

**END TERM EXAMINATION**

FIFTH SEMESTER [B.TECH] DECEMBER 2015

Paper Code: ETCE-303

Subject: Advance Structural Analysis

Time: 3 Hours

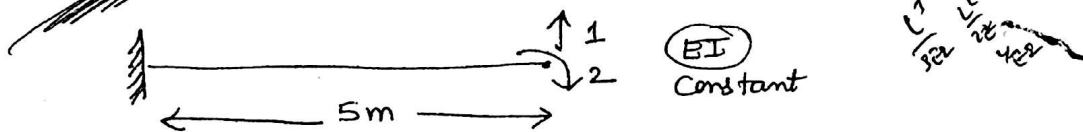
Maximum Marks: 75

Note: Attempt any five questions including Q.no.1 which is compulsory.

Q1 Attempt any five questions:

(5x5=25)

- (a) What is an arch? Define on the basis of material, section, shapes etc.  
 (b) What is Horizontal thrust in an arch? Find horizontal thrust in a circular arch of length  $2R$  and loading  $w/m$  on its complete span.  
 (c) What are curved beams? How they are different from arches?  
 (d) Differentiate between stiffness and flexibility of an structural member.  
 (e) Derive flexibility matrix of a cantilever w.r.t to shown coordinates below.



- (f) Derive formula for static indeterminacy for a space truss with all assumptions.  
 (g) What is principle of virtual work?

Q2 (a) For arches with springing at different level prove that:

(5)

$$\frac{l'}{l} = \sqrt{\frac{y'_c}{y_c}}$$

where  $l$  &  $l'$  are lengths of spans at different springing level's and  $y'_c$  &  $y_c$  are crown heights.

- (b) A three hinged circular arch of span 16 m and rise 4 m is subjected to two point loads 100 kN & 80 kN at left and right quarter span points respectively. Find reactions at supports and BM, Radial shear and Normal thrust at 6 m from left support. (7.5)

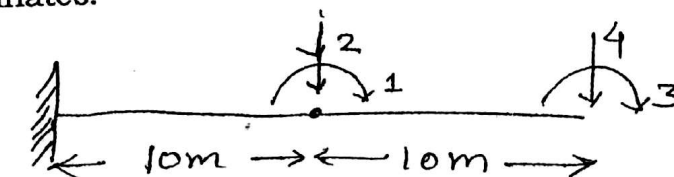
Q3 (a) What is 2 hinged parabolic arch? Derive its horizontal thrust equation. (6)

$$H = \frac{\int_0^l \mu y dx}{\int_0^l y^2 dx}$$

where  $\mu$  is beam moment.

- (b) Derive flexibility matrix of a cantilever having 3 degree of freedom at free end. (6.5)

Q4 Develop flexibility and stiffness matrix of following beam w.r.t to shown coordinates. (12.5)

show that  $[K] [f] = [I]$ .

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FIFTH SEMESTER [B.TECH] DECEMBER 2015-JANUARY 2016

Paper Code: ETCE-305

Subject: Design of Steel Structure

Time: 3 Hours

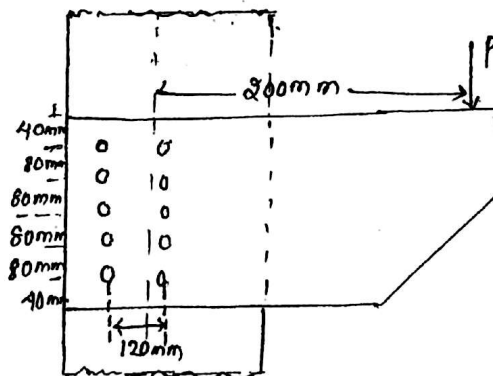
Maximum Marks: 75

**Note: Attempt any five questions including Q.no.1 which is compulsory.**  
**IS: 800: 2007 allowed. Steel table allowed. Appropriate assumption allowed in design question.**

