AKU B.E./B.Tech CIVIL Sem 4 syllabus

Disaster Preparedness & Planning

Disaster Preparedness & Planning

Module 1:Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks- severity,
frequency and details, capacity, impact, prevention, mitigation).
Module 2:Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes,
earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters
(industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills,
transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain
and coastal areas, ecological fragility.
Module 3: Disaster Impacts - Disaster impacts (environmental, physical, social, ecological,
economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special
needs); hazard locations; global and national disaster trends; climate change and urban disasters.
Module 4: Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention,
mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis,
vulnerability and capacity assessment; early warning systems, Postdisaster environmental response
(water, sanitation, food safety, waste management, disease control, security, communications);
Roles and responsibilities of government, community, local institutions, NGOs and other
stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the

activities of National Disaster Management Authority.
Module 5: Disasters, Environment and Development - Factors affecting vulnerability such as impact
of developmental projects and environmental modifications (including of dams, landuse changes,
urbanization etc.), sustainable and environmental friendly recovery; reconstruction and
development methods.

Management I (Organizational Behaviour)

HSMC 401 Human Resource Development and Organizational Behavior

3 Credits

Module 1
Introduction: HR Role and Functions, Concept and Significance of HR, Changing role of HR managers - HR functions and Global Environment, role of a HR Manager. Human Resources Planning: HR Planning andRecruitment: Planning Process - planning at different levels - Job Analysis

Module 2
Recruitment and selection processes - Restructuring strategies - Recruitment-Sources of Recruitment-Selection Process-Placement and Induction-Retention of Employees. Training and Development: need for skill upgradation - Assessment of training needs - Retraining and Redeployment methods and techniques of training employees and executives – performance appraisal systems.

Module 3
Performance Management System: Definition, Concepts and Ethics-Different methods of Performance Appraisal- Rating Errors Competency management. Industrial Relations : Factors influencing industrial relations - State Interventions and Legal Framework - Role of Trade unions - Collective Bargaining - Workers; participation in management.

Module 4

Organizational Behaviour: Definition, Importance, Historical

Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.

Module 5
Leadership: Definition, Importance, Theories of Leadership Styles. Organizational Politics: Definition, Factors contributing to Political Behavior. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation - Bargaining Strategies, Negotiation Process.

Suggested books:
1. Gary Dessler, “Human Resource Management” - (8th ed.,) Pearson Education, Delhi.
2. Robbins, S.P., Judge &T.A., “Organizational Behavior”, Pearson Education, 15th Edn.

Suggested reference books:
1. Decenzo& Robbins, Personnel Human Resource Management, 3rd ed., John Wiley & Sons (Pvt.) Ltd.
2. BiswajeetPatanayak, Human Resource Management, PHI, New Delhi
3. Luis R. Gomez, Mejia, Balkin and Cardy, Managing Human Resources PHI, New Delhi
4. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
5. Shukla, Madhukar: Understanding Organizations - Organizational Theory & Practice in India, PHI

Materials, Testing & Evaluation

Materials, Testing & Evaluation

Module 1: Introduction to Engineering Materials covering, Cements, M-Sand, Concrete
(plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High
Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic
materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and
Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and
adhesives, Graphene, Carbon composites and other engineering

materials including
properties and uses of these
Module 2: Introduction to Material Testing covering, What is the " Material Engineering" ?;
Mechanical behavior and mechanical characteristics; Elasticity – principle and
characteristics; Plastic deformation of metals; Tensile test – standards for different material
(brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test;
hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep –
fundaments and characteristics; Brittle fracture of steel – temperature transition approach;
Background of fracture mechanics; Discussion of fracture toughness testing – different materials;
concept of fatigue of materials; Structural integrity assessment procedure and fracture
mechanics
Module 3: Standard Testing & Evaluation Procedures covering, Laboratory for mechanical
testing; Discussion about mechanical testing; Naming systems for various irons, steels and
nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and
transition temperatures; Fracture mechanics – background; Fracture toughness – different
materials; Fatigue of material; Creep.
Tutorials from the above modules covering, understanding i) Tests & testing of bricks, ii) Tests
& testing of sand, iii) Tests & testing of concrete, iv) Tests & testing of soils, v) Tests & testing of
bitumen & bituminous mixes, vi) Tests & testing of polymers and polymer based materials, vii)
Tests & testing of metals & viii) Tests & testing of other special materials, composites and
cementitious materials. Explanation of mechanical behavior of these materials.

Mechanical Engineering

ESC209 Mechanical Engineering

3 credits

Module 1: Basic Concepts- Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasistatic process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases.

Module 2: First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady-Flow

Module 3: Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, reversible steady-flow work, minimizing the compressor work, isentropic efficiencies of steady-flow devices, and entropy balance. Energy - a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, exergy change of a system, energy transfer by heat, work, and mass, the decrease of exergy principle and exergy destruction, energy balance: closed systems and control volumes energy balance.

