

ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
Roorkee – 247667

No. Acad./8824 /Senate-105

Dated: August 22, 2025

Head of all Departments/Centres/School

**Subject: Revision in the Program structures as per the new PG curriculum
(Item No. 105.12)**

The Senate, in its 105th meeting held on 09.07.2025, has approved the following revised program structures under new PG curriculum:

S. No.	Department/ Centre	S. No.	Programme	Model	Appendix
1	Physics	1	M.Sc. Physics	1-A	A
2	ICED	2	M.Tech. Dam Safety and Rehabilitation	2	B
3	CTrans	3	M.Tech. Transportation Systems Management	2	C
4	WRD&M	4	M.Tech. (Irrigation Water Management)	2	D
		5	M.Tech. (Water Resources Development)	2	D1
		6	M.Tech. (Drinking Water and Sanitation)	2	D2

Encl. Appendix-A, B, C, D, D1 and D2


22/8/25
Assistant Registrar
(Curriculum)

Copy to (through e-mail):-

1. Chairman, Senate & Director
2. All faculty
3. Head of all Departments/Centres/School
4. Dean, Academic Affairs
5. ADoAA (IT Systems & Admission)/ (Curriculum)/ (Evaluation)
6. Deputy Registrar, Academic Affairs Office
7. Assistant Registrar (IT Systems & Admission)/ (Evaluation)
8. Meeting Section
9. Channel i/ Academic webpage of iitr.ac.in

**INTERNATIONAL CENTRE OF EXCELLENCE FOR DAMS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

Program Code : **XXX M.Tech. (Dam Safety and Rehabilitation)**
 Department : **International Centre of Excellence for Dams**
 Year : **I**
 Model : **2**

Teaching Scheme					Contact Hours/Week			Exam Duration	
S.No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical
Semester-I (Autumn)									
1.	DSC-501	Hydrologic Safety Evaluation of Dams	PCC	3	2	1	0	0	0
2.	DSC-503	Reservoir Sedimentation and Silt Management	PCC	3	2	0	2	0	0
3.	DSC-509	Seismic Hazard Assessment for Dams	PCC	3	2	0	2	0	0
4.	DSC-511	Rock Mechanics and Dam Foundation Engineering	PCC	3	2	0	2	0	0
5.	DSC-513	Hydraulic Design of Spillways and Energy Dissipators	PCC	3	2	0	2	3	0
6.		Program Elective-I	PEC	3	-	-	-	-	-
7.		Social Science Course	SSC	2	-	-	-	-	-
		Total		20					
Semester-II (Spring)									
1.		Program Elective-II	PEC	3	-	-	-	-	-
2.		Program Elective-III	PEC	3	-	-	-	-	-
3.		Program Elective-IV	PEC	3	-	-	-	-	-
4.		Program Elective-V	PEC	3	-	-	-	-	-
5.		Science, Technology, and Advanced Research-tools	STAR	3	-	-	-	-	-
6.	DSC-700	Seminar	SEM	2	-	-	-	-	-
		Total		17					

**INTERNATIONAL CENTRE OF EXCELLENCE FOR DAMS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

Program Code : **XXX M.Tech. (Dam Safety and Rehabilitation)**
 Department : **International Centre of Excellence for Dams**
 Year : **II**
 Model : **2**

Teaching Scheme					Contact Hours/Week			Exam Duration	
S.No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical
Semester-I (Autumn)									
1.	DSC-691	Internship Social Activity	ISA	5	-	-	-	-	-
2.	DSC-701A	Thesis Stage-I	THESIS	10	-	-	-	-	-
		Total		15					
Semester-II (Spring)									
1.	DSC-701B	Thesis Stage-II	THESIS	14	-	-	-	-	-
		Total		14					

Summary				
Semester	1	2	3	4
Semester-wise Total Credits	20	17	15	14
Total Credits	66			

M.Tech. (Dam Safety and Rehabilitation)

