NITJ/CED/18/2254
28/2/18

Department of Civil Engineering

Minutes – 11th Meeting of Board of Studies (BOS)
Tuesday, the 13th Feb, 2018

Following faculty members were present for the meeting*:

1. Prof. A K Agnihotri, Professor and Head, Department of Civil Engineering, NIT Jalandhar (AKA)
2. Prof. A P Singh, Professor, Department of Civil Engineering, NIT Jalandhar (APS)
3. Prof. S P Singh, Professor, Department of Civil Engineering, NIT Jalandhar (SPS)
4. Prof. B S Kaith, Dean (Academic), NIT Jalandhar (BSK)
5. Dr. Ajay Bansal, Associate Professor and Head, Department of Chemical Engineering, NIT Jalandhar (ABL)
6. Dr. Vishal Sharma, Associate Professor and Head, Department of Industrial and Production Engineering (VSM), NIT Jalandhar
7. Mr. Charanpreet Singh, Additional Superintending Engineer, Bhakra Beas Management Board, Nangal, PB (CPS)
8. Dr. Amit Kumar, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (AKR)
9. Mr. Davinder Singh, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (DS)
10. Dr. Kanish Kapoor, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (KK)
11. Dr Mahesh Patel, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (MP)
12. Dr. Navdeep Singh, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (NS)
13. Dr. Rajiv Kumar, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (RK)
14. Dr. Rupali Satavalekar, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (RUS)
15. Dr. Senthil Kasilingam, Assistant Professor, Department of Civil Engineering, NIT Jalandhar (SK)

*Dr. R. K. Sharma, Professor, NIT Hamirpur (RKS) and Dr. N. K. Samadhiya, Professor, IIT Roorkee were not able to attend due to their preoccupations. Prof. R. K. Sharma sent his comments by email.

First, Prof. A. K. Agnihotri, Chairman, BOS welcomed the participant of the 11th meeting of BOS, Civil Engineering Department, NIT Jalandhar and asked the secretary, AKR, to initiate the proceedings.

Item 11.1 New teaching scheme for B. Tech. and minor electives to be offered for minor degree in Civil Engineering (Enclosure #1 and #2)

a. VSM iterated the NBA requirements for B. tech. program as the following:
   i. Total credits should be about 160.
   ii. More elective subjects should be offered rather than the core subjects.
   iii. Separate space should be allotted in the laboratories for students working on their B. Tech. projects.
   iv. Nomenclature and syllabus for various courses should be as per the equivalent courses available on NPTEL and MOOCs.
b. Syllabus for Basic Civil Engineering (to be introduced as a Basic Engineering course in 1st year) will be prepared by RS, SK and RK.

Amit Kumar

c. Humanities course in 4th semester (Human Resource Management and Industrial Relations – HMX-304) has been retained and the course on Engineering Economics and Industrial Management (HMX-201) has been removed from 3rd semester as per the institute guidelines on curriculum revision.

d. To make the number of credits similar in all the semesters (as per comments received from RKS), following changes were recommended:
   i. Transfer of Surveying and Surveying Laboratory from 4th semester to 3rd semester
   ii. Transfer of Highway and Traffic Engineering and Highway and Traffic Engineering Laboratory from 6th semester to 4th semester
   iii. Courses on Civil Engineering Material and Building Construction will be 2-credit courses each (2-0-0). Civil Engineering Material will be taught in 3rd Semester and Building Construction in 5th semester.
   iv. The contact hours for the B. Tech. project work in 7th and 8th semester are to be included in the teaching scheme.
   v. 1-credit course for industrial Lecture has been introduced in 7th semester as per institute guidelines.

e. Following name change have been suggested for courses and laboratories:
   i. Environmental Engineering – I will be renamed as Water Supply Engineering.
   ii. Environmental Engineering – II will be renamed as Wastewater Engineering.
   iii. Hydraulics Laboratory will be renamed as Hydraulics and Water Resources Laboratory.
   iv. Building Drawing Laboratory will be renamed as Computer Aided Architectural Drawing Laboratory (CAAD).
   v. Concrete Structures Drawing Laboratory will be renamed as Computational Analysis and Design of Structures Laboratory.
   vi. Steel Drawing will be renamed as Construction Management Laboratory.

f. Proposed teaching scheme approved and final version appended as Enclosure #1

g. List of minor elective courses has been approved and final version as given in Enclosure #2

Item 11.2 New/modified syllabi for elective/core courses in B. Tech. existing scheme (Enclosure #3)

a. CPS suggested modifying the syllabus of Surveying and Surveying Lab as per latest industry practices (e.g. DEM, GIS, latest software including ArcGIS) – RK, SKS and MP to act.

b. VSM suggested including online resources, latest books/editions in all the syllabui (suggestion from VS) – all faculty members to act as per the minutes from meeting on Jan 30th, 2018.

c. The modified course for Disaster Management (CEX 442) has been approved. Also this course will now be shifted to open elective subjects from departmental elective section. It is suggested to include the books and online resources – NS to act.

d. The modified course for Advanced Environmental Engineering (CEX 446) has been approved with the suggestion of including radiation and housing by CPS and DS – AKR to act.

e. The syllabus for Design of Hydraulic Structures (CEX 310) has been modified with the suggestion (from CPS) of removing topic on buttress dams and including topics on head race

tunnel, diversional tunnel, spillways, intake structures, instrumentation for heal monitoring of hydraulic structures – MP to act.

f. The course for Hydrology and Dams (CEX 336) has been renamed as Engineering Hydrology. The syllabus for the course has been modified with the suggestions (from CPS) of including topics on output hydrograph, flood hydrography and inundation mapping – MP to act.

g. New syllabus for Irrigation Engineering (CEX 311) has been approved with suggestions from CPS – MP to act.

h. New elective course on Smart Cities (CEX 449 – Category III) has been approved with the suggestion (from VSM and CPS) of removing unit names and including topics on net metering – KK to act.

i. New elective course on Fluvial Hydrodynamics (CEX 450 – Category V) has been approved with the suggestion (from CPS) of including topics on sediment control, delta formation – MP to act.

j. New elective course on Rural Roads (CEX 452 – Category V) has been approved.

k. New elective (open) course on Green Technology (CEX 451 – Category III) has been approved.

l. New elective course on Environmental Geo-technology (CEX 453 – Category III) has been approved.

m. New software - ArcGIS (Surveying), MIKE (Fluvial Hydrodynamics) and HEC-RAS (Engineering Hydrology) to be introduced in courses (suggested by CPS).

n. Item approved and final version appended as Enclosure #3

Item 11.3 Proposed M. Tech. scheme

a. M. Tech. teaching scheme has been made more flexible by including more elective subjects. Following is the proposed teaching scheme:

   i. 1st semester: 3 core courses and 2 electives; 2 laboratories
   ii. 2nd semester: 3 core courses and 2 electives; 2 laboratories
   iii. 3rd semester: 2 electives, independent study and dissertation
   iv. 4th semester: dissertation only

b. The proposed M. Tech. teaching scheme has been approved.

Item 11.4 New/modified syllabi for elective/core courses in M. Tech. existing scheme (Enclosure #4)

a. New elective course on Advanced Numerical Methods (CE 515) has been approved.

b. New syllabus for Earthquake Resistant Design of Structures (CE 506) has been approved to include latest codes – KK to act.

c. New elective course on Highway Construction and Maintenance (CE 517) has been approved.

d. New course on Theory of Plates and Shells (CE 518) has been approved with suggestion of including topic on folded plates – SK to act

e. CPS also suggested including a new elective course on GeoSpatial Technologies – RK and SKS to act.

f. Item approved and final version appended as Enclosure #4

Item 11.5 Selection of one out of three courses of Mathematics

a. 2 hours for practical per week are proposed and approved for mathematics course in 4th semester so as to hone the software skills of the students for computation.
b. Out of the courses suggested by Mathematics department, course on Numerical methods (MAX-206) has been included in the 4th semester.