Module 4: Properties Of Pure Substance- Properties of pure substances. Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces. Thermodynamic properties of steam. Calculations of work done and heat transfer in non- flow and flow processes.

Module 5: Power Cycles- Vapour and combined power cycles, including the Carnot vapor cycle, Rankine cycle: the ideal cycle for vapor power, the ideal reheat and regenerative and the second- law analysis of vapour power cycles. Gas power cycles, including basic considerations in the analysis of power cycles, the Carnot cycle and its value in engineering, an overview of reciprocating engines, air

standard assumptions, gasoline engine Otto cycle, diesel engine cycle, gas-turbine Brayton cycle, and the second-law analysis of gas power cycles.

Module 6: Ideal and Real Gases and Thermodynamic Relations- Gas mixtures – properties ideal and
real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius Clapeyron equations, Joule – Thomson coefficient.

Module 7: Psychrometry and psychrometric charts, property calculations of air vapour mixtures.
Psychrometric process – Sensible heat exchange processes. Latent heat exchange processes.
Adiabatic mixing, evaporative cooling. Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables. Refrigeration cycles, including refrigerators and heat pumps, the ideal reversed Carnot vapour-compression refrigeration cycle, actual vapor- compression refrigeration cycles, heat pump systems, gas refrigeration cycles, and absorption refrigeration systems.

Text/Reference Books:
1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
2. Cengel, Thermodynamics – An Engineering Approach Tata McGraw Hill, New Delhi. Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.
3. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of Engineering
4. Thermodynamics: John Wiley & Sons.
5. Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.
6. Potter, M. C., & Somerton, C. W. Schaum's Outline of Thermodynamics for Engineers, McGraw-Hill.

Civil Engineering – Societal & Global Impact

HSMC252: Civil Engineering – Societal & Global Impact

Module 1: Introduction to Course and Overview; Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT

revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis.

Module 2: Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering.

Module 3: Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.

Module 4: Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and nonstationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.

Module 5: Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability.

Module 6: Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for

better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development.

Module 7A: Population Dynamics covering, Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity.

Module 8B: Environmental Management covering, Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant).

Module 9A: Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept.

Module 9B: Biotechnology covering, Basic concepts: Totipotency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications.

Module 10A: Biostatistics covering, Introduction to Biostatistics:- Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor).

Text/Reference Books:

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.

4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
6. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130
9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.
10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.
12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30
13. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.

14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.
15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

Engineering Geology

PCC-CE202 Engineering Geology

Module 1: Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

Module 2:Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Igneous petrology- Volcanic Phenomenon and different materials ejected by volcanoes. Types of volcanic eruption. Concept of Hot spring and Geysers. Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their characteristics. Chemical and Mineralogical Composition. Texture and its types. Various forms of rocks. IUGS Classification of phaneritic and volcanic rock.. Field Classification chart. Structures. Classification of Igneous rocks on the basis of Chemical composition. Detailed study of Acidic Igneous rocks like Granite, Rhyolite or Tuff, Felsite, Pegmatite, Hornfels. Metamorphic Aureole, Kaolinization. Landform as Tors. Engineering aspect to granite. Basic Igneous rocks Like Gabbro, Dolerite, Basalt. Engineering aspect to Basalt. Sedimentary petrology- mode of formation, Mineralogical Composition. Texture and its types, Structures, Gradation of Clastic rocks. Classification of sedimentary rocks and their characteristics. Detailed study of Conglomerate, Breccia, Sandstone, Mudstone and Shale, Limestone Metamorphic petrology- Agents and types of metamorphism, metamorphic grades, Mineralogical composition, structures & textures in metamorphic rocks. Important Distinguishing features of rocks as Rock cleavage, Schistosity, Foliation. Classification. Detailed study of Gneiss, Schist, Slate with engineering consideration.

Module3: Physical Geology- Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits.

Module 4: Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of

discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

Module 5: Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.

Module 6: Rock masses as construction material: Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description.

Module 7:Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures.

Module 8:Rock Mechanics- Sub surface 9nvestigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of

rocks, Bearing capacity of rocks.

Text/Reference Books:
1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

Structural Analysis

PCC-CE208 Structural Analysis

4 credits

Analysis of indeterminate structures by force methods, flexibility coefficients, Energy methods: Principle of minimum potential energy, principle of virtual work, Castigliano's theorems, Reciprocal theorem, unit load method, Influence line and Rolling loads, beam, frames and arches, Muller- Breslau Principles and its applications to determinate and indeterminate structures.

Analysis of Beams and Frames: Moment Area method, Slope deflection method, Three Moment Equation, Moments distribution methods, effect of symmetry and ant symmetry, sway correction, Lateral load analysis: Portal and Cantilever methods, Matrix method of structural analysis, Displacement/Stiffness methods.

Text books:
1. C.S. Reddy, Basic Structural Analysis, Second Edition, Tata McGraw Hill, 2005.
2. R.C. Hibbeler, Structural Analysis, Pearson Education, 6th edition, 2009.
3. C.K. Wang, Intermediate Structural Analysis, Tata McGraw Hill, 1984.