- Q1 Answer all: (5x5=25)
- A 20 mm thick plate is joined to a 18 mm plate by 200 mm long (effective) butt weld. Determine the strength of joint if a single -V butt weld is used.
  - Design the axial load capacity of the column ISHB300@577 N/m if the length of column is 3 m and its both ends are pinned.
  - (i) When plate girder is preferred over rolled section? With neat sketch show various component of plate girder.  
(ii) Write a short note on web crippling.
  - Determine the collapse load of fixed beam with udl (length = L, unit weight = w, Total weight = W) using static and kinematic method.
  - Derive the expression for shape factor of hollow circular section.
- Q2 Design a double angle section to carry a tension of 300 KN. The end connection is to be made using M 20 bolts of product grade C and property class 5.6. Assume that angle are provided on both sides of gusset. The yield and ultimate strength of steel are 250 MPa and 410 MPa, respectively. (12.5)

**OR**

- Q3 Determine the safe load P that can be carried by the joint shown in figure given below. The bolts used are 20 mm diameter of grade 4.6. The thickness of the flange of I-section is 9.1 mm and that of bracket plate 10 mm. (12.5)



- Q4 Design a battened column with two channel back to back of length 10 m to carry an axial factored load of 1400 KN. The column may be assumed to be restrained in position but not in the direction at both ends. (12.5)

**OR**

- Q5 Design a single angle discontinuous strut to carry a factored axial compressive load of 65 kN. The length of strut is 3 m between intersections. It is connected to 12 mm thick gusset plate by 20 mm diameter 4.6 grade bolts. Use steel of grade Fe410. (12.5)

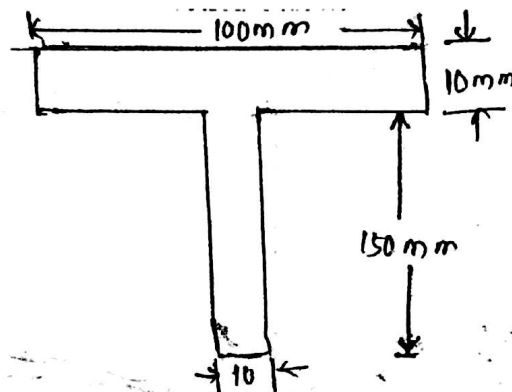
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- Q6 Design a steel beam section for supporting roof of a big hall for the following data and apply the usual checks. Assume steel grade Fe410. (12.5)
- (a) Clear span = 6 m
  - (b) End bearing = 150 mm
  - (c) c/c spacing of beam = 3 m
  - (d) Imposed load on the beam = 10 kN/m<sup>2</sup>
  - (e) Dead Load (including self weight) = 4 kN/m<sup>2</sup>.
  - (f) Restriction on beam depth = 375 mm
- The compression flange of beam is laterally supported throughout.

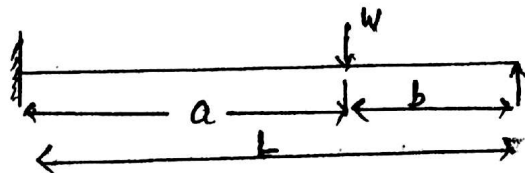
**OR**

- Q7 Design a welded plate girder of span 24 m to carry superimposed load of 35 kN/m. Avoid use bearing and intermediate stiffeners. Use Fe415 (E250) steel. (12.5)

- Q8 (a) Find the shape factor of T - section below. (8)

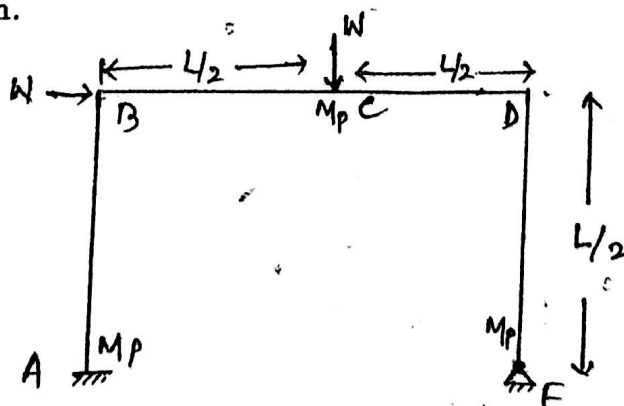


- (b) Find the collapse load 'W' in the figure given below using static and dynamic method. (4.5)