Item 11.6 Proposal for new M. Tech. program in Geotechnical and Geo-environmental Engineering (Enclosure #5)

a. The proposal for new M. Tech. program in Geotechnical and Geo-environmental Engineering has been approved.
b. The program will start from July 2018 and total intake will be about 15-20 students.
c. Item approved and final version appended as Enclosure #5

Item 11.7 Formal approval for P.G. research laboratories (Enclosure #6)

a. The department has existing laboratories for Geotechnical Engineering and Concrete Technology. Both laboratories are being used extensively by the students in their research for master/doctoral degrees.
b. Both the laboratories have been formally approved.
c. Item approved and final version appended as Enclosure #6

Meeting ended with vote of thanks to the Chair.

Amit Kumar 28/02/18
(Amit Kumar)

Assistant Professor and Secretary (Board of Studies)

28/2/2018
Head, Civil Engineering Department and Chairman (Board of Studies)

Enclosure #1

Teaching Scheme – B. Tech. (Proposed)

Summary Table for credit allotments in different kinds of courses

S. No.	Description	Courses/ Labs	Credits (Proposed)	Credits % (Proposed)	AICTE Model Curriculum
1	Humanities & Management (HM)	4	10	5.56	7.5
2	Basic Science (BS)	7	22	12.22	15.6
3	Engineering Arts and Science	12	32	17.78	15
4	Program Core	31	83	46.11	30
5	Program Elective	6	16	8.89	11.25
6	Open Elective	3	9	5.00	11.25
7	Project/ Internship	4	8	4.44	9.3
	Total		**180**		

Comparison of credits with other IIT/NITs

S. No.	Description	Credits % (Proposed) -Civil Engg Department	AICTE Model Curriculum	IIT Delhi	NIT Surathkal	NIT Allaha bad	NIT Kurukshetra
1	Total credit requirements for B. Tech. (Nos.)	180	160	145-155 (150)	170-180 (175)	200	200
2	Humanities & Management (HM) (%)	5.56	7.5	46.67	28.57	-	-
3	Basic Science (BS) (%)	12.22	15.6				
4	Engineering Arts and Science (%)	17.78	15				
5	Program Core* (%)	46.11	30	53.33	60	-	-
6	Program Elective (%)	8.89	11.25			8	4
7	Open Elective (%)	5.00	11.25	6.67		3	4
8	Project/ Internship (%)	4.44	9.3	-	6.86	6	13.25

First Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Course Classification
			L	T	P/D			
1.	-	Applied Physics	3	1	0	4	4	BS
2.	-	Basic Engineering Course-I	3	1	0	4	4	EAS
3.	-	Computer Programming	3	0	0	3	3	EAS
4.	-	Applied Mathematics-I	3	1	0	4	4	BS
5.	-	Management, Principles & Practice	3	0	0	3	3	HM
6.	-	Engineering Graphics & CADD	1	0	4	3	5	EAS
7.	-	Applied Physics Lab	0	0	2	1	2	BS
8.	-	Computer Programming Lab	0	0	2	1	2	EAS
TOTAL						**23**	**27**	

Second Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Course Classification
			L	T	P/D			
1.	-	Applied Chemistry	3	1	0	4	4	BS
2.	-	Applied Mathematics-II	3	1	0	4	4	BS
3.	-	Basic Engineering Course-II	3	1	0	4	4	EAS
4.	-	English Communication & Report Writing	3	0	0	3	3	HM
5.	-	Manufacturing Process	2	0	0	2	2	EAS
6.	-	Product Realization through Manufacturing Laboratory	0	0	4	2	4	EAS
7.	-	English Communication Lab	0	0	2	1	2	HM
8.	-	Applied Chemistry Lab	0	0	2	1	2	BS
9.	-	Environmental Science and Technology	3	0	0	3	3	EAS
TOTAL						**24**	**28**	

Amit Kumar

Third Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Course Classification
			L	T	P/D			
1.	CEX-208	Surveying	3	0	0	3	3	PC
2.	CEX-203	Civil Engineering Materials	2	0	0	2	2	PC
3.	CEX-204	Water Supply Engineering	3	0	0	3	3	PC
4.	CEX-201	Fluid Mechanics	3	0	0	3	3	EAS
5.	CEX-205	Concrete Technology	3	0	0	3	3	PC
6.	CEX-207	Strength of Materials	3	0	0	3	3	EAS
7.	CEX-222	Surveying Laboratory	0	0	2	1	2	PC
8.	CEX-221	Fluid Mechanics Laboratory	0	0	2	1	2	EAS
9.	CEX-223	Concrete Technology Laboratory	0	0	2	1	2	PC
TOTAL						**20**	**23**	

Fourth Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Classification
			L	T	P/D			
1.	HMX-304	Human Resource Management and Industrial Relations	3	0	0	3	HM, 3	HM
2.	MAX-206	Numerical Methods	3	0	2	4	5	BS
3.	CEX-202	Structural Analysis-I	3	1	0	4	4	PC
4.	CEX-306	Highway and Traffic Engineering	3	1	0	4	4	PC
5.	CEX-405	Wastewater Engineering	3	1	0	4	4	PC
6.	CEX-206	Earth Sciences	3	0	0	3	3	EAS
7.	CEX-224	Structural Analysis-I Laboratory	0	0	2	1	2	PC
8.	CEX-324	Highway and Traffic Engineering Laboratory	0	0	2	1	2	PC
9.	CEX-421	Wastewater Engineering Laboratory	0	0	2	1	2	PC
TOTAL						**25**	**29**	

Amit Kumar

Fifth Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Classification
			L	T	P/D			
1.	CEX-301	Design of Concrete Structures-I	3	1	0	4	4	PC
2.	CEX-303	Design of Steel Structures-I	3	1	0	4	4	PC
3.	CEX-305	Soil Mechanics	3	1	0	4	4	PC
4.	CEX-307	Structural Analysis-II	3	1	0	4	4	PC
5.	CEX-	Building Construction	2	0	0	2	2	PC
6.	CEX-311	Irrigation Engineering	3	0	0	3	3	PC
7.	CEX-321	Soil Mechanics Laboratory	0	0	2	1	2	PC
8.	CEX-323	Building Drawing	0	0	2	1	2	PC
TOTAL						**23**	**25**	

Amit Kumar

Sixth Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Classification
			L	T	P/D			
1.	CEX-302	Foundation Engineering	3	1	0	4	4	PC
2.	CEX-304	Design of Concrete Structures-II	3	0	0	3	3	PC
3.	CEX-	Departmental Elective-I	3	0	0	3	3	PE
4.	CEX-	Open Elective-I	3	0	0	3	3	OE
5.	CEX-308	Elements of Earthquake Engineering	3	1	0	4	4	PC
6.	CEX-310	Design of Hydraulic Structures	3	0	2	4	5	PC
7.	CEX-322	Concrete Structures Drawing-II	0	0	2	1	2	PC
8.	CEX-326	Survey Camp*				2	-	-
TOTAL						**24**	**24**	

* 2-3 weeks Survey Camp will be held during summer vacation/winter vacation in hill station/institute after 4th / 5 th semester.

