

UNIVERSITY OF CALICUT

SCHEME AND SYLLABI

FOR

FIFTH SEMESTER

OF

BACHELOR OF TECHNOLOGY

IN

CIVIL ENGINEERING

FROM 2004 ADMISSION ONWARDS

CALICUT UNIVERSITY (P.O), THENHIPALAM

FIFTH SEMESTER

Code	Subject	Hours/week			Internal Marks	University Examination	
		L	T	P/D		Hours	Marks
CE04 501	STRUCTURAL MECHANICS II	3	1	-	50	3	100
CE04 502	STRUCTURAL DESIGN I	3	1	-	50	3	100
CE04 503	BUILDING TECHNOLOGY II	3	1	-	50	3	100
CE04 504	GEOTECHNICAL ENGINEERING I	3	1	-	50	3	100
CE04 505	TRANSPORTATION ENGINEERING I	3	1	-	50	3	100
CE04 506	OPEN CHANNEL HYDRAULICS AND HYDRAULIC MACHINERY	3	1	-	50	3	100
CE04 507	CIVIL ENGINEERING DRAWING II	-	-	3	50	3	100
CE04 508 (P)	FLUID MECHANICS LAB	-	-	3	50	3	100
	TOTAL	18	6	6	400		800

SYLLABI OF FIFTH SEMESTER

CE 04 501 STRUCTURAL MECHANICS II

3 hours lecture and 1 hour tutorial per week
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Objective:

To enable the students to take an integral look at the theories of structural analysis with proper emphasis on structural elements of different geometry and boundary conditions. To reinforce the principles of force and displacement methods of analysis with inputs from the fundamental ideas introduced in the earlier course work on structural mechanics I

Module I (15 hours)

Displacement method of analysis of indeterminate structures: slope deflection method - analysis of continuous beams - beams with overhang - analysis of rigid frames - frames without sway and with sway - different types of loads - settlement effects - moment distribution method as successive approximation of slope deflection equations - analysis of beams and frames - non-sway and sway analysis. - frames with sloping legs - gabled frames

Module II (12 hours)

Analysis of continuous beams and Rigid frames: Derivation of three moment equation, application of three moment equation for analysis of continuous beams due to applied loads and uneven support settlement.

Kani's Method of analysis applied to continuous beams, rigid frames of different geometry, frames without sway and with sway.

Module III (13 hours)

Approximate methods of analysis of multistoried frames: Analysis for vertical loads – substitute frames – loading condition for maximum positive and negative bending moment in beams and maximum bending moment in columns – wind load analysis of multistoried frames – portal method – cantilever method for lateral load analysis.

Module IV (12 hours)

Beams curved in plan: Analysis of cantilever beam curved in plan – analysis of circular beams over simple supports.

Plastic theory: Introduction – plastic hinge concept – plastic modulus – shape factor – redistribution of moments – collapse mechanism – plastic analysis of beams and portal frames by equilibrium and mechanism.

Text Books:

1. Hibbeler, R.C., Structural analysis, Pearson Education
2. Daniel L Schodak, Structures, Pearson Education
3. Reddy, C.S., Basic Structural Analysis, Tata McGraw Hill
4. Jain & Jaikrishna, Plain & reinforced Concrete Vol.II, Nemchand
5. S.S. Bhavikatti, Structural Analysis, Vikas Publication Houses (P) Ltd

Reference books:

1. Wang C.K., Intermediate Structural Analysis, Tata McGraw Hill
2. Wilbur J.B. & Norris C.H., Elementary Structural Analysis, McGraw Hill
3. Timoshenko S.P. & Young D.H., Theory of Structures, McGraw Hill
4. Kinney S.J., Indeterminate Structural Analysis, Oxford & IBH
5. Negi L.S. & Jangid R.S., Structural Analysis, Tata McGraw Hill
6. Rajasekaran S. & Sankarasubramanian G., Computational Structural Mechanics, PHI
7. SP:6(6) : Application of Plastic Theory in Design of Steel Structures
8. Ghali, A. and Neville, A.M., Structural Analysis – A unified and matrix approach, Chapman and

Hall, 3rd edition 1989.
9. Coates.R.C, Coutie.M.G,Structural Analysis
10. D.S. Prakash Rao, Structural Analysis – A unified Approach, Universities Press

Internal work assessment:

2 tests	15x2=30 marks
Assignments (minimum2)	15 marks
Regularity	5 marks
Total marks	= 50 marks