**OR**

- Q9 Find out collapse load 'W' for a portal frame shown in figure given below. The beam and column are of same cross section. Also draw the plastic moment diagram. (12.5)



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FIFTH SEMESTER [B.TECH] DECEMBER 2015-JANUARY 2016

Paper Code: ETCE-307

Subject: Engineering Hydrology

Time: 3 Hours

Maximum Marks: 75

Note: Attempt any five questions including Q.no.1 which is compulsory.  
Select one question from each unit.

Q1 Answer any five questions providing sketches wherever applicable: (5x5=25)

- (a) Describe the hydrologic cycle, and explain the water budget equation.
- (b) Define Evapotranspiration and name different methods of estimating evapotranspiration of a catchment.
- (c) Describe Slope-Area method for estimating discharge through a channel.
- (d) What are the factors affecting a flood hydrograph? Define a Unit Hydrograph.
- (e) Starting with the continuity equation, describe the modified Pul's method of reservoir routing.
- (f) Why is separation of baseflow required from a flood hydrograph? Describe three methods of baseflow separation.
- (g) Derive an expression for steady-state radial flow into a well fully penetrating an unconfined aquifer.

**Unit-I**

- Q2 (a) Describe either the Thiessen polygon or the Isohyetal method of estimating the mean areal rainfall over a catchment. Write an expression for determining the optimum number of rain gauge stations in a catchment for a specified allowable degree of error. (4+1)
- (b) On the basis of isopluvial maps, the 50 year-24 hour maximum rainfall at a place is found to be 17 cm. Determine the probability of a 24 hour rainfall of magnitude equal to or greater than 17 cm occurring at that place (i) once in 25 successive years. (2+2)
- (c) Describe the Intensity-Duration-Frequency relationship of storms over a catchment providing a general form of the relationship. Define 'Return Period' of a hydrological event. (2.5+1)
- Q3 (a) Write Horton's expression of decay of infiltration capacity with time explaining each term of the expression. Hence, find the infiltration capacity of a catchment (i) at the 6<sup>th</sup> hour (hr) from the start and (ii) the total volume of infiltration over the 6 hour period if the initial rate of infiltration is  $5.3 \text{ hr}^{-1}$ , the final capacity is  $0.5 \text{ cm hr}^{-1}$ , and the time constant is  $0.4 \text{ hr}^{-1}$ . (2+2+3)
- (b) Define  $\Phi$ -index. For a 12-hour (hr) storm rainfall over a catchment with the hourly distribution of rainfall in cm given by 2.0, 2.5, 7.6, 3.8, 10.6, 5.0, 7.0, 10.0, 6.4, 3.8, 1.4 and 1.4 and estimated direct runoff 25.5 cm, show that the average  $\Phi$ -index for the catchment would be  $3.5875 \text{ cm hr}^{-1}$ . (2+3.5)

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## Unit-II

- Q4 (a) What is the usefulness of measuring the state at a gauging site? Describe any one type of automatic stage recorder by providing a suitable sketch. (1+3)
- (b) What are the different types of current meter? Describe different procedure of measuring the velocity of a stream using a current meter. (1+3)
- (c) From the following data for measuring discharge of a river at a gauging site, estimate the discharge by calculating by the mid-section method. (1+3)

Distance from the left water edge (m)	0	1	3	5	7	9	11	12
Depth of flow (m)	0.0	1.1	2.0	2.5	2.0	1.7	1.0	0.0
Velocity ( $m s^{-1}$ )	-	0.229	0.326	0.411	0.336	0.260	0.183	-

(4.5)

- Q5 (a) What are the uses of a flow duration curve and a flow-mass curve in water resource planning and development? (3+2)
- (b) Estimate the storage required in a proposed reservoir to meet variable monthly demands in Million Cubic Metre ( $Mm^3$ ) as tabulated below. The table also includes data of mandatory release ( $Mm^3$ ) to be made on the downstream of the reservoir and the net evaporation ( $Mm^3$ ) after according for rainfall over the reservoir's area. (7.5)

