MANAGEMENT

Module I

Air pollution- Sources of air pollution, effects of air pollution , classification of pollutants, Atmospheric transport of pollutants-wind profiles, atmosphere stability, inversion, turbulence, dispersion and diffusion of air pollutants, Gaussian plume dispersion model. Principles and techniques of ambient air and stack emission monitoring; Particulate matter control equipment- working principles of gravity settlers , cyclones, wet scrubbers, fabric filters and electrostatic precipitators; Gaseous control methods- an overview of absorption, adsorption and combustion methods; Biological methods for VOC and odour control.

Module II

Physical, chemical and biological characteristic of waste water; Effects of pollutants on water quality and aquatic life; Physical unit operations in waste water treatment- flow equalization, sedimentation, and flotation; Chemical unit processes in waste water treatment- coagulation and flocculation, chemical precipitation and adsorption; Biological unit processes- kinetics of microbial growth, Aerobic treatment systems: working principle and design parameters of trickling filter, activated sludge process, and rotating biological contactor; Anaerobic treatment systems: mechanism of anaerobic process, low rate and high rate digesters, working principle and applications of anaerobic filters and UASB; Biological nitrification – denitrification; Characteristics and treatment methods for the waste water from fertilizer plants, petroleum refineries, pulp and paper mills and distilleries.

Module III

Solid wastes- environmental ,aesthetic and health risk; Sources, quantities and composition of solid wastes; Storage, collection and transportation of urban solid waste, disposal options- sanitary land fills, composting and its variations, anaerobic digestion, incineration and pyrolysis; Vermi composting; Recovery alternative ; Monitoring of solid wastes. Hazardous wastes- definition and classification, health and environmental effects, treatment, disposal and management of hazardous wastes, legal frame work for hazardous waste management in India.

Module IV

Environmental management in industries- Principles and requirements of ISO 14001 EMS; Environmental auditing and auditing for waste minimization; Environmental impact assessment- description of the environmental setting, prediction and assessment of impacts, methods of impact analysis, Indian scenario, public participation in environmental decision making. Strategies for pollution prevention – recycle and reuse, cleaner technologies. Life cycle assessment – principle and methodology. The concept of industrial ecology. Clean development mechanism (CDM) – carbon trading.

References:

1. C.S. Rao : *Environmental Pollution Control Engineering*, New Age International (P) Ltd Publishers, 1991.
2. M.N. Rao and A.K. Dutta : *Wastewater Treatment*, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1987.
3. Metcalf and Eddy Inc.: *Wastewater Engineering: Treatment and Reuse,* Fourth Edition, Tata McGraw-Hill Publishing Company Limited, 2003.
4. Canter. L.W :*Environmental Impact Assessment,* Second Edition, Irwin / McGraw – Hill, *1996.*
5. David H.F. Liu, I (Ed).: *Environmental Engineers Handbook,* Second Edition, Lewis Publishers, 1997.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1606 E1 POWER PLANT ENGINEERING

Module I

Introduction to power plants & boilers: Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles – Comparison and Selection, Load Duration Curves.
Steam Boilers and Cycles – High Pressure and Super Critical Boilers – Fluidised Bed Boilers.
Steam Power Plant: Fuel and Ash Handling, Combustion Equipment for burning coal, Mechanical Stokers, Pulveriser, Electrostatic Precipitator, Draught – different types, Surface Condenser Types, Cooling Towers

Module II

Nuclear and hydel power plants: Nuclear Energy – Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety.
Hydel Power Plant – Essential Elements, Selection of Turbines, Governing of Turbines- Micro Hydel developments.

Module III

Diesel and gas turbine power plant: Types of Diesel Plants, Components, Selection of Engine Type, Applications Gas Turbine Power Plant – Fuels - Gas Turbine Material – Open and Closed Cycles – Reheating – Regeneration and Intercooling – Combined Cycle.

Module IV

Other power plants and economics of power plants: Geo thermal –OTEC – Tidel - Pumped storage - Solar thermal central receiver system.
Cost of Electric Energy – Fixed and operating Costs – Energy Rates – Types of Tariffs – Economics of load sharing, comparison of economics of various power plants.

References :

1. EI- Wakil M.M, “Power Plant Technology”, McGraw-Hill 1984.
2. Arora S.C and Domkundwar S, “A course in Power Plant Engineering”, Dhanpatrai, 2001.
3. Nag P.K, “Power plant Engineering”, Tata McGraw-Hill, 1998.
4. G.R. Nagpal, “Power Plant Engineering”, Hanna Publishers, 1998.
5. K.K.Ramalingam, “Power Plant Engineering”, Scitech Publications, 2002.
6. G.D.Rai, “Introduction to Power Plant Technology”, Khanna Publishers, 1995.
7. R.K.Rajput, “Power Plant Engineering”, Laxmi Publications, 1995.
8. Frank D.Graham “Power Plant Engineers Guide”, D.B. Taraporevala Sons & Co, New Delhi, 1993.
9. T.Morse Frederick, “Power Plant Engineering”, Prentice Hall of India, 1998

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1606 E2 SAFETY IN PETROLEUM AND PETROCHEMICAL INDUSTRIES

Module I

Simplified flow diagrams of a typical refinery – distillation unit, catalytic cracker, reformer, treating unit (hydro forming, gas purification, Sulphur recovery, lubricating oil unit) Simplified flow diagrams of Petrochemical Industry – steam cracking, butadiene extraction, ethane recovery, butyl rubber polymerization.

Module II

Potential fire hazards in petroleum and petrochemical industries (ignition by local sources, spark, flame, hot surface, ignition of oil mists and fumes.). Storage tank farms of petroleum and petrochemical industries – Identification of Hazards, Type of Tanks, Design, Layout, Fire prevention measures including lightning protection. Fire protection arrangements in large tank farms, Design concepts of various fixed fire protection systems like Foam- Water Systems, Halogen & DCP systems. Lock out procedures. Salient features of codes / standards : NFPA, API, OISD and SHELL.