- University Examination Pattern:**
- Q I -8 short type questions of 5 marks, 2 from each module
 - Q II -2 questions A and B of 15 marks from module I with choice to answer any one
 - Q III -2 questions A and B of 15 marks from module II with choice to answer any one
 - Q IV -2 questions A and B of 15 marks from module III with choice to answer any one
 - Q V -2 questions A and B of 15 marks from module IVwith choice to answer any one

CE 04 502 STRUCTURAL DESIGN I

3 Hours lecture and 1 hour tutorial per week

Objective : To give various aspects of behaviour ,basic principle, analysis and design concepts of R.C.C. structures for various building elements

Module I (14 hours)

Material properties, characteristic strength, characteristic loads- working stress method of design- principles, assumptions, durability and fire resistance aspects, Moment of resistance of singly and doubly reinforced rectangular and flanged beam cross sections, principles and design of members subjected to flexure, shear, deflection criterion, torsion, bond (anchorage and development length).

Module II (14 hours)

Limit state method of design-comparison with working stress method, advantages, principle & assumptions, partial safety factors, all other factors covered in module I, design of simply supported, cantilever and continuous beams, detailing.

Module III (14 hours)

Limit state method –Design of one way slabs- Design of Simply supported & Continuous slabs using IS code coefficients –Design of two way slabs using IS code coefficients.

Module IV (10 hours)

Design of stairs –types of stairs-general principle of design, design of stairs with waist slab, stringer beam, cantilever steps, design of straight flight and dog legged stairs, folded plate stairs.
Analysis and Design of columns-short & long axially loaded columns by working stress method.

Note:

All designs shall be done as per current I.S. specifications
Special importance shall be given to detailing in designs
S.I. units shall be followed
IS 456 shall be permitted in the examination hall.

Text Books:

- 1.Pillai S.U. & Menon D .,Reinforced Concrete Design ..Tata Mcgraw Hill
- 2.Sinha S.N. Reinforced Concrete Design .. Tata Mcgraw Hill
- 3.Varghese P.C. Limit State Design of Reinforced Concrete, Prentice Hall of India

Reference Books:

1. Park & Paulay, Reinforced Concrete
2. Mallick S.K.& Gupta A.K. Reinforced Concrete. Oxford & IBH
3. Jain.A.K. Reinforced Concrete-Limit state Design, Standard Book House
4. Jain& Jaikrishna Plain &Reinforced Concrete Vol. I, Nemchand
5. Purushothaman, Behaviour, Analysis and design of Reinforced concrete Elements, Tata Mcgraw Hill

Internal work assessment:

2 tests		15x2=30 marks
Assignments (minimum 2)		15 marks (one assignment should be in design and detailing)
Regularity		5 marks
Total marks		= 50 marks

University Examination Pattern:

Q I -8 short type questions of 5 marks, 2 from each module

Q II -2 questions A and B of 15 marks from module I with choice to answer any one

Q III -2 questions A and B of 15 marks from module II with choice to answer any one

Q IV -2 questions A and B of 15 marks from module III with choice to answer any one

Q V -2 questions A and B of 15 marks from module IV with choice to answer any one

IS 456-2000 is permitted in the examination hall

CE 04 503 BUILDING TECHNOLOGY –II

3 hours lecture and 1 hour tutorial per week

Objective:

To study the basic concepts of building climatology, lighting requirements and building services. In addition, an introduction to framed construction and building failures are also aimed in this course.

Module I (14 hours)

Functional design of buildings - introduction

Climatic design – Features of tropical climate - Thermal comfort – human body’s thermal balance and heat loss in thermal environments – thermal comfort indices – comfort zone. Heat exchange of buildings - conduction, convection, radiation and evaporation – thermal transmittance of structural elements. Orientation – effects on thermal comfort of interiors - Sol-air temperature – solar gain factor – heat gain calculation. Thermal control - insulation – principles - materials – methods of thermal insulation – insulation by orientation and shading. Ventilation – functions – provisions for ventilation – orientation – external features – cross ventilation – openings - mechanical ventilation systems – mechanical cooling – summer and winter air conditioning – introduction to different types of air-conditioning systems.

Module II (12 hours)

Lighting – photometric quantities – types of visual tasks -lighting requirements of various buildings- day lighting -day light factor – need for artificial lighting .

