

अशोक कुमार डोगरा  
Ashok K. Dogra

संयुक्त सचिव  
Joint Secretary



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विश्वविद्यालय अनुदान आयोग

बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110 002

**UNIVERSITY GRANTS COMMISSION**

Bahadur Shah Zafar Marg, New Delhi-110 002

E-mail : akdogra@ugc.ac.in

D.O. No.F.14-5/2008 (CPP- II)

August, 2008

Dear Sir / Madam,

The Government of India (Ministry of Water Resources, Central Ground Water Authority) has been taking several initiatives aimed at ensuring long term sustainability of ground water resources in the country. The success of these initiatives depends on the active participation of all stake holder including the Universities. In fact, the Universities and other institutions of higher education have a greater role and responsibility for dissemination of information on Ground Water Recharge and Rainwater harvesting. The Central Ground Water Board (CGWB) has launched a special campaign targeted at Educational Institutions. Technical Guidance for the purpose shall be rendered by the Regional offices of the CGWB. In this connection, a copy of the letter No.1-3/M.:Secy./Media Plan/CGWA/2008 dated 20<sup>th</sup> June, 2008 & Letter No. TS/Chmn/CGWB/2007-327 dated 28<sup>th</sup> January, 2008 received from the Central Ground Water Authority / Board is enclosed (Annexure-I).

The UGC has also earlier circulated to all Universities, a Model Course (Certificate, Diploma and Advanced Diploma) in Watershed Technology / Management vide UGC office letter No.1-1/2004 (COP) dated 15<sup>th</sup> December, 2004 (copy attached) Annexure-II.

I request for pro-active role of your University in this National Mission which will go a long way in ensuring the sustainability of Ground water resources in the country. The University may directly get in touch with the Central Ground Water Board with regard to other details.

With regards,

Yours sincerely,

Vice Chancellor  
All Unives.

(A.K. Dogra)

*file*

Copy to -

Shri B.M. Jha, Chairman, Central Ground Water Board, Ministry of Water Resources, Bhujal Bhawan, NH-IV, Faridabad-121001 (Haryana)

Shri R.C. Sharma, Scientist D, Government of India, Ministry of Water Resources, Central Ground Water Authority, A2-W3, Curzon Road Barracks, K.G. Marg, New Delhi-110001 with reference to him letter No.1-3/M.Secy/Media Plan/CGWA/2008 dated 20.06.2008.

US to Chairman, UGC, New Delhi (A status Note/Model Course on Watershed Technology is attached)

Publication Officer, UGC, New Delhi (for posting on UGC website)

Guard file



(V.K. Jaiswal)  
Under Secretary

S.A. 9/13

Dy 1

No. 1-3/ M.Secy/Media Plan/ CGWA/2008

Government of India  
Ministry of Water Resources  
Central Ground Water Authority  
A2-W3, Curzon Road Barracks  
K G Marg, New Delhi - 1

Answer I

Date: 20/06/2008

To,

Prof. Sukhdeo Thorat  
Chairman,  
University Grant Commission  
Bahadur Shah Zafar Marg,  
New Delhi

20 JUN 2008

**Sub: Dissemination of information on Ground Water Recharge and Rain Water Harvesting - reg**

Sir,

Please refer to this office DO letter No. 327/ TS/ Chmn/ 2007 dated 28.01.08 of Chairman, Central Ground Water Authority on the above-cited subject requesting issuance of necessary directives to all concerned for ensuring dissemination of information on ground water recharge and rain water harvesting through various activities in all the educational institutions under the Commission under your able guidance.

The Chairman's office has not received any communication so far. I shall be highly obliged if you kindly communicate a suitable date and time for discussing the broader issues and modalities for achieving the basic objective of this endeavor which will give a major boost to ground water recharge augmentation and sustainability of ground water resources in the country.

The "Advisory Council on Artificial Recharge to Ground Water" would be meeting again in the month of September'08 under the Chairmanship of Hon'ble Union Minister of Water Resources to assess the impact of recommendations of the Council and the subject under discussion is one of the recommendations.

This issues with the approval of Member Secretary, CGWA.