Program Elective Courses

Teaching Scheme					Contact Hours/Week			Exam Duration	
S.No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical
1.	DSL-501	Assessing and Managing Risks Associated with Dams	PEC	3	2	1	0	3	0
2.	DSL-502	Disaster Management and EAPs for Dams	PEC	3	2	0	2	3	0
3.	DSL-503	Dam Safety Surveillance, Instrumentation and Monitoring	PEC	3	2	1	0	3	0
4.	DSL-504	Environmental Monitoring and Impact Assessment of Dams	PEC	3	2	0	2	3	0
5.	DSL-505	Earthquake Geotechnical Engineering	PEC	3	2	0	2	3	0
6.	DSL-506	Geospatial Techniques for Monitoring of Dams	PEC	3	2	0	2	3	0
7.	DSL-508	Contract and Financial Management	PEC	3	2	1	0	3	0
8.	DSL-509	Seismic Safety Evaluation of Dams	PEC	3	2	0	2	3	0
9.	DSL-510	Planning and Design of Hydro-Mechanical Components in Dams	PEC	3	2	1	0	3	0
10.	DSL-511	Ground Improvement and Geo-synthetics	PEC	3	2	0	2	3	0
11.	DSL-512	Sustainable Tourism around Dams	PEC	3	2	1	0	3	0
12.	DSL-513	Seepage through Dams	PEC	3	2	0	2	3	0

M.Tech. (Dam Safety and Rehabilitation)

Science, Technology, and Advanced Research-tools Basket

Teaching Scheme					Contact Hours/Week			Exam Duration	
S.No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical
1.	DST-501	Analysis of Dam Instrumentation Data	STAR	3	2	1	0	3	0

Social Sciences Course Basket

Teaching Scheme					Contact Hours/Week			Exam Duration	
S.No.	Subject Code	Course Title	Subject Area	Credits	L	T	P	Theory	Practical
1.	DSS-502	Stakeholder Management of Dams and Large Infrastructure Projects	SSC	2	1	1	0	0	0

**ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./6846 /IAPC-143

Dated: August 02, 2024

Head, International Centre of Excellence for Dams

The IAPC in its 143rd meeting held on 12.07.2024 vide Item No. 143.2.1 (12) has approved the course outlines of following PCCs of new PG curriculum of International Centre of Excellence for Dams:

1. DSC-501: Hydrologic Safety Evaluation of Dams
2. DSC-503: Reservoir Sedimentation and Silt Management
3. DSC-505: Seepage through Dams
4. DSC-507: Geotechnical Safety Evaluation of Dams
5. DSC-509: Seismic Hazard Assessment for Dams

The approved course outlines are attached as **Appendix-A**.


Assistant Registrar
(Curriculum)

Encl. Appendix-A

Copy to (through e mail):-

1. All faculty
2. Chairperson, CAPC of International Centre of Excellence for Dams
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs (Curriculum)
5. Deputy Registrar, Academic Affairs Office
6. Channel i/ Academic webpage of iitr.ac.in

**ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./6853/IAPC-143

Dated: August 02, 2024

Head, International Centre of Excellence for Dams

The IAPC in its 143rd meeting held on 12.07.2024 vide Item No. 143.2.1 (20) has approved the course outlines of following SSCs of new PG curriculum of International Centre of Excellence for Dams:

1. DSS-501: Sustainable Tourism around Dams
2. DSS-502: Stakeholder Management of Dams and Large Infrastructure Projects

The approved course outlines are attached as **Appendix-A**.


**Assistant Registrar
(Curriculum)**

Encl. Appendix-A

Copy to (through e mail):-

1. All faculty
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3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs (Curriculum)
5. Deputy Registrar, Academic Affairs Office
6. Channel i/ Academic webpage of iitr.ac.in

**ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**

No. Acd./7715 /IAPC-148

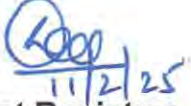
Dated: February 11, 2025

Head, International Centre of Excellence for Dams

The IAPC, in its 148th meeting held on 13.01.2025 vide Item No. 148.2.3 (13), has approved the course outlines of the following PECs and STAR course of the new PG curriculum of the International Centre of Excellence for Dams:

- a) DSL-501: Assessing and Managing Risks Associated with Dams
- b) DSL-502: Disaster Management and EAPs for Dams
- c) DSL-503: Dam Safety Surveillance, Instrumentation and Monitoring
- d) DSL-504: Environmental Monitoring and Impact Assessment of Dams
- e) DSL-505: Earthquake Geotechnical Engineering
- f) DSL-506: Geospatial Techniques for Monitoring of Dams
- g) DSL-507: Hydraulic Design of Spillways and Energy Dissipators
- h) DSL-508: Contract and Financial Management
- i) DSL-509: Seismic Safety Evaluation of Dams
- j) DSL-510: Planning and Design of Hydro-Mechanical Components in Dams
- k) DST-501: Analysis of Dam Instrumentation Data

The approved course outlines are attached as **Appendix-A**.