Acoustics – Introduction – criteria for acoustic environment – sound – control, insulation, and isolation – Acoustic materials and methods of fixing – acoustic requirement of auditorium.

Fire safety – Fire resistant construction – fire load – fire resisting properties of materials – precautionary measures against origin and spread of fire – Alarm systems – hydrants – sprinklers- fire escape – requirements of high rise construction

Module III (13 hours)

Tall Buildings – Framed building – steel and concrete frame – structural systems – erection of steel work – bolting, riveting, welding – plant, equipment and techniques- concrete framed construction – reinforcement – concreting of columns, beams, slabs and stairs – formwork – contraction and expansion joints – introduction to prefabricated construction – slip form construction.

Vertical transportation – Elevators – types – terminology – passenger, service and goods elevators, dumb waiters – design considerations for passenger elevators – handling capacity – arrangement and positioning of lifts – escalators – features – operation and arrangement – use of ramps.

Plumbing services – Typical details of water supply and sewage disposal for residence, hospital and hotel buildings – systems of plumbing – standard requirements.

Module IV (13 hours)

Cost-effective construction – principles-filler slab – rat-trap bond

Building failures – General – reasons – classification – RCC structures – reasons – Steel structures – reasons – Foundation failure by alteration, improper maintenance, overloading and vibration – Fire, Wind and Earthquake – other causes – remedial measures.

Earthquake resistant construction (Reference no. 7 and 8) – (only construction aspects are to be covered and detailed designs not contemplated) – principles – lightness – continuity – suspended parts. Building configuration – strength in various directions – foundations – ductility. Seismic strengthening of masonry and earthen structures – band reinforcing-buttressing.

Text books:

1. Koenigsberger. Manual of tropical housing and building Part I – Climate Design. Orient Longman.
2. Punmia B.C “Building construction”. Laxmi Publications
3. Arora and Bindra, Building construction, Dhanpath Rai and Sons.
4. Rangwala, S C Building Construction, Charotar Publishers

References:

1. Smith P & Julian W. Building services, Applied Science Pub.
2. Mcking T.M, Building Failures, Applied Science Pub.
3. Huntington W.C., Building construction, John Wiley.
4. Narasimhan V, Introduction to Building Physics.
5. Adler R, Vertical Transportation for Building, American Elsevier Pub.
6. Indian Standard Institution , National Building Code of India, 1983
7. Code of practice for earthquake resistant design and construction of buildings, IS:4326-1993
8. Hand book on building construction practices – BIS, SP 62 (S&T) – 1997
9. Tall building systems & concepts, Monograph on planning and design of Tall building, council on Tall buildings and Urban Habitat.
- 10 Patil, S.M., Building Services, Sachin Printers, Mumbai

Internal work assessment:

2 tests	15x2=30 marks
Assignments (minimum 2)	15 marks
Regularity	5 marks
Total marks	= 50 marks

University Examination Pattern:

- Q I -8 short type questions of 5 marks, 2 from each module
- Q II -2 questions A and B of 15 marks from module I with choice to answer any one
- Q III -2 questions A and B of 15 marks from module II with choice to answer any one
- Q IV -2 questions A and B of 15 marks from module III with choice to answer any one
- Q V -2 questions A and B of 15 marks from module IV with choice to answer any one

CE 04 504 GEOTECHNICAL ENGINEERING I

3 hours lecture and 1 hour tutorial per week

Module I (13 hours)

Nature of soil and functional relationships: soil type - concepts of single grained, honey combed and flocculent structure and their effects on the basic soil properties – clay minerals - 3 phase system - void ratio - specific gravity - dry density - porosity - water content - saturated unit weight - submerged unit weight - degree of saturation

Laboratory and field identification of soils: determination of water content by oven drying - specific gravity using pycnometer and specific gravity bottle - grain size analysis by sieve analysis, hydrometer analysis and pipette analysis - Atterberg limits and indices - visual identification by simple field tests - field density by core cutter - sand replacement and wax coating methods

Classification of soils: necessity - principles of classification - I.S. classification - plasticity charts - group index

Module II (15 hours)

Soil water: Modes of occurrence – adsorbed and capillary water types - effective stress - total stress - pore pressure - pressure diagrams

Permeability: definition - Darcy's law - factors affecting permeability - laboratory determination - stratified soils - average permeability. Seepage –hydraulic gradient –quick sand- 2D flow –flow net-construction and application.