Seventh Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Classification
			L	T	P/D			
1.	CEX-401	Estimating and Costing	3	1	0	4	4	PC
2.	CEX-403	Railway, Airport and Harbour Engineering	3	0	0	3	3	PC
3.	CEX-	Departmental Elective-II	3	0	0	3	3	PE
4.	CEX-	Departmental Elective-III	3	0	0	3	3	PE
5.	ID	Open Elective-I	3	0	0	3	3	OE
6.	CEX-	CAD Laboratory	0	0	2	1	2	PC
7.	CEX-400	Project (Phase-I)	0	0	4	2	4	-
8.	CEX-	Industrial Lecture@	-	-	-	1	-	PE
9.	CEX-	Industrial Practical Training*				0	-	-
TOTAL						**20**	**22**	

* Industrial Training will be held in summer vacations after 6th semester.
@Four industrial lectures throughout the semester and quizzes will be conducted on the same day for evaluation.

Amit Kumar

Eighth Semester

S. No.	Course No.	Course Title	Periods			Credits	Contact Hours	Classification
			L	T	P/D			
1.	CEX-402	Construction Management	3	1	0	4	4	PC
2	CEX-404	Design of Steel Structures-II	3	0	0	3	3	PC
3.	CEX-	Departmental Elective-IV	3	0	0	3	3	PE
4.	CEX-	Departmental Elective-V	3	0	0	3	3	PE
5.	ID	Open Elective-II	3	0	0	3	3	OE
6	CEX-422	Steel Drawing	0	0	2	1	2	PC
7.	CEX-400	Project (Phase-II)	0	0	8	4	8	-
TOTAL						**21**	**26**	

Enclosure #2
List of Minor Electives

Following is the list of proposed courses for minor electives*:

1. Soil Mechanics
2. Environmental Engineering – I
3. Structural Analysis – I
4. Design of Concrete Structures – I
5. Design of Steel Structures – I
6. Highway and Traffic Engineering – I
7. Hydropower Engineering
8. Surveying
9. Concrete Technology
10. Construction Management
11. Strength of Materials
12. Elements of Earthquake Engineering

*For the students opting for a minor degree, the heads of both the departments will ensure that no courses are being repeated.

New/modified syllabi for electives in B. Tech. existing scheme

Enclosure #3

CEX-208 Surveying [3 0 0 3] (modified syllabus)

Introduction: Definition, classification of surveys, principle, distorted or shrunk scales, precision in surveying. Different type of surveying: Chain Surveying, Compass Surveying and Plane Table Surveying.

Levelling: Definitions of terms used in levelling, different types of levels, parallax, adjustments, bench marks, classification of levelling, booking and reducing the levels, rise and fall method, line of collimation method, errors in leveling, permanent adjustments, corrections to curvature and refraction, setting out grades, longitudinal leveling, profile leveling. Automatic Levels.

Contouring: Definition, representation of reliefs, horizontal equivalent, contour interval, characteristics of contours, methods of contouring, contour gradient, Interpolation of contours, uses of contour maps. Contouring by using total station and theodolite.

Hydrographic Surveying:

Objects, applications, Establishing controls, Shore line survey, Sounding, Sounding Equipment, Methods of locating soundings – conventional and using GPS , Reduction of soundings, Plotting of soundings, Nautical Sextant and its use, Three point problem and its use, solution of three point problem by all methods, Tides and tide gauges, determination of MSL

Remote Sensing and Geographical Information System:

Remote Sensing Introduction and definition, Necessity, importance and use of remote sensing, Difference between Aerial photograph and satellite image, Manual & digital image interpretation, Elements of visual image interpretation such as size, shape, tone, texture, etc. Field verification or Ground truthing. Advantages and limitations of RS, Different applications of RS- (Land use and land cover mapping, Disaster management Flood & Earth Quake, and Resource Inventory management,) Digital Image processing, its objectives and different steps in it. Introduction to LIDAR & Underground utility Survey.

Geographical Information System -Introduction, Definition, Objectives, Components (people, procedure, hardware, software & data) & functions (input, manipulation, management, querry & analysis and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster & vector) & aspatial data.

Introduction to vector and raster data analysis such as network analysis, overlay analysis etc. for vector, DEM, Management of aspatial data. Applications of GIS such as Visibility analysis, Slope analysis, Watershed analysis.& Preparation of thematic maps. Limitations of GIS.

Books Recommended:

1. Punmia B C, "Surveying" Vol.1 & 2 Laxmi Publications Pvt. Ltd., New Delhi, 2002.
2. Kanetkar T P and Kulkarni S V, "Surveying and leveling" Vol. I & II PVG Prakashan, Pune, 1994.
3. Basak N N , "Surveying and leveling" Tata McGraw Hill, New Delhi, 2000.
4. Agor R , "Surveying" Khanna Publishers, New Delhi, 1998.
5. Venkataramiah C, "A Text Book of Surveying" University Press, Hyderabad, 1998.
6. Surveying: Vol. II. and III by Dr. B. C. Punmia : Laxmi Publication - New Delhi.
7. Surveying and Levelling Vol. II by T. P. Kanetkar and S. V. Kulkarni Pune Vidyarthi Publication.
8. GPS Sattelite Surveying—Alfred Leick—Wiley
9. Remote sensing and Geographical Information System, By A. M. Chandra and S. K. Ghosh, Narosa Publishing House.
10. Remote Sensing & GIS,2/E—Bhatta-- Oxford University Press
11. Principles of Geographical Information System—Burrough-- Oxford University Press
12. Advanced Surveying -Total Station, GIS and Remote Sensing by Satheesh Gopi, R.Sathikumar and N. Madhu , Pearson publication

CEX-222 Surveying Laboratory [0 0 2 1] (modified)

1. To range a line between two stations.
2. Plotting of details in chain survey.
3. Plotting of traverse with a compass.
4. To determine the reduced levels of stations by height of instrument and rise and fall method.
5. Plotting of details using plane table by method of intersection and method of radiation.
6. Temporary and permanent adjustments of a Theodilite.
7. Measurement of horizontal angles using a Theodilite by method of repetition and method of reiteration.
8. Traverse adjustment using Gales' traverse table.
9. Total station
10. Study and use of nautical sextant and measurement of horizontal angles
11. Plotting of river cross-section by hydrographic surveying
12. Solution to three point problem by analytical method

CEX-442 Disaster Management (Open Elective - modified) [3 0 0 3]

Natural Disasters - Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, Volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management - Preparedness through (IEC) Information, education & Communication Pre-disaster stage (mitigation), Effect to mitigate natural disaster at national and global levels. International strategy for disaster reduction,

Emerging approaches in Disaster Management-Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community – based organizations and media.

Central, state, district and local administration, Armed forces in disaster response; Disaster response; Police and other organizations.

Course: Disaster management
Textbooks for reference

1) Disaster Management and Preparedness by Larry R. Collins (Taylor & Francis)
2) Global Challenges and local solutions by Rajib Shaw / R. R. Krishnamurthy
3) Disaster Management by Mukesh Kapoor
4) Disaster Management and Strategies Concept & Methods, Risk Reduction & Insurance, Experiences & Case Studies by Ashu Pasricha / Kiyanoush Ghalavand / Jai Narain Sharma
5) Earthquake & Natural Disasters by Manik Kar
6) Management and Mitigation of Natural Disasters by Rajan Kumar Sahoo / Tilottama Senapati
7) A Manual on Disaster Management by Parag Diwan
8) A practical guide to Disaster Management by A. K. Jain
9) Safety and Disaster Management Methods, Techniques, Recent Approach, Major Events & Exist Framework Hazardous Material by O. P. Dutta

Course: Disaster management
Online sources for reference

https://eulibraryblog.com/crisis-disaster-management-resources/
http://www.gdrc.org/uem/disasters/disenvi/index.html
http://nidm.gov.in/idrn.asp
http://www.wcpt.org/node/36995
https://www.tcyonline.com/video-tutorials-disaster-management/94374
https://www.smartzworld.com/notes/disaster-managent-notes-pdf-dm/

CEX- 446 Advanced Environmental Engineering [3 0 0] (modified)

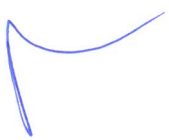
Water Pollution: Natural treatment Systems, Classification, Treatment Mechanisms
Air Pollution: composition, air of occupied rooms, discomfort, indices of thermal comfort, comfort zones, air pollution sources, pollutant, metrological conditions, indications of air pollution, health & other aspects of air pollution, prevention & control disinfections of air.
Land Pollution: Introduction, Causes, Site Investigation, Risk Assessment
Sustainability: Concept, Life Cycle Assessment
Ventilation: Concept, standard of ventilation, types of ventilation.
Lighting: Requirements of good lighting, measurement of light, natural lighting, light measurement units, measurement of day light, artificial lighting, method of artificial illumination, lighting standards.
Noise Pollution: Definition, effect of noise, Exposure, noise control.
Radiation: Source of radiation exposure, type of radiation, radiation units, Biological effect of radiation, radiation protection.
Housing: Criteria for good housing, house standards, rural housing, housing & health over crowding.
Excreta Disposal: Public health, importance, extent of problem how diseases is carried from excreta, sanitation barrier, method of excreta disposal, excreta disposal in un-sewered area.