Module III

Fire protection facilities in Oil Refineries, Depots & Terminals- Transportation of petroleum and petrochemical products (safety considerations, statutory considerations). Design and Construction requirements for cross country hydrocarbon pipelines. Liquefied Petroleum Gas (LPG) Bottling Plant Operations. Design Philosophies. Operating Practices- Safety and Fire Protection in bottling plants. Transportation of Bulk Petroleum Products. Storage and Handling of Bulk Liquefied Petroleum Gas.

Module IV

On- Shore and Off- shore drilling. Classification of wells. Drilling method. Rotary drilling. Drilling equipment. Ground and offshore structures for drilling. Offshore platforms and drilling vessels. Drilling mud – functions, classification and properties. Blow-off, well kicks, Blow out preventer. Shallow gas. Directional drilling. Well killing procedure., Emergency shut down, Methods of Rescue & Fire Fighting. Petroleum and Natural Gas (Safety in Offshore Operations) Rules, 2008.

References:

1.M. Gopal Rao & M. Sittig (Eds), *Dryden's Outlines of Chemical Technology*, Affiliated East West Press.
2. Frank P Lees , *Loss prevention in Process Industries – Vol. I, II & III ,* Butter worth – Heinemann Publishing Company, UK.
3. Manuel of Fireman ship – Vol. I to XIII, HMSO, London.
4. Fire Protection Hand book., NFPA, 2008.
5. OISD Standards.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1606 E3 FOOD AND BIOSAFETY

Module I

Quality attributes of foods, size and shape, colour and gloss, texture – visual and objectively measurable attributes. Aroma of foods – Introductory ideas, formation and chemistry. Introduction to sensory evaluation of foods and beverages.

Food safety, food additives and food contaminants, their chemical, technological and toxicological aspects, Food laws – development and enforcement. Prevention of Food Adulteration Act and Food Regulations. ISO 9000 series and HACCP. Codex Alimentarius protocols for export.

Module II

Principles of food commodity storage, Insect pests – their biology and food preference. Effects of pests on food communities. Pesticide classification and chemistry. Pesticide formulations. Pesticide appliances. Insect growth regulators, biopesticides and grain protectants. Fumigants, Sanitation in food processing / handling units. Ballooning techniques. Irradiation and other physical methods of control. Pesticide and health hazards. Safety devices, pesticide residues in foods, residue analysis and decontamination. Concept of organic foods.

Module III

The legal and socio-economic impacts of biotechnology – Public education of the processes of biotechnology involved in generating new forms of life for informed decision making – Biosafety regulation and national and international guidelines. r-DNA guidelines – Challenges for the Indian biotechnological research and industries – Ethical implications of biotechnological products and techniques.

Module IV

Experimental protocol approvals – Levels of containment – Environmental aspects of biotech applications – Use of genetically modified organisms and their resistance in environment – Special procedures for r-DNA based product production – Social and ethical implications of biological weapons – Good safety practices – GLP standards – Lab contaminants – PI, PII, PIII guidelines.

References:

1) P.K. Gupta, *Elements of Biotechnology*
2) H.D. Kumar, *A Textbook on Biotechnology*
3) Sasson A, *Biotechnologies and Development*
4) P. Fellows, *Food Processing Technology : Principles and practice*

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1606 E4 FAULT DETECTION AND DIAGNOSIS

Module I

Introduction to Fault Detection and Diagnosis: Scope of FDD:- Types of faults and different tasks of Fault Diagnosis and Implementation - Different approaches to FDD: Model free and Model based approaches. Classification of Fault and Disturbances- Different issues involved in FDD- Typical applications.
Analytical Redundancy Concepts: Introduction- Mathematical representation of Fault and Disturbances: Additive and Multiplicative types – Residual Generation: Detection, Isolation, Computational and stability properties – Design of Residual generator – Residual specification and Implementation.

Module II

Design of Structured Residuals: Introduction- Residual structure of single fault Isolation: Structural and Canonical structures- Residual structure of Multiple fault Isolation: Diagonal and Full Row canonical concepts – Introduction to parity equation implementation and alternative representation.

Module III

Design of Directional structured Residuals: Introduction – Directional Specifications: Directional specification with and without disturbances – Parity Equation Implementation – Linearly dependent column.

Module IV

Advanced level issues and design involved in FDD: Introduction of Residual generation of parametric fault – Robustness Issues –Statistical Testing of Residual generators – Application of Neural and Fuzzy logic schemes in FDD – Case study.

References:

1. Janos J. Gertler " *Fault Detection and Diagnosis in Engineering systems*" – 2nd Edition, Macel Dekker, 1998.
2. Sachin. C. Patwardhan, "*Fault Detection and Diagnosis in Industrial Process*" – Lecture Notes, IIT Bombay, February 2005.
3. Rami S. Mangoubi, "*Robust Estimation and Failure detection*". Springer-Verlag-London 1998.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 16 L1 MACHINE SHOP

Introduction to Lathe: Spindle drive - work holding devices - types of Lathe tools - tool holders - tool movement - selection of speeds. Feed and depth of cut - use of cutting coolants - Principle of thread cutting - V-thread and Square thread - thread standards - cutting tool types - grinding of tools - selection of cutting speeds. **Exercises**: Exercises involving cylindrical turning, Taper, Turning, Facing, Shoulder turning and curve turning - thread cutting.

Introduction to machine tools like horizontal milling machines, vertical milling machines, slotting and shaping machines, work holding devices- spindle drives- milling cutters - gear milling - surface slot milling - indexing head - simple and differential indexing - grinding wheel - specification and selection - drilling and reaming - capstan and turret lathes - ideas of tool layout.
Exercise: Exercises on lathe - curve turning, multi start thread, drilling and boring, internal thread.