Shear Strength: definition - Mohr's strength and stress circles - origin of planes - Mohr's envelope - Mohr-Coulomb strength theory – direct shear test - triaxial shear test - drainage conditions – UU, CU & CD tests - measurement of pore pressure - total and effective stress - UCC test - vane shear tests - strength parameters - choice of test conditions for field problems

Module III (13 hours)

Consolidation: definition - concepts of coefficient of compressibility - coefficient of volume change and compression index – Laboratory consolidation test - e-log p curves - pre-consolidation pressure - Terzaghi's theory of one dimensional consolidation – Time rate of consolidation - difference between consolidation and compaction

Compaction: definition and objectives of compaction - proctor test and modified proctor test - concept of OMC and maximum dry density - zero air voids line - factors influencing compaction - effect of compaction on soil properties - field compaction methods - proctor needle for field control

Module IV (11 hours)

Earth pressure: earth pressure at rest - active and passive earth pressure for cohesionless and cohesive soils - Coulomb's and Rankine's theories - point of application of earth pressure for cases of with and without surcharge in cohesionless and cohesive soils - Culmann's and Rebhan's graphical construction for active earth pressure

Stability of slopes: slope failure, base failure and toe failure - Swedish circle method - $\phi=0$ analysis and $c=0$ analysis - friction circle method - Taylor's stability number - stability charts - sliding block analysis

Text Books:

1. Arora K.R., *Soil Mechanics & Foundation Engg.*, Standard Publications
2. Punmia B.C., *Soil Mechanics and Foundations*, Laxmi Publications
3. Murthy V.N.S., *Soil Mechanics and Foundation Engineering*, Dhanpat Rai

Reference books:

1. Terzaghi K. & Peck R.B., *Soil Mechanics in Engineering Practice*, John Wiley
2. Venkatramiah, *Geotechnical Engineering*, New Age International Publishers
3. Gopal Ranjan and Rao A.S.R., *Basic and applied soil mechanics*, New Age International Publishers
4. Alam Singh, *Soil Engineering-Theory and Practice*, Asia Pub.
5. Khan I.H., *Text Book of Geotechnical Engineering*, Prentice Hall of India

Internal work assessment:

2 tests		15x2=30 marks
Assignments	(minimum 2)	15 marks
Regularity		5 marks
Total marks		= 50 marks

University examination pattern:

- Q I - 8 short type questions of 5 marks, 2 from each module
Q II - 2 questions A and B of 15 marks from module I with choice to answer any one
Q III - 2 questions A and B of 15 marks from module II with choice to answer any one
Q IV - 2 questions A and B of 15 marks from module III with choice to answer any one
Q V - 2 questions A and B of 15 marks from module IV with choice to answer any one

CE 04- 505 TRANSPORTATION ENGINEERING I

3 hours lecture and 1-hour tutorial per week

Objective:

To equip the students to plan, and design various structures and traffic control devices coming under two modes of transportation viz: Highways and Airports.

Module I (14 hours)

Introduction – Role of transportation in society- Different modes of transport- Importance of roads in India- classification of roads - road patterns -typical cross sections of roads in urban and rural areas - requirements and factors controlling alignment of roads - engineering surveys for highway location

Highway geometric design - pavement surface characteristics - camber and width requirements - sight distances - stopping and overtaking sight distances - overtaking zone requirements - design of horizontal alignment – speed – radius - super elevation - methods of providing super elevation - extra widening of pavements - transition curves - design of vertical alignment – gradient - grade compensation - summit curves and valley curves - worked out problems

Module II (13 hours)

Traffic Engineering: Introduction - road user, vehicle and traffic characteristics - traffic engineering studies – speed - speed and delay - volume - origin and destination - parking and accident studies - worked out problems –

Road intersections- principles of design of at grade intersection - simple layouts –

Traffic operation-Traffic control devices- classifications and uses of traffic signs and markings - traffic signals – signal co-ordination- design of isolated signals by Webster’s method

Module III (12 hours)

Highway materials-Desirable properties and testing of highway materials –subgrade soil, road aggregates and bituminous materials

Design of flexible and rigid pavements - IRC methods - worked out problems – Construction of -- bituminous and cement concrete pavements

Causes of failures in flexible and rigid pavements

Module IV (13 hours)