Books Recommended:

1. Garg S K, "Environmental Engineering", Khanna publishers New Delhi,2003
2. Rao C S, "Environmental Engineering", McGraw Hill Book Company,2001
3. Metcalf and Eddy, "Waste Water Engineering- Treatment Disposal and Reuse", Tata- McGraw Hill Publishing company limited, New Delhi, 2003.
4. Masters G M, "Introduction to Environmental Engineering and Science" Prentice Hall of India, New Delhi.
5. Eckenfelder W W, "Industrial Water Pollution control" McGraw Hill, New Delhi, 1989.
6. Sharma, H. D. and Reddy, K. R., "Geo-environmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies". John Wiley & Son, 2004.
7. Allen, D. and Shonnard, D., "Sustainable Engineering: Concepts, Design, and Case Studies by", Prentice Hall, ISBN-10: 0132756544, ISBN-13: 9780132756549
8. Dotro, G., Langergraber, G., Molle, P., Nivala, J., Puigagut, J., Stein, O., Sperling, M. V., "Treatment Wetlands", IWA Publishing, ISBN: 9781780408774 (freely available on the internet).

Online Resources:

1. https://www.iwapublishing.com/books/9781780408767/treatment-wetlands
2. https://www.epa.gov/wetlands



CEX-311 Irrigation Engineering [3 0 0 3] (modified)

Introduction: Water shed and its management, its relation to hydrologic cycle (in brief), introduction about rain water harvesting and about the present need in Punjab.

Surface water hydrology - Rainfall and its measurement, mean rainfall, runoff; Flow measurements; Infiltration losses

Methods of Irrigation: Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta and crop relation, Duty of water, relation between delta, duty and base period, Soil crop relationship and soil fertility, sprinkler Irrigation – advantages & limitations, Planning and design of springler irrigation, Drip irrigation – advantages & limitations, suitability.

Canal Irrigation: Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages. Silt theories – Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy & Lacey's theories, suspended and bed loads.

Lined Canals: Types of lining, selection of type of lining, economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals methods of providing drainage behind lining.

Investigation and preparation of irrigation project: Classification of projects, project preparation investigations, design of works and drawings, concepts of multi purpose projects, Major, medium and minor projects, planning of an irrigation project, economics & financing of irrigation works documentation of project report, Present cutes of water changed by Irrigation Department from cultivation.

Tube Well Irrigation: Types of tube wells strainer type, cavity type and slotted type. Type of strainers, aquiclude, aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability, transmissibility and storage. Yield or discharge of tube well, assumptions, Theim & Dupuit's formulas. Interference of tube wells with canal or adjoining tube wells, optimum capacity. Duty and delta of a tube well. Rehabilitation of tubewells.

Books Recommended:

1. Singh Bharat, "Fundamentals of Irrigation Engineering" Nem Chand & Brothers, Roorkee, 1975.
2. Arora K R, "Irrigation Water Power & Water Resources Engineering" Standard Publishers Distributors, Delhi, 2002.
3. Garg S K, "Irrigation Engineering & Hydraulic Structures" Khanna Publishers, Delhi, 1995.
4. Varshney, Gupta & Gupta, "Irrigation Engineering & Hydraulic Structure" Nem Chand & Bros., Roorkee,1982.
5. Asawa G L, "Irrigation Engineering" Wiley Eastern Ltd., New Delhi,1993.
6. Subramanya K, "Engineering Hydrology" Tata McGraw-Hill, New Delhi, 2001.

CEX-310 Design of Hydraulic Structures [3- 0- 2-4] (modified)

Dams: Gravity dams, arch dams and earthen dams, also introduction about rivers and canal projects in Punjab.
Earth Dams: Components of earth dams and their functions, Phreatic line determination by analytical and graphical methods.
Theory of Seepage: Seepage force and exit gradient, salient features of Bligh's Creep theory, Lane's weighted Creep theory and Khosla's theory Determination of uplift. Pressures and floor thickness.
Gravity Dams-Non Overflow Section: Forces acting, Stability factors, stresses on the faces of dam, Design of profile by the method of zoning, Elementary profile of a dam.
Gravity Dams Spillways: Creagers profiles neglecting velocity of approach, profile taking velocity of approach into account, upstream lip and approach ramp, Advantages of gated spillways, Discharge characteristics of spillways.
Arch Dam: Classification of arch dam-constant radius constant angle and variable radius types, cylinder theory, expression relating central angle and cross-sectional area of arch. Types of buttress dams, advantages of buttress dams.
Energy Dissipation Devices: Use of hydraulic jump in energy dissipation, Factors affecting design, types of energy dissipation and their hydraulic design.
Dam's Safety: instruments, stress-strain meter, piezometric reading of seepage, seepage analysis, sensors.
Canal Falls: Necessity and location, types of falls and their description, selection of type of falls, principles of design, design of Sarda type, straight glacis and inglis or baffle wall falls.
Distributory Regulators: Off take alignment, cross regulators-their functions and design, Distributory head regulators - their functions and design, canal escape.
Cross Drainage Works: Definitions, choice of type, hydraulic design considerations. Aqueducts their types and design, siphon aqueducts their types and design considerations, super passages, canal siphons and level crossings.
Design of Weirs: Weirs versus barrage, design consideration with respect to surface flow, hydraulic jump and seepage flow. Design of a barrage or weir.
Tunnels: Head-race tunnel, diversion tunnel

Books Recommended:

1. Sharma S K, "Design of Irrigation Structures" S. Chand & Company (Pvt.) Ltd., New Delhi.
2. Murty C S, "Design of Minor Irrigation and Canal Structures" Wiley Eastern Ltd. New Delhi.
3. Garg S K, "Irrigation Engineering & Hydraulic Structures" Khanna Publishers, Delhi,1999.
4. Arora K R, "Irrigation Waterpower & Water Resources Engineering" Standard Publishers Distributors, Delhi, 2003.
5. Asawa G L, "Irrigation Engineering" Wiley Eastern Ltd., New Delhi 2001.

CEX-336 ***Engineering*** **Hydrology** **[3 0 0 3] (modified)**

Introduction, Precipitation, Importance of hydrological data in water resources planning. The hydrologic cycle. mechanics of precipitation, types and causes, measurement by rain gauges, Gauge net-works, hyetograph, averaging depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves, depth area-duration curves.

Interception, Evapo-transpiration and infiltration: Factors affecting interception. Evaporation from free water surfaces and from land surfaces, transpiration, Evapo-transpiration.

Infiltration-Factors affecting infiltration, rate, infiltration capacity and its determination.

