Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Design of Hydraulic Structures **Semester: VII**
Programme: B Tech Civil Engineering **Time: 03 hrs.**
Max. Marks: 100 **Course Code: CEEG 421**
Instructions: Write your assumptions carefully and attempt all the questions

Set A

SECTION A

S. No.		Marks	CO
Q1.	Mention the only arch dam built in India. Explain its design criteria.	**4**	**CO1**
Q2.	What are the limitations of the cylinder theory for the design of an arch dam?	**4**	**CO2**
Q3.	Explain the Reservoir Leakage problem.	**4**	**CO3**
Q4.	What is river meandering? What are its causes?	**4**	**CO3**
Q5.	Differentiate between run-off-the-river scheme hydel plants and the storage reservoir hydel plants.	**4**	**CO4**

SECTION B

Q6.	A storage hydel plant with an installed capacity of 5000 kW operates at 35% load factor when it serves as a peak load station: a) What should be the minimum discharge in the stream, so that it may serve as a base load station? The plant efficiency may be assumed to be 100% when working under a head of 20m. b) Also calculate the maximum load factor of the plant when the discharge in the stream is 50 cumecs.	**10**	**CO4**
Q7.	Explain the design and specifications of river training method used for bank protection. Draw a neat sketch also.	**10**	**CO3**
Q8.	Determine the average daily water requirements to supply the load and storage required to produce peak load for a hydro-power plant working at 42.47m head and 80% efficiency, given the following data:	**10**	**CO4**

Time (h)	Load (MW)
0-4	30
4-8	40
8-12	150
12-16	80
16-20	110

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<tr><td></td><td>OR</td><td></td><td></td></tr>
<tr><td>Q8.</td><td>Explain the concept of water hammer with reference to hydel plants. Suggest the measures to counteract water hammer.</td><td>10</td><td>CO4</td></tr>
<tr><td>Q9.</td><td>The yearly rainfall data for a proposed reservoir for 35 years is given below. Compute 75% and 60% dependability.

<table><tr><th>Year</th><th>Annual Rainfall (cm)</th><th>Year</th><th>Annual Rainfall (cm)</th></tr><tr><td>1956</td><td>98</td><td>1978</td><td>208</td></tr><tr><td>1957</td><td>100</td><td>1979</td><td>114</td></tr><tr><td>1958</td><td>101</td><td>1980</td><td>104</td></tr><tr><td>1959</td><td>99</td><td>1981</td><td>120</td></tr><tr><td>1960</td><td>85</td><td>1982</td><td>108</td></tr><tr><td>1961</td><td>112</td><td>1983</td><td>102</td></tr><tr><td>1962</td><td>116</td><td>1984</td><td>80</td></tr><tr><td>1963</td><td>78</td><td>1985</td><td>109</td></tr><tr><td>1964</td><td>160</td><td>1986</td><td>122</td></tr><tr><td>1965</td><td>66</td><td>1987</td><td>115</td></tr><tr><td>1966</td><td>184</td><td>1988</td><td>140</td></tr><tr><td>1967</td><td>90</td><td>1989</td><td>138</td></tr><tr><td>1968</td><td>76</td><td>1990</td><td>60</td></tr><tr><td>1969</td><td>118</td><td></td><td></td></tr><tr><td>1970</td><td>86</td><td></td><td></td></tr><tr><td>1971</td><td>92</td><td></td><td></td></tr><tr><td>1972</td><td>96</td><td></td><td></td></tr><tr><td>1973</td><td>93</td><td></td><td></td></tr><tr><td>1974</td><td>88</td><td></td><td></td></tr><tr><td>1975</td><td>94</td><td></td><td></td></tr><tr><td>1976</td><td>107</td><td></td><td></td></tr><tr><td>1977</td><td>110</td><td></td><td></td></tr></table></td><td>10</td><td>CO3</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q10.</td><td>An elementary profile of a concrete gravity dam of triangular section has a maximum water level upto the top of the dam which is 50m high and the d/s slope has a batter of 0.8H: 1V. There is no tail water. Analyze the dam section and determine:

a) Factor of safety against overturning
b) Factor of safety against sliding
c) Whether there is tension or not at the base
d) Maximum compressive stress within the allowable crushing strength of concrete (1000 kN/m^2)</td><td>20</td><td>CO1</td></tr>
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	Assume: Coefficient of friction between masonry and foundation material = 0.67 Unit Weight of concrete = 24kN/m^3 Uplift pressure intensity coefficient acting on 100 % area = 0.5		
	OR		
Q10.	A concrete gravity dam has Max. Reservoir level at 200m, base level at 115m and top level as 205m. The upstream face is vertical and the downstream face batter starts at 199m and is 1H: 1.5V. There is no tail water level. The central line of the drainage gallery starts at 8m from the u/s face. Analyze the dam for safety. Include the earthquake action	**20**	**CO1**
Q11.	Design an ogee spillway for a concrete gravity dam having the d/s face sloping at a slope of 0.7H: 1V. The design discharge is 10000 m^3/s. The height of the spillway crest is kept at RL 200.0 m. The average river bed level at the site is 100 m. The spillway length consists of 6 spans having a clear width of 10m each. Assume the values of K_a and K_p. Calculate atleast 10 coordinates for d/s profile and atleast 5 coordinates for u/s profile.	**20**	**CO2**