Exercises on - Shaper and slotting - machining of plane and bevel surfaces - keyway and slot machining, exercises on drilling and reaming, surface grinding and tool grinding.

References:

1) *Production technology* : HMT
2) *Tool Engineer's hand book* : ASTME
3) Burghardt, Axllered and Anderson, *Machine tool operations 1 & 2*
4) B.L. Boguslavsky, *Automatic and semiautomatic lathes*, Pease publications.
5) *Fundamentals of tool design* : ASTME

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 16 L2 ENVIRONMENTAL ENGINEERING & MANAGEMENT LABORATORY

1. Determination of pH, turbidity, total hardness, total solids and dissolved oxygen of water samples.

2. Determination of BOD and COD of waste water samples.

3. Jar test for determining the optimum coagulant dose for water treatment.

4. Determination of kinetic constants of activated sludge process.

5. Determination of sulphur dioxide, oxides of nitrogen and particulate matter from chimney sources.

6. Determination of particulate matter, chlorine, ammonia, carbon monoxide and sulphur dioxide in ambient air.

7. Analysis of lead and other heavy metals in air using spectroscopy.

8. Study of pollution prevention and control facilities in industries.

9. Preparation of Environmental Impact Statement (EIS) for an industrial project.

10. Preparation of an Environment Audit Report.

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 1701 HAZARD IDENTIFICATION AND RISK ASSESSMENT

Module I

Hazard and risk , Types of hazards – fire, explosion and toxic gas release, Structure of hazard identification and risk assessment.

Identification of hazards : Inventory analysis, Fire and explosion hazard rating of process plants - The Dow Fire and Explosion Hazard Index, The Mond Index, Plant layout and unit hazard rating, Preliminary hazard analysis, Hazard and Operability study (HAZOP), What If analysis, Case studies.

Module II

Plant availability and process reliability : ways of improving plant availability, MTBF and MTTF, the reliability function, failure rate, bathtub curve, probability relationships, simple reliability estimation.

Estimation of frequency of occurrence of a hazard : The logic tree approach, set theory and Boolean algebra, application to probability, Boolean manipulation.

Fault tree analysis – logic symbols, minimal cut set, logic gates, fault tree quantification.

Event tree analysis – notation, event tree construction, advantages and disadvantages of ETA.

Failure mode and Effect Analysis (FMEA) – methodology, criticality analysis, corrective action and follow-up.

Module III

Consequence modelling :

Source models – discharge rate models, flash and evaporation, dispersion models.

Explosions and fires – vapour cloud explosions, flash fires, physical explosions, BLEVE and fire ball, confined explosions, pool fires, jet fires.

Effect models –dose-response functions, probit functions, toxic gas effects, thermal effects, explosion effects – Software application for effect and damage calculations.

Module IV

Quantification of risk : QRA, Vulnerability analysis, accepted and imposed risk, perception of risk, risk indices, individual risk and societal risk, acceptance criteria for risk, ALARP, Presentation of measures of risk – risk contour, F-N curve. Calculation of individual risk and societal risk.

Human reliability analysis (HRA) : factors leading to human error, characteristics of HRA techniques, Technique for Human Error Rate Prediction (THERP), Accident Sequence Evaluation Program (ASEP), Techniques using expert judgment, Operator Action tree (OAT).

References:

1. AIChE/CCPS, *Guidelines for Hazard Evaluation Proce*dures second edition. Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 1992.
2. AIChE/CCPS, *Guidelines for Chemical Process Quantitative Risk Analysis* second edition. Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York, 2000.
3. .Lees F.P. *Loss Prevention in the Process Industries* second edition. Butterworths, London, 1996.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1702 TRANSPORTATION SYSTEMS AND SAFETY

Module I

Railway Engineering: Permanent way and its components like rails, sleepers, ballast Geometric design- curves, super-elevation, negative super-elevation, transition curve, grade compensation on curves, widening of gauge on curves Railway operation & control - points and crossings, turn-out, station and marshalling yards, signaling and interlocking, track circuiting, control of train movement by centralized traffic control system Railway accidents & safety Rapid transit railways - types, merits & demerits.

Module II

Highway Engineering: Classification of highways Typical cross-section of roads Definition of various cross-sectional elements- Requirements & factors controlling alignment of roads- Basic geometric design of streets and highways.

Module III

Traffic Engineering: Traffic characteristics various traffic studies and their applications Traffic signals Carriage-way markings Traffic islands Highway intersections Principles of highway lighting Road Accidents prevention, investigation and reduction regulatory measures Traffic Calming.

Module IV

Harbour & Dock Engineering: Water transportation, classification of harbours, accessibility and size, ports, Indian ports planning and layout of ports breakwater facilities (in brief) for docking, repair, approach, loading/unloading, storing and guiding.

References :

1. S.C. Rangwala, *Railway Engineering,* Charotar Book Distributors, 2012.
2. S. Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press
3. S.K. Khanna and C.E.G. Justo, *Highway Engineering,* Nem Chand & Brothers
4. L.R. Kadiyali, *Traffic Engineering and Transport Planning*, Khanna Publishers, New Delhi, 2004.
5. Mike Slinn, Peter Guest and Paul Mathews, Traffic *Engineering Design: Principles and Practice*, Butterworth-Heinemann Elsevier.
6. R. Agor, *Railway Track Engineering*, Khanna Publishers.
7. R. Srinivasan, *Harbour, Dock and Tunnel Engineering*, Charotar Publishing House Pvt. Ltd.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1703 PRINCIPLES OF INDUSTRIAL MANAGEMENT

Module I

Organisation : Concept, characteristics, elements, organisational structure, *organisation* charts, Types of organisation- line & staff organization, functional organisation, project organisation, matrix organisation,
Management: Functions, Evolution of management theory, Principles of scientific management,

Module II

Personnel Management: Motivation theories, Leadership theories and models, Recruitment and training, labour turnover, operator training,
Wages and Incentives: feature of wages, time and piece rate, incentive plans, profit sharing. Job evaluation and Merit rating methods- factors of comparison and point rating-defects.
Industrial Relations: industrial disputes, collective bargaining, trade unions, workers' participation in management, labour welfare.