Yours faithfully,

R. Sharma  
20/06/08

(R.C. SHARMA)  
Scientist 'D'

Copy for Information to  
Chairman, CGWB, CHQ, Faridabad

Dr. No. 42/19  
Date 25/06/08

01/21/08  
14/2/08-78

S.A-10 (A)

0129-2419075



**B. M. JHA**  
Chairman

E-mail : chmn-cgwb@nic.in  
Fax : 0129-2412524  
भारत सरकार  
केन्द्रीय भूमि जल बोर्ड  
जल संसाधन मंत्रालय  
भूजल भवन  
एन. एच.- IV  
फरीदाबाद-121001

Government of India  
Central Ground Water Board  
Ministry of Water Resources  
Bhujal Bhawan  
NH-IV, Faridabad - 121001

Date  
28 JAN 2008

No. TS/Chmn/CGWB/2007-327

Dear Prof Thorat,

As you must be aware, Ministry of Water Resources, Govt. of India has been taking several initiatives aimed at ensuring long-term sustainability of ground water resources in the country. The constitution of "Artificial Recharge to Ground Water Advisory Council", by the Ministry of Water Resources under the Chairmanship of Hon'ble Minister of Water Resources has been a major step in this direction. As per the recommendations of the council, the 1st National Ground Water Congress was successfully organised by CGWB during September 2007 to provide a common platform for exchange of idea, information and concerns among policy makers, planners, scientists and stakeholders.

The 2nd meeting of the Artificial Recharge to Ground Water Advisory Council constituted by Ministry of Water Resources held on 12.09.2007 has recommended that a special campaign be launched for dissemination of information on ground water recharge and rainwater harvesting in educational institutions. In this regard I request you to take necessary initiative in the matter by issuing necessary directives to ensure dissemination of information on ground water recharge and rain water harvesting through various activities in all the educational institutions under the University Grants Commission in the country. Necessary technical guidance for the purpose shall be rendered by the Regional offices of CGWB, the list of which is enclosed for kind perusal. I request you to kindly accord top priority to this endeavour, which will give a major boost to ground water recharge augmentation and for the sustainability of ground water resources.

With regards.

Yours sincerely,

24.1.08  
(B. M. Jha)

**Prof. Sukhadeo Thorat**  
Chairman,  
University Grants Commission  
Bahadur Shah Zafar Marg,  
New Delhi, Pin:110 002  
India

US(CPP-II)

35 (CPP-II)  
Take necessary action and  
send reply by 31/1/08

IS (Chmn/CGWB)  
Date: 21/1/08

IS (Chmn/CGWB)  
Date: 21/1/08

VS to F

5-2-2008  
M.V.B.

30 (CPP-II)