Month	J	F	M	A	M	J	J	A	S	O	N	D
Inflow	50	40	30	25	30	40	200	250	175	100	70	60
Demand	60	80	80	90	120	130	40	30	50	50	50	50
Mandatory Release	11	9	11	10	11	10	11	11	10	11	10	11
Evaporation	2	3	3	4	4	2	0	1	1	3	2	3

## Unit-III

- Q6 (a) What are the assumption made in the Unit Hydrograph (UH) theory? Name the methods of deriving a new UH of duration different from the duration of a UH that is already available. Describe the method in the case of the required duration being fraction of the duration for which a UH is available. (2.5+2+3)
- (b) The observed flow in  $m^3 s^{-1}$  from a storm of 6-hour duration at a stream gauging site having catchment area of 500  $km^2$  are given below. Assuming the base flow to be negligible, derive the ordinates of a 6-hour unit hydrograph. (5)

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66	72
Flow	0	100	250	200	150	100	70	50	35	25	15	5	0

- Q7 (a) Describe a procedure for deriving UH from a complex storm. (4)
- (b) Regression equations of a Synthetic Unit Hydrograph (SUH) of 1-day duration for hydrometeorologically homogeneous subzone 2(a) of India as given in the Flood Estimation Report of the Central Water Communication are reproduced below. Evaluate the parameters of the P.T.O.

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SUH at a weir site on a river in that subzone using relevant catchment parameters provide below, and by following the usual convention. Sketch the resulting SUH. How is such an SUH finalized for practical application? If the depth of effective rainfall of a design storm of 1-day duration is 2.2 cm, what would be the peak flow of the resulting direct runoff hydrograph at the weir site? (4+2.5+2)

SUH Parameters	Regression Equation
$t_p$ (hour)	$2.272 (L/c/S)^{0.409}$
$q_p (m^3 s^{-1})$	$2.164 (q_p)^{-0.940}$
$W_{50}$ (hour)	$2.084 (q_p)^{-1.065}$
$W_{75}$ (hour)	$1.028 (q_p)^{-1.071}$
$W_{80}$ (hour)	$0.856 (q_p)^{-0.865}$
$W_{85}$ (hour)	$0.440 (q_p)^{-0.918}$
$T_b$ (hour)	$5.428 (q_p)^{0.852}$
$T_m$ (hour)	$t_p + t_b/2$
$Q_p$ (hour)	$q_p \cdot A$

Catchment parameter	Value
Area $A$ ( $km^2$ )	120
Length of longest stream $L$ (km)	18.19
Length of the stream from CG to dam site $L_c$ (km)	10.05
Stream slope $S$ (m/km)	64.6

## Unit-IV

- Q8 (a) Write the general equation of hydrologic frequency analysis? Describe procedure for estimating the design flood of a specified return period for practical application using Gumbel's method? (1+4)
- (b) Peak floods of return periods 50 and 100 year in a river were estimated as being 40809  $m^3 s^{-1}$  and 46300  $m^3 s^{-1}$  respectively. Estimate the peak flood with a return period of 300 years. (4.5)
- (c) Define Standard Project Flood (SPF) and Probable Maximum Flood (PMF). (3)
- Q9 (a) Define with the help of suitable sketches: (i) an aquifer, (ii) an aquitard, (iii) an aquiclude, (iv) an aquifuge, and (v) a leaky aquifer giving examples. (5)
- (b) A 10 cm diameter well penetrates a 10 m thick confined aquifer. The steady state drawdowns were found to be 2.5 m and 0.05 m at distances of 10 m and 40 m respectively from the centre of the well when the well was pumped at a constant rate of 125 litre/min. Calculate the transmissibility and hydraulic conductivity of the aquifer. (4)
- (c) What purposes does artificial recharge serve? Describe any one method of artificial recharge by providing a sketch. (2+1.5)

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# END TERM EXAMINATION

FIFTH SEMESTER [B.TECH.] DECEMBER-JANUARY- 2016

Paper Code: ETCE-309

Subject: Geotechnical and Foundation Engineering

Time: 3 Hours

Maximum Marks: 75

Note: Attempt any five questions including Q.No.1 which is compulsory.  
Internal choice is indicated.