Module III

Production Management: Production System-Functions-Product Design-Product Life Cycle. Demand forecasting for operations - components of demand - methods of prediction and forecasting - forecasting models – casual & time series
PPC-Functions –Models Capacity Planning - Evaluating future capacity - capacity requirement –Aggregate Planning
Inventory Control-Objectives-Costs-Models : Basic, Production, Shortage-ABC Analysis.

Module IV

Project Management: Project Appraisal - Feasibility Analysis, Market feasibility, Technical feasibility, Financial feasibility, Economic feasibility, Financial and Economic appraisal of a project, Social Cost- Benefit Analysis in India, Project Report.
Project Scheduling : Network Techniques, PERT , CPM ,GANTT charts , GERT , Time cost trade off and crashing procedure

References :

1. Harold Koontz., *Essentials of Management*, 5th Edition., Tata Mc graw Hill, 1998
2. Buffa, E.S., *Modern Production and Operations Management*, 7th edn., John Wiley and Sons, 1983.
3. Prasanna Chandra., *Projects Planning, Analysis, Selection, Implementation & Review*, 4th edn..,Tata Mcgraw Hill ,New Delhi,1995.
4. Martand Telsang, *Industrial Engineering and Production management*, 2nd edn. ,S.Chand & Co., New Delhi

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1704 LIFE SAFETY IN BUILDING FIRE

Module I

Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people; Stages of evacuation; Planning and design of evacuation routes and exits; planning of seating arrangements in large assembly buildings.

Module II

Classification of buildings based on occupancy and type of construction according to fire resistance as per NBC; Fire zone; General fire safety requirements applicable to all individual occupancies.

General exit requirements as per NBC; Internal staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders; Planning of location and calculation of capacity, number and width of exit as per NBC for different occupancy classification.

Module III

Fire and life safety requirements in different groups of buildings-Hotel, Schools & Colleges, Hospitals, Theatres, Shopping malls, etc.; Fire protection and prevention in high rise buildings; Fire protection in underground structures and in buildings under construction.

Sitting of detectors as per relevant Indian standard specifications; Selection and planning of alarm system as per relevant standards (BIS). General requirements and guidelines for the installation of fire detection and alarm system in buildings of different occupancy classification.

Module IV

Selection and distribution of portable extinguishers (for class A and B fires) and other fire protection equipments and systems for different occupancy classification as per NBC; Planning of fixed fire fighting installation for different occupancy classification- sprinkler system; total flooding system; CO_2 system; foam system;

Fire Investigation; Detection of arson; Fire training and education- fire drill, fire order; - Fire safety audits; Fire risk assessment.

References:

1. Roytman M. Ya., "*Principles of Fire Safety Standards for Building Construction*", Amerind Publishing Co. Pvt. Ltd., New Delhi, 1975
2. E.Gorden Butcher E. G. and Parnell A. C., "*Designing of fire safety*", John Wiley and Sons Ltd., New York, U.S.A., 1983.
3. Barendra Mohan Sen, "Fire protection and prevention the essential handbook"
4. BIS, "NBC Part 4- *Fire and Life safety*", Bureau of Indian Standards, New Delhi, 2005.
5. Marchant E.W., "*A Complete Guide to Fire and Building*",
6. Adam and Charles Black, "*Fire safety in Buildings*",

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1705 E1 FIRE DYNAMICS

Module I

Qualitative description of a fire sequence. Ignition, flame spreading. Various ways of categorising a fire. The effect of the building on the fire.

Heat release rate. Mass burning rate and time-dependency of the heat release rate, the order of magnitude of the heat release rate, the strengths and weaknesses of various test methods, growth of alfa-t2, the effect of the enclosure on the heat release rate, extraction of a power curve.

Module II

Fire plumes and flames. Froude number, mean flame height, flame-height correlations, various profiles in a plume, ideal plumes, strong and weak plumes, plume correlations, ceiling jets, special issues to be considered in the design process, quasi-stationary conditions, selecting a plume model.

Module III

Pressure profiles. Background on air-flow in buildings. Bernoulli's equation. Various forms of pressure. Computing pressure, rate and mass air-flow through openings.

Gas temperatures. Energy balance, rate of heat transfer, correlations for computing gas temperatures. Fully-developed fires, ISO 834, temperature calculation. The influence of high temperatures on structural elements of steel or wood.

Module IV

Smoke filling. Pressure build-up in the fire enclosure. Transient smoke filling models. Stationary models for control of combustion gases. Various fire safety engineering systems for handling and control of combustion gases. Continuity equations. Effect of sprinklers on smoke filling. Correlations.

Combustion products. Equivalency ratios. Soot production. Visibility, dosage. How soot particles are formed. CO, CO2.

Computer modelling. Sub-models for computer models. Model constraints. CFD models.

References:

1. Karlsson, B., Quintiere, J G: Enclosure Fire Dynamics. CRC Press, 1999.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1705 E2 RELIABILITY ENGINEERING

Module I

Reliability: Definition; Probability Concept; Addition of Probabilities; Complimentary Events; Kolmogorov Axioms.

Failure Data Analysis: Introduction, Mean Failure Rate, Mean Time to Failure (MTTF), Mean Time between Failures (MTBF), Graphical Plots, MTTF in terms of Failure Density, MTTF in Integral Form.