Airport planning and design:-

Introduction - aircraft characteristics and their influence on planning of airports - airport obstructions and zoning - component parts of airports and site selection - runway design - orientation - basic runway length - corrections and geometric design; design of taxiways and aprons - terminal area planning concepts and its facilities - aircraft parking configurations - surface and subsurface drainage systems - worked out problems

Text books:

1 Khanna.S.K and Justo.C.E.G., Highway Engineering, Nemchand and Bros.

2 Khanna.S.K and Arora.M.G., Airport Planning and Design, Nemchand&Bros.

References:

1.Kadiyali.L.R., Traffic Engineering and Transportation planning, Khanna Publishers, New Delhi

2.Kadiyali.L.R., Principles of Highway Engineering, Khanna Publishers, New Delhi

3 Yoder and Witenzak,Principles of Pavement design, John Wiley and sons, New York

4 IRC 37-2001-Guide lines for flexible pavement design

5 IRC 58-1974- Guide lines for rigid pavement design

6.O’Flaherty.C.A, Highway - Traffic Planning and Engineering, Edward Arnold London

7.Horonjoff.R, Planning and Design of Airports, Mcgraw Hill book

Internal work assessment:

2 tests	15x2=30 marks
Assignments (minimum 2)	15 marks (One assignment must be field oriented)
Regularity	5 marks
Total marks	50 marks

University examination Pattern:

- Q. 1 8 short type questions, 2 from each module, carries 5 marks each
- Q. 2 2 questions of 15 marks each, from module 1, with choice to answer any one
- Q. 3 2 questions of 15 marks each, from module 2, with choice to answer any one
- Q. 4 2 questions of 15 marks each, from module 3, with choice to answer any one
- Q. 5 2 questions of 15 marks each, from module 4, with choice to answer any one

CE 04 506 OPEN CHANNEL HYDRAULICS AND HYDRAULIC MACHINERY

3 hours lecture and 1 hour tutorial per week

Objective:

Students are enlightened to learn, understand and develop concepts regarding the types of free surface flow and their applications in order to have adequate background for the design of various hydraulic structures.

Module I (13 hours)

Uniform flow in open channels: types of channels and flow - qualification for uniform flow - computation of uniform flow - Chezy's formula - Manning's formula - velocity distribution in open channels - conveyance of canal cross section - normal depth and velocity - algebraic method - normal discharge curve - hydraulic exponent for uniform flow computation - design of rigid boundary channels - most efficient cross section - circular cross section not flowing full - rectangular - trapezoidal-triangular

Energy in open channel flow: specific energy - specific force diagrams - alternate depths - critical velocity - critical stages of flow - hydraulic exponent M for critical flow - application of specific energy and critical flow - transitions in rectangular channels - metering flumes - venturi - standing wave - par shall

Module II (13 hours)

Non uniform flow: gradually varied flow - basic assumptions - dynamic equation for gradually varied flow - different forms of the dynamic equation - characteristics of flow profiles in prismatic channels

Back water curve: computation of length of back water curve - numerical integration - Standard step method- direct step method - computation of backwater profile using spreadsheet.

Stream flow measurement - gauges and recorders - determination of velocity of flow - measurement of discharge in rivers - area-velocity method - stage - discharge relation

Module III (13 hours)

Rapidly varied flow: characteristics of the flow - hydraulic jump - initial and sequent depths - non-dimensional equation - practical application of hydraulic jump - types of jump in horizontal floor - basic characteristics of the jump - energy loss - efficiency - height of jump - jump as energy dissipater - stilling basins - jump position - tail water conditions - jump types - stilling basins of generalized design - rapidly varied unsteady flow - introduction to surges and types of shallow water waves (Numerical examples not expected)

Module IV (13 hours)

Hydraulic machines

Turbines: hydrodynamic force on plates - impact of jets - fixed and moving - flat and curved - velocity triangles - equation for power and work done - classification of turbines - components of Pelton wheel, Francis turbine, Kaplan turbine (Design is not expected) - specific speed - selection of turbines - penstock and surge tanks

Pumps: classification- NPSH - Selection of pumps

Rotodynamic pumps: types - volute and whirl pool chambers - velocity triangle for pumps - least starting speed - efficiency - specific speed - multistage pumps - operating characteristics of centrifugal pumps

Positive displacement pumps: reciprocating pump - types - work done - effect of acceleration and frictional resistance - slip and coefficient of discharge - separation in suction and delivery pipes - air vessel - gear pump

Deep well pumps: submersible, jet and airlift pumps - general principle of working - selection and installation of pumps