11/2/25
**Assistant Registrar
(Curriculum)**

Encl. Appendix-A

Copy to (through e mail):-

1. All faculty
2. Chairperson, CAPC of International Centre of Excellence for Dams
3. Dean, Academic Affairs
4. Associate Dean of Academic Affairs (Curriculum)
5. Deputy Registrar, Academic Affairs Office
6. Channel i/ Academic webpage of iitr.ac.in

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams

Subject Code: DSC-501

Course Title: Hydrologic Safety Evaluation of Dams

L-T-P: 2-1-0

Credits: 3

Subject Area: PCC

Course Outlines: Basic concepts of hydrological safety evaluation, Design flood estimation for gauged and ungauged catchments using hydro-meteorological approach; Design storm analysis; Design flood estimation for gauged and ungauged catchments using statistical analysis, Reservoir routing and spillway capacity determination, hydrologic and hydraulic channel routing; Dam breach modelling; preparation and revision of reservoir rule curves, Hydrological safety under changing climate.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams

Subject Code: DSC-503

Course Title: Reservoir Sedimentation and Silt Management

L-T-P: 2-0-2

Credits: 3

Subject Area: PCC

Course Outlines: Need of Silt Management in the Reservoir; Erosion and Sedimentation in Drainage Basins; Catchment area Development; Sediment Delivery Ratio; Reservoir Sedimentation Process; Incipient Condition and Sediment Transport; Sediment Yield; Trap Efficiency; Distribution of Sediment in a Reservoir; Sediment Measurement and Monitoring; Mathematical and Physical Modelling; Mitigation of Reservoir Siltation; Structural and Non-Structural Adaptive Measures; National and International Practices of Reservoir Sediment Management.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams

Subject Code: DSC-509

Course Title: Seismic Hazard Assessment for Dams

L-T-P: 2-0-2

Credits: 3

Subject Area: PCC

Course Outlines: Introduction to seismology; Causes of earthquakes, their classifications & their effects on Dam& structures; Plate tectonics; Internal structure of earth; Body & surface waves; Seismic phases; Intensity & magnitude, Principles of seismograph; networks; Probabilistic & deterministic Seismic Hazard Assessment; Earthquake occurrence models; maximum credible earthquake; design basis earthquake; Frequency magnitude relationship; Poissonian & Non Poissonian models; GMP equations; Return periods; Geophysical Methods: Seismic; Well logging; SASW & MASW methods; GPR; bedrock profiling; Site Effects.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams

Subject Code: DSC-511 **Course Title:** Rock Mechanics and Dam Foundation Engineering

L-T-P: 2-0-2 **Credits:** 3 **Subject** **Area:** PCC

Course Outlines: Fundamentals of applied Rock Mechanics; Foundation problems in dams and remedial measures; Bearing capacity and Strength Behaviour of Jointed Rocks: Linear and Non-Linear Strength Criteria for designs; Geological discontinuities and implications in design, Classification systems; Stability of rock slopes in abutments and reservoir rims; Design principles of gravity dams; Probabilistic analysis of slopes and foundations; Different software and their applications in designs

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSC-513 **Course Title:** Hydraulic Design of Spillways and Energy Dissipators

L-T-P: 2-0-2

Credits: 3

Subject Area: PCC

Course Outlines: Introduction to hydraulic structures and their necessity, Embankment Dams, Gravity Dams, Spillways, Energy dissipators, Supercritical flow, oblique jump, supercritical transition, Hydraulic modelling of spillways and energy dissipators, dimensional analysis, modelling of turbulence, friction, air entrainment etc., scale effects, Lifetime assessment of dam and associated works.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-501 **Course Title:** Assessing and Managing Risks Associated with Dams

L-T-P: 2-1-0

Credits: 3

Subject Area: PEC

Course Outlines: Overview of Dams' Risk Assessment and Management, Basis for a Risk-Informed Dam Safety Management Program for India, Initial Risk-Based Screening, Identification of Failure Modes, Semi-Quantitative Risk Analysis, Risk Evaluation (Quantitative Risk Assessment), Risk Governance, Institutional Framework in Dam Safety, National and International Guidelines, Dam Insurance Aspects.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-502