Runoff: Factors affecting runoff, run-off hydrograph, unit hydrograph theory, S-curve hydrograph, Synder's synthetic unit hydrograph.

Peak Flows: Estimation of Peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph, Principles of flood routing through a reservoir by ISD method (description only).

Dam's hydrology: Outflow hydrograph of dam, stage hydrograph, flow routing, topography and flood inundation using Arc GIS.

Ground water hydrology - Introduction, types of aquifers, wells, well yield

Books Recommended:

1. Subramanya K, "Engineering Hydrology" Tata McGraw-Hill, New Delhi, 2001.
2. Wilson E M, "Engineering Hydrology" ELBS, English Language Book Society/Macmillan Education Ltd. London, 1999.
3. Raghunath H M, "Hydrology" Wiley Eastern, New Delhi, 2000.
4. Pence V M, "Hydrology – Principles and Practices" Prentice Hall, New Jersy. , 1998.
5. Karanth K R, "Hydrology" Tata McGraw Hill, New Delhi 2001.
6. ArcGIS software (prefer latest version).

CEX 449- Smart Cities (new departmental elective)

Introduction to smart cities, Concept, Need and importance, Benefits of smart cities, Features & components of a smart city, Strategies to be adopted, Characteristics and factors of smart cities, Smart structures, Classification of smart structures, Challenges faced in developing smart cities, Scope of smart cities

Introduction to Smart Materials and buildings: Natural materials, Sustainable materials, Orientation of buildings, Sustainable buildings- Concept of green buildings, Features of green building rating systems in India: LEED, GRIHA. Sustainable site, Green home rating system, Green neighborhood concept, Concept of Net zero energy building, Net zero community.

Power and energy requirements: Energy, material and indoor environmental issues for smart buildings, Alternate sources of energy, Renewable sources-biomass, geothermal, wind, solar, water, green fuels, Sustainable energy uses, Energy efficient techniques, Smart electricity, Smart Grid, Utility metering, substation automation.

Smart City Framework: Smart Transport, Concept of smart transportation, Challenges Faced, Intelligent Transport systems- Background, Technologies, IT applications, periodic traffic forecasts, Smart Traffic Signals, Smart Transport Cards, Smart Parking, Electric vehicles, Hybrid vehicles, charging stations, Urban transport systems, Vehicle tracking systems, Integrated traffic management, Examples.

Smart Water and Waste Management: Integrated water management, Solid waste management, Smart utility services, Water harvesting, Water pollution monitoring systems, Energy Optimization System for wastewater treatment, Smart water networks, Recycling systems and technologies, Waste to energy equipment, Sensor Based Waste Storage and Collection, Automated waste collection systems.

Recommended Books:

1. Smart rules for smart cities by Eleonora Riva Sanseverino, Raffaella Riva Sanseverino, Valentina Vaccaro, Gaetano Zizzo By Springer
2. Smart Cities and Homes: Key Enabling Technologies,by Mohammad S. Obaidat and Petros Nicopolitidis (Elsevier)
3. Building Smart Cities: Analytics, ICT, and Design Thinking by Carol L. Stimmel
4. Redefining Indian smart and sustainable cities, Prof. Charanjit Singh, Ik International publishing house

New Proposed Subject (Elective)

CEX-450 Fluvial Hydrodynamics [3 0 0 3]

Introduction to sediment: Physical properties of fluid and sediment, origin and properties of sediments, nature of problems.

Fluvial hydraulics: Scour criteria and problems: regimes of flow, Shields curve, incipient motion of sediment particles, terminal fall velocity of sediment in fluid, alluvial bed forms and Resistance to flow.

Sediment transport: Bed load, suspended load and total load transport, Meyer-Peter approach, du Boys' approach, Einstein's approach, Engelund and Fredsøe's approach, sediment samplers, design of stable channels, alluvial stream and their hydraulic geometry.

Turbulence in Open-Channel Flows: Decomposition and averaging procedure, equation of motion (Reynolds equations), Prandtl's mixing length theory, hypothesis of von Kármán, velocity distribution, the linear law in viscous sub-layer, the logarithmic law in turbulent wall shear layer, law in buffer layer, log-wake law and velocity defect law, turbulence intensity, calculation of bed shear stress using bed slope, velocity distribution, average velocity, Reynolds shear stress distribution, turbulent kinetic energy distribution.

River Training Works: Objectives, classification of river training works, design of guide banks, groynes or spurs their design and classification ISI Recommendations of approach embankments and afflux embankments, pitched islands, artificial cut-offs, objects and design considerations, river control-objectives and methods.

Sediment control: Silt management, management of canal in Punjab, Bhakra calal, delta formation.

Books Recommended:

Dey, Subhasish, "Fluvial Hydrodynamics" 2014, Springer, India

Garde, R.J., Raju, K.G.R, "Mechanics of Sediment Transportation and Alluvial Stream Problems" 1985, Wiley Eastern Ltd.

Yang, C.T., "Sediment Transport: Theory and Practice." 1996, McGraw-Hill, USA.

Yalin, M.S., "Mechanics of Sediment Transport" 1977, Pergamon Press, Oxford.

CEX 451 – Green Technology (open elective - new)

Energy sources: Introduction to nexus between Energy, Environment and Sustainable Development; Energy transformation from source to services; Energy sources, sun as the source of energy; biological processes; photosynthesis; food chains, classification of energy sources, quality and concentration of energy sources; fossil fuel reserves - estimates, duration; theory of renewability, renewable resources; overview of global/ India's energy scenario.

Green Energy and sustainable development: The inseparable linkages of life supporting systems, biodiversity and ecosystem services and their implications for sustainable development; global warming; greenhouse gas emissions, impacts, mitigation and adaptation ; future energy Systems- clean/green energy technologies; International agreements/conventions on energy and sustainability - United Nations Framework Convention on Climate Change (UNFCC); sustainable development;

Green building and roads: Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Green Composites for buildings: Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment. Green roads and its construction procedure.

Green Chemistry: Introduction to Green Chemistry: Principles of Green Chemistry, Reasons for Green Chemistry (resource minimisation, waste minimisation, concepts), Green reactions solvent free reactions, Catalyzed (heterogeneous/homogeneous) reactions, MW/ Ultrasound mediated reactions, Bio catalysts etc

Green Nanotechnology: Introduction to nanomaterials: Nanoparticles preparation techniques, Nanomaterials for "Green" Systems: Green materials, including biomaterials, biopolymers, bioplastics, and composites Nanotech Materials for Truly Sustainable Construction: Windows, Skylights, and Lighting. Paints, Roofs, Walls, and Cooling.

References:

1. Energy and the Environment, 2nd Edition, John Wiley, 2006, ISBN:9780471172482; Authors: Ristinen, Robert
A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A., Publisher: Wiley, Location: New York, 2006.
2. Energy and the Challenge of Sustainability, World Energy assessment, UNDP, N York, 2000.
3. Global Energy Perspectives : Edited by Nebojsa Nakicenovic, Arnulf Grubler and Alan McDonald, Cambridge University Press, 1998.
4. Energy: Science, Policy, and the Pursuit of Sustainability by Robert Bent, ISBN13: 9781559639118, ISBN10:1559639113, 2002.
5. K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
6. Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
7. Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C.
Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008.
8 James H.Clarke & Duncan Maacquarrie, Handbook of Green Chemistry and Technology, Wiley-Blackwell; 1
edition (2002)
9. Paul T.Anastas and John C. Warner, Green Chemistry: Theory and Practice, Oxford University Press, USA
(2000)
10. Nanotechnology for Photovoltaics, by Loucas Tsakalakos, ISBN:9781420076745, Publisher: CRC Press,
Publication Date: April 2010.
11. Dahl, 1. A.; Maddux, B. L. S.; Hutchison, 1. E. Toward Greener Nanosynthesis. Chemical Reviews, 2007, 107, 2228-2269.
12. Nanomaterials, nanotechnologies and design: an introduction for engineers By M. F. Ashby, Daniel L. Schodek, Paulo J. S. G. Ferr
13. Nanoscale materials By Luis M. Liz-Marzán, Prashant V. Kamat
14. Environmental applications of nanomaterials: synthesis, sorbents and sensors By Glen E. Fryxell, Guozhong Cao