Text book:

Modi P.N. & Seth S.M., *Hydraulics & Fluid Mechanics*, Standard Book House

Reference books:

1. Subramanya K., *Flow in Open Channels*, Tata McGraw Hill
2. Hanif Choudhary M., *Open Chanel Flow*, Prentice Hall of India

3. Chow V.T., *Open Channel Hydraulics*, McGraw Hill
4. Richard French H., *Open Channel Hydraulics*, McGraw Hill
5. Addison H., *A Treatise on Applied Hydraulics*, Asia Publishing House
6. Michael, *Wells and Pumping Machinery*

Internal work assessment:

2 tests	15x2=30 marks
Assignments	15 marks (Students may be encouraged to collect flow details from nearby hydraulic structures so as to understand the practical application of the subject)
Regularity	5 marks
Total marks	= 50 marks

University examination pattern:

- Q I -8 short type questions of 5 marks each, 2 from each module
- Q II -2 questions A and B of 15 marks each from module I with choice to answer any one (50 to 70% numerical questions)
- Q III -2 questions A and B of 15 marks each from module II with choice to answer any one (30 to 60% numerical questions)
- Q IV -2 questions A and B of 15 marks each from module III with choice to answer any one (40% to 60% numerical questions)
- Q V -2 questions A and B of 15 marks each from module IV with choice to answer any one (40 to 70% numerical questions)

CE 04 507 CIVIL ENGINEERING DRAWING II

3 hours per week

Objective :

1. To make the students to be able to plan and draw different views of Building according to State Building rules.
2. To make the students to draw different views of Building in drafting packages
(The student is expected to know the local building rules and National Building Code provisions. After the course, the student should be in a position to Prepare Building sketches for the clients and submission drawings for approval. Each student shall complete a term project in tracing paper)

Module 0: Prepare Building Drawings with specification in any popular drafting software (9 Hours)

Module I: (21 hours) Planning from given requirements of areas and specifications and preparation of Sketch & working drawings for :

1. Different types of residential Buildings- Single and two storied with RCC roof. Two storied Flats.
2. Planning of simple tile roof building.
3. Variety of Public Buildings- Small public utility shelters, dispensaries, libraries, schools, banks, hostels, offices, factories etc.

Module II (9 hours)

1. Preperation of site plan and service plans as per building rules
2. Building Services (for single and two storied buildings only)
3. Septic tanks and soak pit detailed drawing

Assignment : Plan and draw all the views of a Single Storied Building with all details in any popular drafting package as per prevailing building rules on any fictitious plot area.

Reference Books :

1. National Building Code of INDIA
2. Kerala Building rules
3. Balagopal T.S. Prabhu, Building drawing and detailing, Spades Publishers
4. Shah & kale ,Building Drawing, Tata Mc Graw Hill

Internal assessment

Sheets and assignment	- 25 marks
Term Project	- 10 Marks
Test	- 10 marks
Regularity	- 5 marks
Total	- 50 marks

University Examination Pattern

1. No Questions from Module 0
2. One compulsory question from module I carrying 80 marks- Given the area and specifications for a proposed building, the student has to plan and prepare drawings. Planning aspect should be given weightage in the examination.
3. 2 Questions A and B of 20 marks from module II with choice to answer any one

CE 04 508(P) FLUID MECHANICS LAB

3 hours practical per week

Group A

1. Study of instruments: pressure gauge - piezometer - manometer-pressure transducers - pilot tubes - current meter.
2. Demonstration: Bernoulli's theorem - phreatic lines - fluming horizontally and vertically
3. Steady flow through pipes: determination of friction factor for various types of pipes
4. Orifices and mouthpieces: various types-steady case
5. Notches and weirs: various types-steady case
6. Time of emptying: unsteady flow
7. Discharge measurements: venturimeter - venturi flume - orifice meter - water meter

Group B

8. Open channel flow: determination of manning's coefficient
9. Plotting the specific energy curve
10. Tracing back water profiles / draw down profiles
11. Hydraulic jump parameters

Group C

12. Study of pelton wheel - Francis-Kaplan turbines
13. Study of centrifugal - reciprocating - jet and deep well pumps
14. Calibration of pressure gauge.
15. Air flow measurement using air blowers.

Internal assessment:

Laboratory practicals and record	= 25 marks
Test/s	= 20 marks
Regularity	= 5 marks
Total marks	= 50