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<p>The Regional Director Central Ground Water Board Northern Region Bhujal Bhawan Sector B, Sitapur Road Yojna Ram Ram Bank Chau Lucknow-226021 (U.P)</p>	<p>The Regional Director Central Ground Water Board North Eastern Region Tarun Nagar, Bye Lane-1 Near Rajiv Bhawan Guwahati-781005 (Assam)</p>	<p>The Regional Director Central Ground Water Board Southern Region 3-6-291, Sadhana Building 1st Floor, Hyderguda Hyderabad-500029(A.P)</p>
<p>The Regional Director Central Ground Water Board North Western Region 3-B, Bhujal Bhawan Sector 27-A, Madhya Marg Chandigarh-160026.</p>	<p>The Regional Director Central Ground Water Board Eastern Region Block- C.P6, Sector-V, Salt Lake City, Kolotta-700091 (W.B)</p>	<p>The Regional Director Central Ground Water Board South Eastern Region Bhujal Bhawan Khandagiri Chhak Bhubaneswar Orissa-751030</p>
<p>The Regional Director Central Ground Water Board Western Region 6-A, Jhalna Doongri Jaipur-302004 (Raj.)</p>	<p>The Regional Director Central Ground Water Board West Central Region Swaminarayan College Bldg Shah Alam Tol Naka Ahmedabad-380 022 (Gujarat)</p>	<p>The Regional Director Central Ground Water Board North Central Region Block-1, 4<sup>th</sup> Floor, Paryawas Bhawan Arera Hills, Bhopal-162011 (M.P)</p>
<p>The Regional Director Central Ground Water Board Central Region N.S. Building, Civil Lines Nagpur-440001 (Maharashtra)</p>	<p>The Regional Director Central Ground Water Board Kerala Region Kedaram, Kesavadasapuram Trivendrum-695004 (Kerala)</p>	<p>The Regional Director Central Ground Water Board South Eastern Coastal Region E-1, G-Block, Rajaji Bhawan, Besant Nagar, Chennai- 600090</p>
<p>The Regional Director Central Ground Water Board North West Himalayan Ruby Shopping Complex, Sanjay Nagar Jammu-180001 (J&amp;K)</p>	<p>The Regional Director Central Ground Water Board Middle East Region Lok Nayak Bhawan, 68<sup>th</sup> Floor Dak Bunglow Chowk Patna-1</p>	<p>The Regional Director Central Ground Water Board Northern Himalayan Region Barol- Jhikli, Post - Dari Dharmshala - 176057</p>
<p>The Regional Director Central Ground Water Board North Central Chhattisgarh Rep. 2<sup>nd</sup> Floor, Reena Appt, N. C. Chhantani Rd., Parsons Naka, Raipur-491001</p>	<p>The Regional Director Central Ground Water Board South Western Region 31<sup>st</sup> Cross, 11<sup>th</sup> Main Block 4, Jayanagar Bangalore- 560011(Karnatak)</p>	<p>The Regional Director Central Ground Water Board Uttaranchal Region 2-Ankitpuram General Mahadev Singh Road Dehradun 248001</p>

Annexure II

शंखर मीना

Chander Shokhar Meena

युक्ता सचिव  
Joint Secretary

दूरभाष PHONE : 011-23386128  
निवास RES. : 011-26197645  
फैक्स FAX : 011-23386128  
011-23382087  
e-mail : csmeena@ugc.ac.in

विश्वविद्यालय अनुदान आयोग

उत्तर-क्षेत्रीय महाविद्यालय ब्यूरो एवं  
व्यवसाय दिशा-निर्देशन कार्यक्रम

35 फिरोज शाह रोड, नई दिल्ली-110 001

UNIVERSITY GRANTS COMMISSION

Northern Regional College Bureau &  
Career Oriented Programme

35, Feroze Shah Road, New Delhi-110 001

F.No.1-1/2004 (COP)

The Registrar

All Universities.

(List attached).

November, 2004

Dec.

15 DEC 2004

Subject:-Syllabi for the courses (Certificate, Diploma and Advanced Diploma in  
Watershed Technology/Management.

Sir/Madam

The UGC has decided to introduce Watershed Technology/Management as one of the Courses under its scheme of Career Oriented Programme. I am enclosing herewith a copy of the Syllabi for the Courses (Certificate, Diploma and Advanced Diploma in Watershed Technology and Management) as framed by the UGC for your information and necessary action.

It is requested that you may kindly inform all your affiliated colleges/institutions about the introduction of this course under the UGC Scheme of Career Oriented Programme by enclosing a copy of the syllabi to these colleges. It is therefore, requested that the colleges may be asked to submit their proposals for introduction of this course under Career Oriented Programme.

Yours faithfully,

(C.S.Meena)  
Joint Secretary

Encl:-As above

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## Certificate Course in Watershed Technology/Management

### Earth System:

Earth as a member of solar family. Atmosphere, hydrosphere and lithosphere. Idea about the age and interior of the earth.

### Weather and Climate:

Latitudes and longitudes. Weather and climate, atmospheric general circulation. Air mass as weather fronts. Weather elements. Monsoon circulation, types of rainfall distribution. Monsoon through monsoon depressions and tropical cyclones. Recording of rainfall, rain gauge, methods of determining mean areal depth of rainfall.

### Introductory Geology:

Geological Time Scale. A brief history of the earth through geological time. Rocks as aggregates of minerals, types of rocks. Main geological formations of India as water bearing strata.