CEX 452 RURAL ROADS (new departmental elective) (3-0-0-3)

SYLLABUS

Introduction
Definition& distinctions between rural roads and highways, Indian scenario – road development plans of GOI, PGMSY-phase I,II,III, NRRDA

Geometric Design
Speed, typical cross-section, road width, camber, sight distance, longitudinal gradient

Structural Design
Traffic conditions, Assessment of sub-grade and construction materials, Design methodology specification, premises of rural roads

Construction
Equipment for construction, suitability of local construction materials for sub-base and base coarse, compaction of different layers, quality control

Stabilized soil roads
Use of lime, flyash, cement, bitumen etc – their influence on soils, advantages of agglomeration, OMC, MDD, CBR, conjugation methodology including curing.

TEXT BOOKS:
1. IRC-2010, rural roads Manual, Indian Road Congress

REFERENCEBOOKS:
1. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management.
2. Guidelines of Ministry of Road Transport and Highways, Government of India.

CEX 453 - Environmental Geo-technology (new departmental elective) (3- 0-0-3)

Introduction, Sources & Impact of Contamination, Waste – Soil Interaction, Solid Waste Generation and Disposal, Waste Minimization by Integrated Solid Waste Management (ISWM), Principles of Landfilling, Planning of Landfills, Liners for Landfills, Covers for Landfills, Generation and Control of Leachate and Landfill gas, Stability of Slopes, Settlement of Landfills, Subsurface Monitoring Around Landfills, Cost of Geotechnical Components of Landfills, Construction and Operation of Landfills, Site Selection for Landfills, Closure, Rehabilitation and Expansion of MSW Landfills, Control and Remedial Measures at Contaminated Sites, Slurry Disposal on Land, Disposal of Slurry Waste in Ponds & Impoundments and Dry Waste in Mounds, Geotechnical Properties of Coal Ash & Mine Tailings, Planning & Design of Slurry Ponds, Stability of Incrementally Raised Embankments, Remedial Measures for Slope Failures in Embankments / Dykes of Slurry Ponds, Environmental Control Measures at Slurry Ponds, Geotechnical Reuse of Waste Materials.

Reference books:

1. Daniel, D.E., Geotechnical practice for waste disposal, Chapman and Hall, 1993.
2. Datta, M., Waste disposal in Engineered landfills, NarosaPublishers, 1998.
3. Qian, X., Koerner, R., and Gray, D.H., Geotechnical aspects of landfill design and construction, Prentice Hall, 2002.
4. Vick, S.G., Planning, analysis and design of tailings dams, John Wiley & Sons, 1990.
5. Gulhati, S.K. and Datta M., Geotechnical Engineering, McgrawHill, 2005.

New/modified syllabi for electives in M. Tech. existing scheme

Enclosure #4

CE 515 - Advanced Numerical Methods (new department elective) (3-0-0-3)

- Introduction
- Solutions to linear equations, properties of matrices, Eigen values and Eigen vectors, solutions of linear systems; direct methods and iterative methods, Computation of Eigen values, solutions to the problems using programming languages (C, C++, FORTRAN, MATLAB)
- Solutions of non linear equations, importance of non linear equations, different numerical techniques to solve non linear equations (Newton Raphson method, secant method, Aitken method)
- Approximation of functions. Introduction, Taylor series, least squares, legendre polynomials, regression analysis
- Numerical differentiation and integration, ODE and PDE, truncation errors

Recommended Books:

- Moin, P., 2001, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, New York
- Hoffman, J.D., 2001, Numerical Methods for Engineers and Scientists - Second Edition, Marcel Dekker, Inc., New York
- Chapra, S. and R. Canale, 2001, Numerical Methods for Engineers: With Software and Programming Applications, McGraw-Hill, New York
- Abbot, M.B. and A.W. Minns, 1994, Computational Hydraulics, Ashgate Pub. Co.
- Chapra, , 1997, Surface Water Quality Modeling, McGraw Hill
- Chaudhry, M. H. 1993. Open-Channel Flow. Prentice-Hall, Inc.
- Chaudhry, M.H., 1987, Applied Hydraulic Transients, Van Nostrand Reinhold
- Cunge, J.A., F. M. Holly, Jr., and A. Verwey, 1980, Practical Aspects of Computational River Hydraulics, Pitman Publishing Limited, London (reasonably-priced, paperback copy available here)
- Julien, P.Y., 2002, River Mechanics, Cambridge University Press, New York
- Vreugdenhil, C.B., 1989, Computational Hydraulics - An Introduction, Springer-Verlag, Berlin
- Smith, G.D., 1985, Numerical Solution of Partial Differential Equations: Finite Difference Methods - Third Edition, Clarendon Press, Oxford
- Guha, S. and Srivastav, R., 2010, Numerical Methods: For Engineering and Science, Oxford University Press, India

CE-506 Earthquake Resistant Design of Structures [3 0 0 3] (modified)
Behaviour of buildings and structures during past earthquakes and lessons learnt, goals of earthquake resistant design. Linear static procedure for seismic load calculation – IS 1893 –2016, combination of gravity and seismic action. Multimodal and Multidirectional response spectrum analysis. Earthquake resistant measures at planning stage: Geotechnical and architectural considerations, irregularities, earthquake resistant measures in sloping roofs, staircase, foundations and general construction details IS : 4326 –1993, principals of earthquake resistant design – behaviour of concrete and steel, confined concrete, the capacity design method; Study of IS 13920 – 2016, behaviour of masonry structures during earthquakes, analysis and behaviour of masonry infilled RC frames, earthquake resistant measures in masonry buildings.

Books Recommended:
1. Dowrick D J "Earthquake Resistant Design for Engineers and Architects" John Wiley and Sons, New York, 1987.
2. Dowrick D J "Earthquake Risk Reduction" John Wiley and Sons, New York, 2003.
3. Englekirk R E "Seismic Design of Reinforced and Pre-cast Concrete Buildings" John Wiley and Sons, New York, 2003.
4. Pauley T and Priestley M J N "Seismic Design of Reinforced Concrete and Masonry Buildings" John Wiley and Sons, New York, 1992.
5. Key D "Earthquake Design Practices for Buildings" Telford Publishers, London, 1990.

CE 517 HIGHWAY CONSTRUCTION AND MAINTENANCE (3 – 0 – 0 – 3) (new departmental elective)

COURSE OBJECTIVES:

- To give an overview of highway engineering with respect to the development, design, construction and maintenance of highways
- To know about the pavement materials and design
- To study about the types and components of pavements
- To study the design of Rigid & Flexible pavements
- To study the modern construction practices of Rigid pavement and Flexible pavement
- To study how to assess and evaluate the condition of pavement for distresses and failures
- To study how to repair, retrofit, rehabilitate a pavement against maintenance and strengthening works

COURSE CONTENT:

PAST CONSTRUCTION PRACTICES OF FLEXIBLE AND RIGID PAVEMENTS: Past construction practices; Construction of Earth road, Construction of Gravel road, Construction of WBM & WMM roads.

4

DESIGN OF FLEXIBLE AND RIGID PAVEMENTS:

Design principles, pavement components and their role, Design practice for flexible and rigid pavements (IRC method).