Q1 Attempt **any ten** questions.

(10x2.5=25)

- (a) What is the purpose of sub surface exploration?
- (b) What is bore log?
- (c) What is disturbed sample and undisturbed sample?
- (d) What is recovery ratio of sample?
- (e) List any five factors that affect the sample disturbance?
- (f) Define mat foundation.
- (g) Define uplift and lateral resistance of pile.
- (h) Explain briefly different type of soil failure.
- (i) Explain briefly piping in soil.
- (j) What do you mean by the term \*Geo-synthetics?
- (k) Write a note on ground improvement by sand drain method.

Q2 (a) What are the conditions where a well foundation is more suitable than a pile foundations? (3.5)

- (b) A square footing located at a depth of 1.5 m below the ground surface in cohesionless soil carries a column load of 1280 kN. The soil is submerged having an effective weight of 11.5 kN/m<sup>3</sup> and angle of shearing resistance of 30°. Find the size of footing for  $F_s=3$  by Terzaghi's theory of general shear failure. (9)

OR

Q3 (a) Write the various modes of failure of shallow foundation with neat suitable diagram. (3.5)

- (b) If the ultimate bearing capacity of a 1 m wide strip footing resting on the surface of sand is 250kN/m<sup>2</sup>, what will the net allowable pressure that a 3x3m square footing resting on the surface can carry with  $F_s=3$ . Assume that the soil is cohesionless. Use Terzaghi's theory. (9)

Q4 (a) Give the classification of piles. Explain how loads are distributed from the pile to earth with neat diagram. (5.5)

- (b) A concrete pile 45 cm in diameter and 15m long is driven into homogeneous mass of clay soil of medium consistency. The water table is at the ground surface. The unit cohesion of the soil under undrained condition is 50kN/m<sup>2</sup> and the adhesion factor=0.75. Compare ultimate bearing capacity and allowable bearing capacity of pile with factor of safety=2.5. (7)

OR

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- Q5 (a) What do you mean by under reamed pile foundation? Where it is used? (2.5)
- (b) A group of 9 piles with 3 piles in 3 rows were driven in to soft clay extending from ground level to a great depth. The diameter and the length of the piles were 30 cm and 10m respectively. The unconfined compressive strength of clay is 70kPa. If the piles were place 90 cm center to center, compute the allowable load on the pile group on the basis of shear failure criterion for a factor of safety of 2.5. (10)
- Q6 (a) Define earth pressure at rest? In designing the lateral resistance of piles, should engineers use earth pressure against piles caps only? Justify your answer. (5.5)
- (b) List the various earth pressure theories. Explain any one of them with neat diagram. (7)
- OR**
- Q7 (a) What is the function of shear key in the design of retaining wall? Explain. (4.5)
- (b) Write short note on:- (8)
- (i) Cantilever and anchored sheet pile retaining wall
- (ii) Braced excavation
- Q8 (a) What is soil stabilization? What are the various advantages of soil improvement techniques? Explain any one method of soil improvement. (8.5)
- (b) List the difference between chemical stabilization and mechanical stabilization. (4)
- OR**
- Q9 (a) What is subsurface contamination? Explain in detail the sources, production and classification of waste. (8.5)
- (b) Explain failures of foundations due to soil pollutants. (4)

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FIFTH SEMESTER [B.TECH.] DECEMBER 2015-JANUARY- 2016

Paper Code: ETCE-311

Subject: Wastewater Engineering & Reuse

Time: 3 Hours

Maximum Marks: 75

Note: Attempt any five questions including Q.No1, which is compulsory. Select two questions each from section A and Section B. Assume suitable missing data.