Weathering and erosion. Soil formation. soil profile and classification of soils.

Rocks as layers (beds), their attitude (dip and strike). Use of clinometer compass and Brunton compass. Simple geological structures: Folds, faults and unconformities.

Maps: Topographical maps, scale and its representation. Map reading. Global Positioning System (GPS) and its use.

Geological agents, their erosional and depositional activities. Brief introduction to types of landforms. Study of toposheets: Land forms drainage patterns and watershed.

Water Resources: Hydrological cycle. Assessment of surface and groundwater resources. National water resources. Economics of water use, legal control of water use. Need for sustainable water management. NGOs and their role in water management practices.

### Ground Water:

Occurrence. Vertical distribution of ground water. Aquifers, confined and unconfined. Water table variations. Perched water table. Porosity and permeability. Movement of ground water, Darcy's Law. Types of wells. Introductory ideas about the following: Water logging, Conjunctive use of water, Causes for depletion of water table. Water analysis kit and its use. Elementary idea about groundwater exploration.

13/11/14

Water Quality:

Physical and (chemical) characteristics of water, their significance. Standards for drinking and agriculture water.

Water pollution: Water pollution; sources and remedial measures.

Heavy metals and arsenic problems in ground-water. Graphical presentation of chemical data and its interpretation.

Watershed: Significance, principles and objectives.

Watershed characteristics, causes of deterioration.

Watershed management: Factors influencing watershed operation

Watershed management to watershed hydrology.

Water Conservation:

Water conservation ideas:

Water conservation measures: Gully control, terracing, bunding, check dams; reclamation of degraded land.

Water conservation techniques: Rain water harvesting, roof water harvesting, artificial recharge.

Measurement of depth of rainfall by Thiessen polygons and by Isohyetal methods.

Geological time: Visit to geological museum.

Common igneous, metamorphic and sedimentary rock types. Texture of common rocks.

Classification of soils.

Field study of river deposits, terraces, gullies, soil erosion and other features.

Topographical maps: Orientation of maps, map reading, locating of position on the map.

Use of Clinometer/compass or Brunton compass for location on the map.

Determination of dip and strike of strata and its plotting on the map.

Work with NGOs; their activities.

Use of water analysis kit for determining pH, temperature, conductivity, dissolved oxygen content of water sample.

Use of kit for determining quality of water.

Field study of drainage pattern and delineation of watershed.

Field study of drilling site and artificial recharge structures: its description.

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## Diploma Course in Watershed Technology/Management

### Surface Hydrology:-

Hydrological cycle. Infiltration factors, infiltration curve and indices. Runoff, stream flow, Methods of estimation of run-off.

Hydrology of droughts, definition and types, combating of droughts.

✓ Causes of floods.

Flood controls: Flood control dams, detention basins, levees, diversion channels, flood channel improvement schemes.

### Geomorphology:

✓ Geomorphic processes, endogenic and exogenic. Classification of valleys – drainage patterns and their significance. Morphometric and hypsometric analysis of drainage basin. Watershed delineation.

### Ground Water Hydrology:

✓ Dracy's Law and its validity. Aquifer, types. Steady and unsteady radial flow of ground water. Analysis of pump test data. Aquifer performance test and step Draw-Down Test for determination for aquifer parameters and well-loss (Theis & Jacob's method). Ground Water Estimation. Conjunctive use of surface and groundwater. Inland salinity problem and saline fresh interface. National Water Policy.

### Ground Water Exploration:

Introduction to geohydrological and geophysical methods of groundwater exploration. Techniques for resistivity method of exploration.

Wells types and their construction in soils and hard rock areas. Methods of drilling tubewells : Cable tool, hydraulic rotary, reverse rotary and DTH (Down The Hole). Centrifugal and borehole type pumps. Development & rehabilitation of tube-wells.

### Irrigation Management:

✓ General irrigation development in India, historical review, modern trends. Crop requirements and irrigation scheduling. Major Indian crops, times of sowing and harvesting. Crop selection, depth and frequency application of water irrigation schedules. Water use of efficiency, cropping patterns. Water conveyance and application methods: Lined and unlined canals, control and diversion structures in field channels and drains, their design. Underground pipe system.