12

HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE:

Prevalent construction of Asphalt roads; premix carpet roads, mastic asphalt construction, dense mix macadam topping, bituminous concrete roads. Modern construction techniques with modified bitumen. Prevalent construction practices of Rigid pavements; JPCP, JRCP, CRCP & PCP. Modern construction techniques with admixed concrete. Recycling, Different materials – Glass, Fibre, Plastic, Geo-Textiles, Geo-Membrane - Highway drainage – Special considerations for hilly roads.

12

EVALUATION AND MAINTENANCE OF PAVEMENTS:

Pavement distress in flexible and rigid pavement, Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements, Strengthening of pavements, Types of maintenance. Maintenance techniques; repair, retrofitting and rehabilitation.

12

Total 40 lectures

REFERENCES:

- Khanna.K and Justo.C.E.G. Highway Engineering, Khanna Publishers, Roorkee, 1994.
- Arora.N.L. Transportation Engineering, New India Publishing Home, 1996.
- Sharma.S.K Principles, Practices and Design of Highway Engineering, S.Chand and Company Ltd.1995.
- O"Flaherty.C.A Highways, Butterworth – Heinemann, Oxford,2006.
- Clarkson.H Oglesby and R.Gary Hicks, Highway Engineering, John Wileysons, 1992.

- Yoder and Witezak, Principles of pavement design, John Wiley and sons, 1975 Yang, Design of functional pavements, Mc Graw -Hill, 2004.
- IRC: 58, Guidelines for the Design of Rigid Pavements for Highways
- IRC:37, Guidelines for the Design of Flexible Pavements

COURSE OUTCOMES:

On completion of the course, the students will be able to:

- Identify the pavement components used in modern construction of pavements. Determine the characteristics of pavement materials.
- Design the flexible pavement and Rigid pavements using IRC specifications.
- Find out whether the pavement need which type of maintenance and apply knowledge to assess the condition of pavement in quantitative form.
- Describe the procedure for strengthening, repairing and retrofitting of pavement.

CE 518 - Theory of Plates and Shells (new departmental elective) (3-0-0-3)

Course Objectives:

To achieve fundamental understanding of the classical theory of plates and shells, address importance of plate and shell structures, introduce analytical solutions and numerical techniques and present detailed design of plate as well as shell structures.

Course Outcome:

To enable students to apply the theory of plates and shells to problems, involving various geometries, loading and boundary conditions, to diverse problems in civil engineering and other related fields such as aerospace and mechanical engineering.

Syllabus

Plates: Introduction, Classification of plates, Governing equation of thin rectangular plate, Navier's Method of solution for Rectangular Plates subjected to point load, uniformly distributed load, patch load and linear hydro-static load, Levy's Solution, Bending of Orthotropic plates and Governing equation of thin rectangular plate, Analysis and Design of Grid flat thin slab system, Governing equation of Circular plate, Triangular plate and Elliptical plate, Structural behaviour of Folded plate roofs, Slab-beam analysis of folded plates, The vibration of plates.

Shells: Introduction, Type of shells, Equation of equilibrium of Spherical Shells, Design of Spherical shells with/without circular ring beam, Equation of Equilibrium of Conical Shells, Umbrella Shells, Conical water tank, Design of conical roof including edge beam, Equation of Equilibrium of cylindrical shells, Semi-circular shells, Circular cylindrical shells under axisymmetric loading, Analysis of doubly curved shells, Hipped roof.

References

1. S. P. Timoshenko, and S. W. Krieger "Theory of Plates and Shells," McGraw-Hill, 1959.
2. B.K. Chatterjee, Theory and Design of Concrete Shells" Spon Press; Revised edition, 1988.
3. E.H. Mansfield "The Bending and Stretching of Plates," 2nd edition, Cambridge University Press, 1989.
4. H. Kruas, Thin Elastic Shells, John Wiley & Sons Ltd, 1968.
5. G.S. Ramaswamy, Design and Construction of Shell Structures, CBS Plublishers, New Delhi, 1996.
6. E. Ventsel, and T. Krauthammer, Thin Plates and Shells: Theory, Analysis, and Applications, 1st Edition, CRC Press, 2001
7. K. Chandrasekhara, Analysis of Thin Concrete Shells, Oxford and IBH, Kolkata, 1971.
8. J.N. Bandopadhyay Thin Shell Structures, New Age International Publishers, New Delhi, 1986.
9. IS 2210-1988, Criteria for design of reinforced concrete shell structures and folded plates, Bureau of Indian Standards, New Delhi.

CE 519 Geospatial Technologies (new departmental elective) (3-0-0-3)

The course introduces global positioning systems, remote sensing, and light detection and ranging technology and their integration with Geographic Information Systems.

Course Objectives:

The goals of this course are to:

- Provide knowledge about the fundamentals of remote sensing, sensor systems and image characteristics
- Provide knowledge about the GPS system and its components, the GPS signal structure, the types of GPS measurements and their errors and biases.
- Provide an introduction to LIDAR data and discusses how to integrate and manage LIDAR data in GIS
- Enhance student understanding of characteristics of spatial data that come from different sources
- Enhance student understanding of data quality issues when integrating different data sources in GIS.

Course Syllabus:

Geospatial Overview: Introduction to Geospatial Technology, Why to study, Geospatial Technology, Importance of Geospatial Technology.

Mapping & Cartography: What is Map & its Importance, Map Scale and Types, Elements of Map and Indexing, Map Coordinate System, Interpretation of Satellite Images.

Remote Sensing: Introduction, Spectral Reflectance Signature, Digital Image Processing, Visual Interpretation of Satellite data, Aerial Photo and Its Interpretation, Advanced Remote Sensing Technologies, Advantages and Benefits of RS, Overview on Remote Sensing Technology, Fundamentals of Remote Sensing, Physics of Electro Magnetic Energy, Remote Sensing Platforms, Sensors and Data Products, Remote Sensing Applications, Indian Remote Sensing Systems.

Geographic Information System (GPS): Introduction, Digital Cartography, Advantages and Benefits of GIS, GPS Accuracy and Accuracy factors, Types of GPS, List of Global Navigation System, GPS Today & Limitations of GPS, Uses of GPS Technology. GIS Data Element and Data Structure, Fundamentals of Database Concept, Data Input to GIS System, GIS Data Editing, Attribute Data Linking, Spatial and Non Spatial data Analysis, Map Projection and Coordinate System, Applications of GPS.

Geographical Information System (GIS), Fundamentals of GIS, Components of GIS. GIS Acquisition of GIS, Data Types of GIS, Application of GIS.

Trends in Geospatial Technology: Introduction, Remote Sensing Trends & Technology, GIS Trends & Technology, Web Based GIS, Enterprise GIS, Mobile GIS, 3-D Visualization and Fly through, Open GIS, GPS Trends & Technology.

Applications of Geospatial Technology: Water shed Studies, Flood Studies, Ground water Studies, Health Issues, Utility Studies, Security and Defense Studies, Urban and infrastructure Studies

Course Outcomes:

Upon successful completion of the class, students should be able to:

- Critically evaluate and analyze data quality for their GIS project
- Design a geo-database and defend the data type selection
- Appraise the degree to which remote sensing data can be used efficiently and effectively
- Interpret the GPS signal and the factors that affect signal quality
- Interpret the significance of Dilution of Precision and its effect on position accuracies and evaluate correction techniques
- Decide and defend the use of raster versus terrain when performing analysis with LIDAR data

- Combine LIDAR data with multiple data sources to create more complex three-dimensional surfaces

Textbooks:

Ahmed El-Rabbany; Introduction to GPS: The Global Positioning System, Second Edition; published by Artech House; ISBN 978-1-59693-017-9

David L Verbyla; Satellite Remote Sensing of Natural Resources; Published by CRC Press; ISBN 1-55670-107-4

Proposal for new M. Tech. program in Geotechnical and Geo-environmental Engineering

Enclosure #5

Proposal for New M Tech Program

Program Name: **Geotechnical and Geoenvironmental Engineering**

The department is having very good infrastructural facilities in the area of geotechnical and environmental engineering and sufficient well-qualified faculty members in the proposed area. To enhance R & D and Consultancy activities in the department, it is proposed to start a new M Tech Program in Geotechnical and Geoenvironmental Engineering.