- Q1
- (a) What are the advantages and limitations of disposal of sewage on land. (6)
  - (b) State the function of detritus and skimming tanks. (4)
  - (c) Explain the different types of surface aerators. (5)
  - (d) State the uses and limitations of interceptors in plumbing systems. (5)
  - (e) What is the difference between oxidation pond and oxidation ditch? What are their principles of operation? (5)

## SECTION-A

Attempt any two question:-

- Q2
- A main combined sewer was designed to serve an area of 60 km<sup>2</sup> with an average population of 185 persons/hectare. The average rate of sewage flow is 180 litres/capita/day. Maximum flow is 50% in excess of the average together with the rainfall equivalent of 12mm. in 24hrs, all of which are runoff. what should be the capacity of sewer? Find the minimum velocity and gradient required to transport coarse sand through a sewer of 40cm diameter with sand particles of 1mm diameter roughness coefficient (n) for sewer material may be assumed as 0.013. (12.5)

- Q3
- A town having a population of 30000 persons is producing the following sewages:- (12.5)
- (i) Domestic sewage @ 120 lpcd having 200 mg/L of BOD.
  - (ii) Industrial sewage @ 300000 lpd having 800 mg/L of BOD.
- Design a high rate single stage trickling filter for treating the above sewage. Assume that the primary sedimentation removes 35% of BOD. Allow an organic loading of 10000kg/ha. m/day (excluding recirculated sewage). The recirculation ratio is 1.0 and the surface loading should not exceed 170ML/ha/day (including recirculated sewage). Also determine the efficiency of the filter and the BOD of the effluent.

- Q4
- Design the aeration and sedimentation tank of domestic sewage with diffused air aeration system, given: (12.5)
- Population=40000  
Average sewage flow=160 lpcd  
BOD of sewage=220 mg/L  
BOD removed in primary treatment=30%  
Overall BOD reduction desired=85%

## SECTION-B

Attempt any two question:-

- Q5
- (a) What are the different methods of collection of sewage samples? What are the methods for prevention of sewage sickness? (6)
  - (b) Using a diagram, explain the sulphur cycle under aerobic oxidation. (6.5)
- Q6
- (a) State the principle of operation and design features of RBC. (6)
  - (b) What are the advantages and disadvantages of using septic tanks? (6.5)
- Q7
- (a) Define the terms MLSS, MLVSS and SVI. How is the test for determination of SVI carried out? (6.5)
  - (b) Differentiate between plug flow and complete mixed flow. State the limitations of conventional Activated Sludge Process. (6)
- Q8
- (a) What are the different forces acting on sewer pipes? Explain. (4)
  - (b) What are the functions of manholes, catch basins and grease & oil traps? (4.5)
  - (c) What are traps? What are the different categories based on their shapes? (4)

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# END TERM EXAMINATION

FIFTH SEMESTER [B.TECH.] DECEMBER 2015

Paper Code: ETHS-301

Subject: Communication Skills for Professionals

Time: 3 Hours

Maximum Marks: 75

Note: Attempt all questions as directed. Internal choice is indicated.

- Q1 Write short notes on **any five** of the following:- (5x5=25)
- (a) Attributes of a good essay
  - (b) Speech mechanism
  - (c) Emotional Intelligence
  - (d) Barriers to communication.
  - (e) Voice modulation in presentation
  - (f) Feed-back
  - (g) Routine Report
- Q2 'Soft' skills are essential for the employee as well as the employer'. Discuss. (10)
- OR**
- How are 'self-assessment' and 'self-esteem' significant in personality development? (10)
- Q3 Discuss the significance of paralanguage in communication. (10)
- OR**
- Transcribe the following words and mark stress on them: 'coffee', 'systematic', 'corpus', 'thread', 'breathe', 'engineer', 'chef', 'introduction', 'employee' and 'brunette'. (10)
- Q4 Prepare a cover letter and resume for a candidate applying for the post of Assistant Engineer in a construction company. (10)
- OR**
- Discuss the structure of a formal report. (10)
- Q5 Discuss the 'dos' and 'don'ts' of a good presentation. (10)
- OR**
- What are the essentials of good listening? (10)
- Q6 Describe 'inside citation' and 'bibliography'. Give two examples in appropriate format. (10)
- OR**
- What are the characteristics of an effective professional writing? (10)

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