Drip and sprinkler irrigation systems. Drainage: causes of water logging, design of surface and sub-surface drains, saline and alkaline lands. Reclamation and management of salt affected lands.

### Soil and Water conservation:

Characterization and identification of watershed. Soil and Water conservation practices. Geotechnical investigation and design of artificial recharge structures: Injection Wells. Induced Recharge structures, Pit/Trenches and combination of structures. Safety analysis of recharge structures.

130  
Interaction with at least was local Non-Governmental Organizations strongly of their  
on-going projects.

#### Contaminated & Water Quality Monitoring:

Importance of surface and groundwater and its health hazards. Preventative measures.

Latest technologies of contaminated water with special reference to fluoride and

#### Interests:

Importance for identification of various geomorphic features including drainage patterns.

Classification of drainage basins.

Measurement of stream velocity and run-off (field)

Measurement of T & S using Thiess Curve Type Method, Jacob's Method

Measurement of stream velocity.

Identification and construction of soil and water conservation structures such as Gully  
Plugging, Contours Trenching, Check Dams including cost estimation and design  
(Practical & Field Visit). Soil sampling procedures, visit to chemical soil testing  
laboratory. Interaction with local NGOs engaged in Watershed Programme.

### Advanced Diploma in Watershed Technology/Management

#### Watershed Management:

Advanced engineering technologies to harness surface and sub-surface water. Artificial  
recharge methods including ASR (Aquifer Storage Recovery) Management of artificial  
recharge aquifer.

Outline of planning watershed projects, guidelines for project preparation. Watershed  
delineation, codification. Macro and micro-level delineation, drainage basins.

Formulation on watershed : Analysis of project elements, need assistance, socio-  
economic survey.

Watershed resources management with multiple use concept. Project economics

Project implementation and management. Watershed impact analysis.

#### Data analysis/Modeling/Management:

Classification of data, classification of data, measures of central, measures of dispersion  
(quartile deviation, mean deviation, standard deviation), skewness, kurtosis.

Probability: Definition, addition of probability theorem, multiplication law of probability  
Computer programming. Data base management systems.

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### Photogrammetry & Remote Sensing:-

Definition and terminology. Geometry and types of aerial photographs. Photographic scale. Relief displacement. Photographic mosaics.

Electromagnetic spectrum. Energy source and its characteristics. Remotesensing platforms and sensors. Earth resources satellites: Land sat, SPOT, IRS Series. Visual image interpretation, key elements; topography, drainage patterns & texture, erosion, image tone, vegetation and land use.

### GIS :

Fundamentals of GIS. Components of GIS. GIS technology & application. Raster and vector data. Data input and editing. Data query and analysis. Spatial data modeling, attribute data management. Analytical modeling in GIS.

### NGOs and their function:

NGOs: Role of voluntary agencies. Sociology and community participation.

Formation & registration of NGO/Public Trust. Rules & regulations. Liaison with Government Department & Donor Agencies. Formation of village watershed and water-user groups. Functioning of Zila Parishad, Tehsil (BDO) & Gramsabha. Role of women in watershed management. Watershed informatics, data bases and regulations.

### Practicals:

Use of stereoscopes for study of aerial photographs.

Preparation of land use, land cover maps.

Use of software in Water Management.

Digitization of various thematic maps.

Integration and application of GIS.

Close interaction with NGO : Contact programme, field work and studies on type watershed.

### Books:-

Texts:

Apello, C.A.J. and Postma, D.1993. Geochemistry, Groundwater and pollution John Wiley

Billings, M.P.1977. Structural Geology. Prentice Hall of India.

Mukherjee, P.K. A Textbook of Geology

Thornbury, W.D. Principles of Geomorphology

Todd, D.K.1980. Ground Hydrology. John Wiley, N.Y.

Krishnan, M.S. Geology of India and Berma

Tideman, E.M. Watershed Management guidelines for Indian conditions. Omega Scientific Publications, New Delhi.

Duff.D.1993. Holmes Principles of Physical Geology

Maitra, M.K. Watershed management project planning development and implementation. Omega Scientific Publications, New Delhi.