Module II

Hazard Models: Introduction, Constant Hazard; Linearly Increasing Hazard, The Weibull Model, Density Function and Distribution Function, Reliability Analysis, Important Distributions and their Choice, Standard Deviation and Variance.

Conditional Probability: Introduction, Multiplication Rule, Independent Events, Vernn Diagram, Hazard Rate as conditional probability, Bayes Theorem.

Module III

System Reliability: Series. Parallel and Mixed Configurations, Complex Systems, Logic Diagrams, Markov Models.

Reliability Improvement & Repairable Systems: Redundancy, Element, Unit and standby Redundancy, Optimization; Reliability – cost trade- off, Introduction to Repairable Systems, Instantaneous Repair Rate, MTTR, Reliability and Availability Functions, Important Applications.

Module IV

Fault-Tree Analysis and Other Techniques: Fault-tree Construction, Calculation of Reliability, Tie- set and Minimal Tie-set.

Maintainability and Availability : Introduction, Maintenance Planning, Reliability and Maintainability trade – off.

References:

1. L.S. Srinath, Reliability Engineering, Affiliated East-West Press, New Delhi.
2. A.K.Govil, Reliability Engineering, Tata Mc-Graw Hill, New Delhi.
3. L.Balagurusamy, Reliability Engineering, ,Tata Mc-Graw Hill, New Delhi, 1984.
4. S. Rao, Reliability Based Design, Mc-Graw Hill, 1992.
5. K.C. Kapur and L.R. Lamberson, Reliability in Engineering Design, Wiley Publications.
6. D.J. Smith, Reliability Engineering, 1972, E.W. Publications.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1705 E3 AUTOMOBILE ENGINEERING AND SAFETY

Module I

Types of automobiles. Limiting Dimensions as per Central Motor Vehicles Rules. Engines – Classification, Construction, Materials of engine components. Prototype Testing as per Central Motor Vehicles Rules.
Fuel System – Fuel tank, Fuel filter, Types of Fuel system. Carburetor – Simple and Modern, Fuel injection System. Emission Standards as per CMV Rules.

Module II

Electrical System – Storage Battery Operations and Maintenance. Ignition System – Coil and Magneto Ignition System. Starting System, Lighting System, Horn System – Wind Shield Wiper Motors, Fans, Heaters, Traficators. Automobile air conditioning. Central Motor Vehicles Rules regarding Lighting, Windshields, Wipers.

Module III

Transmission System – Clutches – operation and fault finding of clutches, Fluid Flywheel, Gear Box-types, Steering Systems, Chassis Springs, Suspension. Differential, Dead and Live axles, Rims, Tyre etc. Brakes – Types, construction and fault finding. CMV Rules – Brakes, Steering & Tyre.

Module IV

Lubrication Systems – Types, Components, Lubricating oil, Cooling system – Details of components, Study of Systems, Types. Miscellaneous – Special gadgets and accessories for fire fighting vehicles. Automobile accidents. CMV Rules regarding Safety devices for drivers, passengers.

References :

1. William H. Crouse, *Automobile Chassis and Body Construction, Operation and Maintenance.*
2. William H. Crouse, *Automobile Machines –Principles& Operations.*
3. GBS Narang, *Automobile Engineering*
4. Kirpal Singh, *Automobile Engineering*
5. Joseph Heitner, *Automotive Mechanics-Principles & Practices*
6. P. L. Kohli, *Automotive Electrical Equipments*.
7. *The Central Motor Vehicles Rules, 1989*

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1705 E4 INDUSTRIAL ECOLOGY

Module I

Humanity and the Environment - The Industrial Ecology Concept - Technological Change and Evolving Risk.
The Relevance of Biological Ecology to Technology- The Status of Resources - Governments, Laws, and Economics

Module II

Industrial Product & Process Design and Operation - Choosing Materials - Designing for Energy Efficiency.
Product Delivery -Environmental Interactions During Product Use - Design for End of Life.

Module III

An Introduction to Life-Cycle Assessment - The LCA Impact and Interpretation Stages - Streamlining the LCA Process.
Using the Corporate Industrial Ecology Toolbox - Managing Industrial Ecology in the Corporation- Indicators and Metrics - Services Technology and Environment

Module IV

Industrial Ecosystems - Metabolic and Resource Analyses - Systems, Analysis, Models and Scenario Development.
Earth Systems Engineering and Management - The Future of Industrial Ecology.

Reference:

1. T. Graedel and B. Allenby, *Industrial Ecology*, 2nd edition, Prentice-Hall, 2003.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 17 L1 FIRE ENGINEERING LABORATORY

1. Determination of flash Point, fire point and pour point of hydrocarbons.

2. Tests on Dry Chemical Powder as per relevant Indian standard specifications

a. Apparent Density Test
b. Hygroscopicity Test
c. Caking Test
d. Water Repellency Test
e. Heat Test
f. Efficient Fluidity Test
g. Fire Knocking Down Property Test
h. Foam Compatibility Test

3. Performance Tests on Portable DCP Fire Extinguishers (Catridge Type)

4. Performance Tests on Portable and Trolley mounted Fire Extinguishers CO_2 Type.

5. Tests on Foam as per relevant Indian standard specifications
a. pH value
b. Sludge content
c. Specific Gravity
d. Miscibility
e. Freezing Point
f. Film Formation Test
g. 25% Drainage Time
h. Burn- back Resistance
i. Fire Extinguishing Property

6. Test of non-combustibility of Building Materials.

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 17 L2 INDUSTRIAL HYGIENE LABORATORY