Course Title: Disaster Management and EAPs for Dams

L-T-P: 2-0-2

Credits: 3

Subject Area: PEC

Course Outlines: Overview of Disaster Management, Flood Risk Associated with Dams, Flood Mapping, Disaster Mitigation, Remote Sensing and Geographic Information Systems (GIS) applied to Emergency Preparedness and Flood Mapping, Dam Hazard & Vulnerability Classification Framework in India, Institutional Framework for EAP and Stake Holder Consultation under Dam Safety Act, Emergency Action Plans Preparation & Implementation.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-503

Course Title: Dam Safety Surveillance, Instrumentation
and Monitoring

L-T-P: 2-1-0

Credits: 3

Subject Area: PEC

Course Outlines: Dam Safety Inspection Program, Documenting an Inspection, Comprehensive Dam Safety Evaluation, Instrumentation System Planning, Seismological and Hydro-Meteorological Instrumentation, network design, Data Collection and time and frequency domain analysis of data, Forecasting, Automation of Instrumentation, Institutional Framework for Dam Instrumentation under Dam Safety Act.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-504

Course Title: Environmental Monitoring and Impact
Assessment of Dams

L-T-P: 2-0-2

Credits: 3

Subject Area: PEC

Course Outlines: Water quality issues, Ecosystem resilience issues, Assessment of carbon footprints in dams, Guidelines and Standard Codes, EIA methods and Tools, Environmental Clearances, Legal Issues, Societal considerations in dams, Water quality analysis using advanced instruments like TOC, flow cytometer, zeta-sizer, UV spectrometer, Advanced membrane-based water purification systems, JAR tests for water purification using different chemicals.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-505

Course Title: Earthquake Geotechnical Engineering

L-T-P: 2-0-2

Credits: 3

Subject Area: PEC

Course Outlines: Introduction to the Earthquakes, Engineering Seismology, Earthquakes Magnitude and Intensity, in Different Geological Set-Ups, Mapping, Wave Propagation, Dynamic Soil Properties, Ground Response Analysis, Liquefaction, Evaluation of liquefaction potential, Earth Pressure, Seismic Slope Stability, Ground Improvement Techniques, Remote Sensing in Earthquake Geology.

List of Experiments: Processing of pre and post-earthquake satellite images, Collection of data using GPS and mapping, Use of SAR interferometry for surface displacement measurement, Liquefaction Resistance of Soil using Vibration Table, Shear Velocity Profile using MASW, N values of cohesionless soils using SPT, c and Φ of soil using direct shear/triaxial tests, Liquefaction resistance of soil using cyclic triaxial test apparatus, Determination of dynamic properties using laboratory tests.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-506

Course Title: Geospatial Techniques for Monitoring of Dams

L-T-P: 2-0-2

Credits: 3

Subject Area: PEC

Course Outlines: Overview of Geospatial Technologies, Introduction to Optical Remote Sensing and its applications to surface water changes; Fundamentals of Digital Image Processing, Introduction to microwave (SAR) remote sensing; InSAR processing and its application to dam monitoring and associated tools/software; Structural Monitoring of Dam Structures using SAR, Introduction to UAV sensing; Introduction to LiDAR, Introduction to GPS Systems, Monitoring of Catchment Characteristics using geospatial technologies, Monitoring of landslide zones using geospatial technologies and their representation in GIS, Application of geospatial technologies for land use/cover change monitoring in flood-prone downstream areas of dams and risk assessment.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-508

Course Title: Contract and Financial Management

L-T-P: 2-1-0

Credits: 3

Subject Area: PEC

Course Outlines: Contract Types, Contract Specification, Contract Document, Contract Processing, Online Contracts, Breach, Force Majeure, Damages, Risk, Warranties, Delivery, Bank Guarantees, Arbitration, Taxation and Vigilance. Financial Management of Dam Projects, Financial Statements, Ratio Analysis, Financial Viability Studies and Innovative Financing Options.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-509

Course Title: Seismic Safety Evaluation of Dams

L-T-P: 2-0-2

Credits: 3

Subject Area: PEC

Course Outlines: Seismic Behavior of Different Types of Dams, Fundamentals of Soil and Structural Dynamics, Seismic Site Characterization, Ground Response Analysis, Local Site Effects and Liquefaction; 2D and 3D FEM Modelling of Dams, Dynamic Response and Stability Checks for Gravity Dams, Seismic Slope Stability Analysis of Embankment Dams.