Duff, D.1993. Holmes' Principles of Physical Geology. Chapman & Hall, London

- Holtz, M.J. Water and Waste Water Technology  
 M. J. Holtz, M.L. and Schoch, R.M. 1998. Environmental Science  
 System and solutions. Jones and Barlett  
 ...glous, G. and Schrolder E.D. Water Quality  
 ...K. and goel, P.K. chemical and geological Methods for Water Pollution  
 ...  
 Leach and Kirkpatrick, C. 2000. Sustainable Development and Integrated Approach.  
 Edward Elgar  
 ... S. and Brides. J.S. 1993. Water supply and Sanitary Engineering  
 Dhanpat Rai and Sons.  
 ... Dutta, A.K. 1987. Industrial Waste Water Treatment. Oxford and IBH

Diploma Course:

- Text  
 ... 1981. Geomorphology. Allen and Unwin  
 ... H.M. 1983. Ground Water. Wiley Eastern  
 ... H.M. 1986. Hydrology. Prentice Hall, India  
 ... W.D. Principles of Geomorphology  
 ... D.K. 1980. Groundwater Hydrology, John Wiley N.Y.  
 ... M.K. 2001. Watershed Management. Omega Scientific publications, New Delhi  
 ... E.M. 2001. Watershed Management. Guidelines for Indian conditions 4000p  
 on environmental scientific pollutions, New Delhi

References:

- Dunne and Dewist. Geohydrology  
 ... 1955. Methods for Storm Water Management. Lewis  
 ... K.R. 1987. Groundwater Assessment, Development and Management  
 ... K.R. 1989. Hydrogeology. Tata McGraw Hill  
 ... W.M. 2001. Storm Water Collection and Designing  
 ... S and Patangay, N.S. Principles and Applications of Ground Water Geophysics.  
 ... P. 1978. Groundwater and Tube Wells. Oxford and IBH

Advanced Diploma Course:-

- Text  
 ... Zeddy, M. 2001. Textbook of Remote Sensing and GIS. BS Publications, Hyderabad  
 ... S. Geographic Information Systems.  
 ... K.C. 1999. Getting Started with Geographic Information System. Prentice Hall  
 ... Statistical Methods in Hydrology  
 ... I. Sarah C. and Carver, S. 1998. An Introduction to Geographical Information  
 System. Persons Educations Ltd., Singapore  
 ... K.R. 1987. Groundwater Assessment, Development and Management  
 ... M and Kiefer, R.W. remote Sensing and Image Interpretation  
 ... Taylor and Francis (Ed.) 2003. GIS for Water Resources and Watershed  
 Management  
 ... M.K. 2001. Watershed Management Omega Scientific publications, New Delhi.

Tidewan, E.M.2001. Watershed Management. Guidelines for Indian conditions 4000p  
omga scientific pollutions, New Delhi

Murthy, J.V.S.1994. Water Management in India. Wiley Eastern

Reddy, P.J.Stochastic Hydrology

Sahu, B.K.2002. Statistical Methods in Earth Sciences. Oxford

Wolf, P.Elements of Photogrammetry

References:

Anderson, D.D.1976. Times Series Analysis. Butterworth, London

Anji Reddy, M.2003. Geoinformatics for Environmental Application BS Publications:  
Hyderabad

DeMeres, M.N.1997. Fundamentals of GIS. Wiley

Grewal, B.S.Elementary Engineering Mathematics

Korth H.F. and Silberschatz. Database System Concepts. Tata McGraw Hill

Sten, J and Estes, J.1990. Geographical Information System, Prentice Hall

Lauvini, R.& Thompson.1997. Fundamental of Spatial Information System Academic  
Press

Rajora, R.Integrated Watershed Management. Rawat Publ.

Rao, S.S.1990 Optimization Prentice Hall, India

Sahu, B.K.2002. Time Series Modeling in Earth Sciences. Oxford.

Seeber, G.1993. Satellite Geodesy. Walter deGruyter, Berlin

Walton, W.C.1970.Groundwater Resources Evaluation. McGraw Hill.