1 Demonstration and calibration of Air sampling equipment

2 Sampling and estimation of gases in work environment by calorimetric method

3 Sampling and estimation of solvent vapours in work environment

4 Sampling and estimation of dust-gravimetirc method

5 Noise level measurement - Sound level meter, Octave filter set
   a) Measurement of sound pressure level in db A and db linear
   b) Frequency analysis of noise

6 Measurement of illumination level

7 Study of lungs models

8 Study of occupational diseases with photographic models

9 Demonstration of medical laboratory equipments

10 Thermal stress analysis.

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 17 L3 COMPUTATIONAL LABORATORY

1. Use of spread sheets in the computation of empirical and molecular formula, heat of mixing and vapor pressure.

2. Use of spread sheets for statistical analysis of data – Regression, Analysis of Variance and Interpolation.

3. Use of statistical software packages like SPSS and ANOVA for data analysis.

4. Graphical representation of various data related to safety and fire engineering.

5. Linear Programming, transportation, assignment and dynamic Programming in Fire engineering – formulation and solution through PC based programs.

6. Programming in MATLAB/SCILAB to solve fault tree and fire dynamics problems.

7. Applications of risk analysis software like ALOHA.

8. Fire modeling and simulation using the following open source software.
(a) NIST Fire Dynamics Simulator (FDS) and Smoke View.
(b) ALOFT – FT
(c) CFAST

Note : 50 % marks is earmarked for continuous evaluation, and 50 % marks for end semester examination to be assessed by two examiners .A candidate shall secure a minimum of 50 % marks in the aggregate and 50 % minimum in the end semester examination for a pass.

SE 17 L4 SEMINAR

Students shall individually prepare and submit a seminar report on a topic of current relevance related to the field of Safety & Fire Engineering. The reference shall include standard journals, conference proceedings, reputed magazines and textbooks, technical reports and URLs. The references shall be incorporated in the report following IEEE standards reflecting the state-of-the-art in the topic selected. Each student shall present a seminar for about 30 minutes duration on the selected topic. The report and presentation shall be evaluated by a team of internal experts comprising of 3 teachers based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

SE 1801 HUMAN FACTORS ENGINEERING

Module I

Human factors - objectives and approach. Systems thinking - human –machine systems, characteristics of systems, system reliability. Human beings as information processors- information theory, displaying information, coding of information, characteristics of good coding system, compatibility, types of compatibility, perception, memory, decision making, attention, age and information processing, mental workload and its measurement.

Module II

Process of seeing, visual capabilities, accommodation, visual acuity, contrast sensitivity, factors affecting visual acuity and contrast sensitivity, adaptation, colour discrimination, perception. Design of hard copy and VDT screens. Graphic representations – symbols, objectives and criteria for selection, perceptual principles of symbolic design. Codes – dimension, colour.

Design of dynamic information displays, uses of dynamic information, design of quantitative visual displays, design of qualitative visual displays, design of signal and warning lights, recommendations regarding signal and warning lights, representational displays, head-up displays.

Hearing, nature and measurement of sound, complex sound, anatomy of ear, conversion of sound waves to sensations, masking. Auditory displays, detection of signals, relative discrimination and absolute identification of auditory signals, sound localization, principles of auditory display, cutaneous senses, tactual displays, substitutes for hearing and seeing, olfactory senses and displays.

Module III

Physical work - muscle physiology, work physiology, measures of physiological strain, physical work load, work efficiency, energy consumption, grades of work, factors affecting energy consumption, controlling energy expenditure, strength and endurance, measurement of strength, factors affecting strength. Manual materials handling – lifting tasks, carrying tasks, pushing tasks, limits of MMH tasks, reducing risks of MMH overexertion.

Motor skills – biomechanics of human motion, types of body movements, range of movements, classes of motor movements, Speed of movements – reaction time, movement time, accuracy of movements.

Human control of systems – compatibility, spatial compatibility, movement compatibility. Supervisory control. Controls devices – functions of control, factors in control design.

Principles of hand tool and device design.

Module IV

Workplace design – anthropometry, static dimensions, dynamic dimensions, principles in the application of anthropometric data. Work spaces - work-space envelopes for sitting and standing personnel, out-of-reach and clearance requirements. Design of work surfaces. Science of seating - general principles of seat design. VDT workstations.

Arrangement of components within a physical space – principles of arranging components, methodologies for arranging components, types and uses of various data, link diagrams, general location of various controls and displays within work space, specific arrangements of controls and displays within work space, spacing of control devices. General guidelines in designing individual workplaces.

References:

1. Sanders, M.M. & McCormick, E.J, *Human Factors in Engineering & Design ,* 7th ed. McGraw-Hill International Edition, 1993.
2. Martin Helander, *A Guide to Ergonomics of Manufacturing*, TMH, 1996.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1802 ADVANCED SAFETY ENGINEERING AND MANAGEMENT

Module I

Domino incident investigation – technique, logic diagram, input requirements, output, example. Unavailability analysis of protective systems – technique, logic diagram, input requirements, example.Reliability analysis of automatic control systems - PES safety system development logic diagram , system analysis, calculation of fractional dead time, application, strengths and weaknesses.Introduction to MORT analysis, IFAL analysis, Markov processes and application of Markov modeling to safety instrumented systems, Sneak analysis.

Module II

Behaviour- Based Safety - Fundamentals of BBS Management - Identification – Situation, Behavior or Act - Mental Capacity of Creating or Eliminating an Unsafe Act - Attitudes that Affect Behaviour -Establishing Self-Supporting Behavioral Safety - Critical Error Reduction Techniques - Accident Prevention and Investigation: Critical Information Sharing - Situational Awareness – Identification versus Reaction, Accountability and Responsibility – Who Pays for Inattention?

Module III

Security for chemical process industries - Assessments and regulatory environment, methods for assessing security vulnerability, emerging security regulations, government development and industry activities that relate to security for process facilities. Strategies and counter measures – prevention of intentional releases and theft of chemical releases at process facilities.