List of Experiments: Dynamic response analysis of a gravity dam using response spectrum and time history; Stability assessment of an existing dam using SLOPE/W; Seismic stability assessment of an existing dam using QUAKE/W; Generation of spectrum compatible time histories; Deconvolution of time histories to obtain base input motions; Dam model studies using shake table; Experiments for material characterization.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-510

Course Title: Planning and Design of Hydro-Mechanical Components in Dams

L-T-P: 2-1-0

Credits: 3

Subject Area: PEC

Course Outlines: Introduction and Types of Gates, Gates Design and Weight Estimation, Hydrodynamic Forces, Gate Operating Systems including Hydraulic Hoist, Materials, Fabrication, Erection, Testing & Commissioning, Hoist Bridge, Operation & maintenance of Gates, Gate Inspection, Gate Rehabilitation and Gate Automation.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-511

Course Title: Ground Improvement and Geo-synthetics

L-T-P: 2-0-2

Credits: 3

Subject Area: PEC

Course Outlines:

Introduction and Types of ground improvement techniques; Compaction, shallow and deep compaction methods; Chemical treatment and grouting: dam foundation grouting, blanket grouting, consolidation grouting, permeability assessment, Lugeon test; permeation grouting, compaction grouting, jet grouting, deep soil mixing; Grout materials, particulate grouts, chemical grouts, properties and testing of grouts, mechanism of cement stabilization; Dam foundation grouting, design considerations, Case studies; Geosynthetics, types and functions, properties and testing; Reinforced earth, design of reinforced earth walls, reinforced embankments; Designing for drainage and filtration, Case studies; Other advanced ground improvement techniques.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-512

Course Title: Sustainable Tourism Around Dams

L-T-P: 2 -1-0

Credits: 3

Subject Area: PEC

Course Outlines:

Concept of sustainability and sustainable development. Concept of Sustainable Tourism around dams, issues, challenges and limitations. The current state of tourism around dams in India, UNWTO. The Framework Convention on Tourism Ethics, SF-MST, India's and different state's tourism policy, Socio-cultural problems and understanding feasibility assessment for dam tourism and its key components. Highlight best case studies and effective strategies for implementing agencies to enhance tourism around dams.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DSL-513

Course Title: Seepage through Dams

L-T-P: 2-0-2

Credits: 3

Subject Area: PEC

Course Outlines:

Importance of seepage in dam safety and rehabilitation, Flow through porous media, Darcy's law, seepage velocity, Dupuit's theory, Phreatic lines, free surface and seepage discharge. Flow nets, Boundary conditions, Numerical techniques; Measurement of seepage, seepage control, Seepage detection, control and monitoring, Selection of core materials, Dam filters and Design criteria, use of geo-textiles, stability conditions, Drainage of embankments, Dam Grouting, Design and installation of grout curtains.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams (ICED)

Subject Code: DST-501

Course Title: Analysis of Dam Instrumentation Data

L-T-P: 2-1-0

Credits: 3

Subject Area: STAR

Course Outlines: Types of Instruments used in the dams and catchments, Basics of time series analysis, Synthetic data generation, Time domain analysis of the data, Frequency domain analysis of the data, Applications of AI & ML in Dam Engineering, Flow forecasting using Artificial Neural Networks (ANN), Fuzzy Logic and Genetic Algorithms.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE: International Centre of Excellence for Dams

Subject Code: DSS-502

Course Title: Stakeholder Management of Dams and
Large Infrastructure Projects

L-T-P: 1-1-0

Credits: 2

Subject Area: SSC

Course Outlines: Relevance of stakeholder management in dam projects; Variety, variability & complexity of issues; Project impediments: social, environmental, legal, and associated issues of financing, contracts, resource management; Identification and classification; Networked effect; Stakeholder model for dam projects; Two-way process of stakeholder relationship; Level of relationship, Measurement of stakeholder value; Social & environmental safeguards; Stakeholder oriented organizations.