Significance of the Program

There are two major reasons for the development of environmental geotechnology. First is population growth, and second is rising living standards. When population increases, more land is needed; many soil deposits previously claimed to be unfit for residential housing and other construction projects are now being used. In a progressive society, rising projects are now being used. In a progressive society, rising living standards indicate an increase in industrial growth. As a consequence, hazardous pollution of air, water, and land and urban refuse production become inevitable, thereby endangering the global environment. To cope with these problematic soil deposits and adverse environmental conditions, the present conventional construction technology has to take, by necessity, a new direction. Problematic soil deposits on one hand and ground pollution problems on the other have challenged the current soil mechanics concepts and methods of analyzing soil behavior under varied environmental conditions. For this reason, the environmental aspects of geotechnology have been expanded and their subsequent response to engineering behavior has paved the way for the emergence of Environmental Geotechnolgy.

Teaching Scheme

The following scheme is proposed

a. 6 core courses and 6 electives
b. 1st semester: 3 core courses and 2 electives and two laboratory courses
c. 2nd semester: 3 core courses and 2 electives and two laboratory courses
d. 3rd semester: 2 electives, independent study and dissertation-part I
e. 4th semester: dissertation- part II

Core Courses

Engineering Behaviour of Soils
Analysis and Design of Foundations
Soil Dynamics and Machine Foundations
Solid and Hazardous Waste Management
Geoenvironmental Engineering
Environmental Risk Assessment
Materials Testing and Characterization Laboratory
Soil Engineering Laboratory
Advanced Water and Wastewater Laboratory
Simulation Laboratory
Independent Study
Dissertation

Elective Courses

Ground Water Hydrology
Mechanics of Sediment Transport
Water Resources Systems
Geosynthetics
Geotechnical Investigations and Ground Improvement
Landfills and Ashponds

Earth Dams and Stability of Slopes
Emerging topics in Geotechnical Engineering
Pavement Design
Rock Mechanics
Engineering Geology
Advanced Solid Mechanics
Environmental Impact Assessment
Environmental System Analysis
Contaminant Fate and Transport
Natural treatment Systems

Formal approval for P.G. research laboratories

Enclosure #6

Dr B R AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY
JALANDHAR – 144 011 (PB), INDIA
DEPARTMENT OF CIVIL ENGINEERING
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NITJ/CED/2017/.....

Date...8.2.2018.....

Subject: Establishment of Geotechnical Engineering (PG Research Laboratory).

Geotechnical Engineering (PG Research Laboratory) for Post-graduate Research has been established in the department. The following equipments/research facilities have been added, which have been/being extensively used by the students of the Department.

- LARGE DIRECT SHEAR Upgraded: JUNE/2013 (Crane included for easy operation i.e. lifting and placing the heavy assembly)
- ELECTRONIC TRIAXIAL TESTING MACHINE-Upgraded: JUNE/2013
- CALIFORNIA BEARING RATIO TEST (DOP: 15/06/2012)
- REACTION FRAME for Determination of bearing capacity of soil for allowable settlement under vertical static loads at shallow foundation. Capacity : 250 kN
- UNIVERSAL TESTING MACHINEUpgraded: JUNE/2013 for Tests on geosynthetic and geofibers
- SWELL PRESSURE TEST-JULY/2016
- LABORATORY VANE SHEAR TEST-D.O.P: 08/12/2015
- REACTION FRAME for Determination of bearing capacity of soil for allowable settlement under horizontal and eccentric loads at shallow foundation.

Using the research facilities created by the undersigned, 07 Research Scholars have **completed PhD** degrees and PhD of 05 more students is in progress. More than 40 students have completed their M Tech dissertation work using this facility in addition to PG lab (Foundation Engineering Lab) of M Tech programme.

It is, therefore requested that it may be placed in the BoS for formal approval.

Arvind K Agnihotri
Professor & Head

Secretary BoS

Dr B R AMBEDKAR NATIONAL INSTITUTE OF TECHNOLOGY
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8 February 2018

Subject: Establishment of New Laboratory- Approval of Board of Studies.

It is submitted that I have developed Concrete Technology (PG Research Laboratory) for Post-graduate Research since 2007. The following equipments/research facilities have been added, which have been/being extensively used by the students of the Department.

- Diamond Saw Cutting Machine
- Core Cutting /Drilling Machine
- Temperature Control Curing Tanks
- Temperature and Humidity Control Chamber
- Workability Testing of Self Compacting Concrete
- Modification to Reaction Frame
- Servo-controlled Actuator (250kN)
- PC Automation for Servo-controlled Actuator
- Data Acquisition System
- Accelerated Curing Tank
- Concrete Impermeability
- Accelerated Carbonation
- Natural Carbonation Shelter
- Initial Surface Absorption Test
- Capillary Suction Test
- Half-cell Digital Corrosion Meter
- Rapid Chloride Permeability Tester
- Oxygen Permeability
- Autoclam Permeability
- Digital Rebound Hammer
- Ultrasonic Pulse Velocity Tester
- Muffle Furnace
- Mercury Intrusion Porosimeter

Using the research facilities created by the undersigned, the following Research Scholars have completed PhD degrees:

1. Vineet Bajaj- Flexural Fatigue Strength of Steel - Polypropylene Hybrid Fibre Reinforced Concrete (2011).
2. Sanjay Goel- Flexural Fatigue of Plain and Steel Fibre Reinforced Self Compacting Concrete (2012).
3. Gurbir Kaur- Flexural Fatigue Performance of Steel Fibre Reinforced Concrete Containing Cement Additives (2013).
4. Raman Bedi- Flexural Fatigue Studies on Fibre Reinforced Polymer Concrete Composites (2014).

8.2.18

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5. M P Singh- Water Permeability and Strength Characteristics of Hybrid Steel Fibre Reinforced Concrete (2015).
6. Sumit Arora- Flexural Fatigue Performance of Concrete made with Recycled Concrete Aggregates (2017).
7. Navdeep Singh- Carbonation Resistance of Self Compacting Concrete containing Recycled Concrete Aggregates (2017).
8. Kanish Kapoor- Durability Properties of Self Compacting Concrete made with Recycled Concrete Aggregates (2017).
9. Rahul Sharma- Strength and Durability Properties of Self Compacting Concrete Containing Copper Slag as Fine Aggregates (Submitted).

The following Research Scholars are presently working for their PhD degrees.

1. Shailja Bawa- Flexural Fatigue Performance of Steel-Polypropylene Hybrid Fibre Reinforced Self Compacting Concrete.
2. Dilraj Singh- Properties of Pervious Concrete made with Recycled Concrete Aggregates and Cement Additions.
3. Jagmeet Singh- Use of Copper Slag as Binder in Geopolymer Concrete.
4. Raghubir Singh- High Performance Concrete Containing Copper Slag as Fine Aggregates.
5. C K Devi- Mechanical and Durability Characteristics of Graphene Oxide Reinforced Concrete Composites Containing Recycled Coarse Aggregates.
6. Babanpreet Singh- Geopolymer Concrete Composites (Tentative)

In addition, more than 40 MTech Students have also completed their dissertations.
It is, therefore, requested that it may be placed in the meeting of the Board of Studies of the Department for formal approval.

S P Singh 8.2.18
Professor

Head of Department

Secretary BoS