Site security for process industries – Essential elements – threat analysis, security counter measures, mitigation and emergency response. Specific security measures – information security, cyber security, physical security, policies and procedures, training, mitigation and response, inherently safer processes. Case study.

Module IV

Safety Management Systems : SHEMS, OHSAS 18001 and OSHA's PSM – Policy, planning, training, implementation, management control and review.

Layer of Protection Analysis (LOPA) – Overview of relevant standards and guidelines, risk tolerance criteria. Preparation of LOPA – LOPA methodology, the LOPA team. Scenario development – components, inherently safe considerations. Initiating causes / effects – identification, estimation of frequencies. Independent protection layers – IPL criteria, allocation of IPL credit – basic process control systems, operator response, pressure relief device, safety instrumented system, safety instrumented function. Safety integrity level (SIL) assignment, Interpreting LOPA results and making recommendations.

References:

1. Centre for Chemical Process Safety, AIChE : *Guidelines for Chemical Process Quantitative Risk Analysis*, second edition, 2000.
2. ACC : *Site Security Guidelines for the U.S Chemical Industry*, American Chemistry Council, Washington DC , 2001.
3. Thomas R. Krause, *The Behaviour – Based Safety Process: Managing involvement for an injury-Free Culture*, 2nd edition, John Wiley & Sons, 1996.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1803 DISASTER MANAGEMENT

Module I

Importance of disaster management for chemical industry - Types of emergencies – major industrial disasters – causes and consequences of major industrial disasters like Flixborough, Seveso and Bhopal. Components of a major hazard control system – identification of major hazard control installations – purpose and procedures – safe operation of major hazard installations – mitigation of consequences – reporting to authorities. Implementation of major hazard control systems – group of experts – training – checklists – inspection – evaluation of major hazards – information to the public – manpower requirements – sources of Information

Module II

Emergency planning – on-site and off-site emergency plan – need of plan – possible approach – objectives of emergency plan.

On-site emergency planning – formulation of the plan and emergency services – Identification of resources – actions and duties – emergency procedure – mock drills. Off-site emergency planning – objectives and elements of off-site plan – role of administrative machinery – role of major hazard works management – role of the local authority. Emergency preparedness at local level – Awareness and preparedness for emergencies at local level (APELL) – The process and its partners.

Module III

Requirements of emergency plan as per Indian legislations like Factories Act, Manufacture, Storage and Import of Hazardous Chemicals Rules, Chemical Accidents (Emergency planning, Preparedness and Response) Rules.

Emergency planning and preparedness in international standards like ISO 14001, OHSAS 18001 and OSHA's Process Safety Management System, Emergency Planning in Seveso II directive – elements of emergency planning in IS : 18001 – Hazardous Materials / Spills Emergencies – contingency plans for road transportation of hazardous chemicals – contingency plans for oil spills in marine environment.

Module IV

Natural Hazards – potentially hazardous natural phenomena – earthquakes – landslides – flooding – cyclones – hazards in arid and semi-arid areas – nature of the hazard – hazard management activities – disaster mitigation – natural hazard prediction – emergency preparedness – disaster, rescue and relief – post disaster rehabilitation and reconstruction – education and training activities – vulnerable elements to be considered in the development planning for natural hazard management – applications of remote sensing and GIS in disaster management.

References:

1. ILO, Geneva : *Major Hazard Control – a Practical Manual.*
2. UNEP, Paris : *APELL - A Process for responding to technological accidents , A Handbook,* Industry & Environment Office., 1998
3. *Accident Prevention Manual for Business and Industry, Vol. I* – National Safety Council, USA.
4. *Oil spill Response : The National Contingency Plan* - Institute of Petroleum, London
5. Petak, W.J and Atkisson, A.A.: *Natural Hazard Risk Assessment and Public Policy : Anticipating the Unexpected*
6. U.R. Rao : *Space Technology for Sustainable Development*

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1804 E1 FLUID POWER SYSTEMS

Module I

Introduction to Hydraulics- Pascal's Law- Conservation of energy- Pressure, Work and Power-Principles of Power Hydraulics, Pressure and Flow Measurements- Bernoulli's Principle- Hydraulic symbols- Advantages. Hydraulic fluids, Properties Pipings and Seals- Reservoirs. Actuartors-Cylinders, Rams, Hydraulic Motors. Pumps- Gear, Vane and Piston types- Fixed and variable flow. Testing of Actuators & Pumps- Safety Precautions

Module II

Directional Control- Check valve, Pilot – operated, Two- way and Four -way valves- Rotary valves. Pressure Control – Relief valves- Different functions. Volume control- Methods and Types. Testing of Control Valves and Safety precautions.

Module III

Pneumatic Systems : Introduction : Production of compressed air, Air Receives, Accumulators, Dry and oil free compressed air.

Pneumatic control : Components, Types of Cylinders, Control Valves- Direction, Pressure and Flow, Air Motors and Pneumatic Symbols.

Maintenance & Safety : Compressors & Accessories.

Module IV

Accessories- Accumulators, Pressure Switches. Fluid Power Systems, Simple circuits- Hydraulic, Pneumatic, Hydropneumatic and Electrohydraulic. System Maintenance and Safety .

References:

1. J.Pippenger & T. Hicks : *Industrial Hydraulics* , McGraw Hill
2. Majumdar.S. R : *Pneumatic Systems – Principles & Maintenance*, TMH
3. Ernst : *Oil Hydraulics and its Industrial Applications* , McGraw Hill
4. Jagadish Lal : *Hydraulic Machines*
5. W. Deppert & K. Sto l: *Pneumatic Control* , Vogel Buch Verlag Wurzburg, 1987
6. W.Deppert & K.Sto l: *Pneumatic Application* , Kemprath Reihe Vogel Verlag Wurzburg, 1976.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)

Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1804 E2 EXPLOSIVES TECHNOLOGY AND SAFETY

Module I

Chemistry of Explosives – Chemical reactions – Categories of explosives by chemical type – Use forms of Explosives, Propellants, Pyrotechnics.
Mechanics of Burning – Burning model – Geometry shape of grains – Calculating the state of the gas – interior ballistics.

Module II
Sound, shock and Detonation – Sound waves – shock waves – Detonation waves – Explosive output tests.
Initiation and initiators – Initiation theory and criteria – Initiation sensitivity testing – Non electric initiators – Hot-wire initiators – exploding bridge wire detonators – Slapper detonators.

Module III
Scaling in Design and Analysis – Geometric similarity – Accelerating metal with explosives – Shock waves in air – Shock waves in water – Craters from explosives – Conical – shaped chargers.
Off-the - Shelf explosive Devices – Linear explosive products – Mechanical / explosive devices.

Module IV
Classification, Transportation and Storage of Explosives – Explosives classification – Transportation of explosives – Storage of explosives.
Explosive Facilities and Explosives Operations – Explosive facilities – Explosive operations – Good work practices – Maintenance – Explosive waste – Spills and general cleaning – Explosive handling – Testing and firing of explosives – Licenses, permits and penalties.

Reference:

Paul Cooper and Stanley R. Kurowski, *Introduction to the Technology of Explosives*, Wiley – VCH, New York, 1996.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1804 E3 TOTAL QUALITY MANAGEMENT

Module I

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

Module II

TQM Principles - Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

Module III

Statistical quality control - The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

Module IV

TQM tools - Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs.
Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing

References:

1. Dale H.Besterfiled, et al., "*Total Quality Management*", Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6.
2. James R.Evans & William M.Lidsay, "*The Management and Control of Quality*", (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
3. Narayana V. and Sreenivasan, N.S. "*Quality Management – Concepts and Tasks*", New Age International 1996.
4. Zeiri. "*Total Quality Management for Engineers*", Wood Head Publishers, 1991.

Type of Questions for University Examination

Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 1804 E4 INTRODUCTORY DESIGN OF STRUCTURES

Module I

Concrete structures: Structural forms – loads – serviceability, strength and structural safety – design basis – design codes. **Material properties**: Properties in compression – tensile strength – reinforcing steels for concrete.
Flexural design of R.C. beams: Bending of homogeneous beams – reinforced concrete beam behaviour – design for tension reinforcement in rectangular reinforced concrete beam – introduction to design aids – rectangular beams with tension and compression reinforcement.

Module II

Edge supported R.C. Slabs: Types of slabs – design of one-way slabs – temperature and shrinkage reinforcement. **R.C. Columns**: Design of short columns – axial compression – lateral ties and spirals – compression plus bending in rectangular columns – Code provisions for design of short columns.

Module III

Structural steel materials and specifications: Rolled steel sections- types of structural steel – specifications
Structural Fasteners: Types of riveted and bolted joints –strength of a riveted joint –design of riveted joints for axially loaded members – welded joints – advantages and disadvantages of welded joints – types of welds and their symbols –design of fillet weld – design of butt weld – design of plug and slot weld. Design of bolted joint

Module IV

Structural steel tension member: Net sectional area – permissible stresses – design of axially loaded tension member – lug angle – tension splice.
Compression member: Strength of an axially loaded compression member – effective length – maximum slenderness ratio.
Beams: Design procedure for laterally supported and unsupported beams – built up beams – plate thickness – simple beam end connectors.

References:

1. Nilson A.H., *Design of Concrete Structures*, McGraw Hill Companies Inc.
2. Pillai S.U. & Menon D., *Reinforced Concrete Design*, Tata McGraw Hill, New Delhi.
3. Varghese P.C., *Limit State Design of Reinforced Concrete*, Prentice Hall of India Pvt Ltd, New Delhi.
4. Ramamrutham S. & Narayanan R., *Design of Reinforced Concrete Structures*, Dhanpat Rai & Co.
5. Ram Chandra, *Design of Steel Structures*, Standard Book House, Delhi.
6. Dayaratnam, *Design of Steel Structures,* S. Chand
7. Negi L.S., *Design of Steel Structures*, Tata McGraw Hill.

Type of Questions for University Examination
Q1. Eight short answer questions of 5 marks each with two questions from each of the four modules. (8x5 = 40 marks)
Q2 to Q5 : Two questions A & B of 15 marks from each module with option to answer either A or B. (4x15 = 60 marks)

SE 18 L1 PROJECT

Each batch of students (comprising of about five students) shall carry out a project in an industry / R&D institution / university department.

- A detailed project report in the prescribed formal shall be submitted at the end of the semester. All test results and relevant design and engineering documentation shall be included in the report
- The work shall be reviewed and evaluated periodically

The final evaluation of the project shall be done by a team of minimum 3 internal examiners including the project guide. The evaluation shall be based on :

- Presentation of the work
- Oral examination
- Quality and content of the project report

Guidelines for evaluation:

i. Regularity and progress of work	60
ii. Work knowledge and involvement	80
iii. End semester presentation and oral examination	100
iv. Project Report – Presentation style and content	60
Total	300 marks

Note : Points (i) and (ii) to be evaluated by the respective project guide and the project coordinator based on continuous evaluation. (iii)-(iv) to be evaluated by the final evaluation team comprising of 3 internal examiners including the project guide.

SE 18 L2 VIVA - VOCE

Each student is required to appear for a viva-voce examination at the end of the complete course work.. The examination panel shall comprise of a minimum of one internal examiner and one external examiner, both appointed by the University. The examiners shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the field. The students shall produce the seminar report and project reports duly attested by the institutional authorities, before the examiners.