EX/PE/T/323/2019

B.E Power Engineering 3rd Year 2nd Semester Examination – 2019

Subject: Non-conventional Power Generation

Time: Three hours **Full Marks: 100**

	Each question must be answered as per given instruction	Marks
[1]	**Answer *any ten* from this module**	[10×2]
(a)	Define green energy & brown energy resource.	
(b)	What are the main advantages of renewable energy?	
(c)	Define terrestrial solar radiation.	
(d)	What is Betz's limit of wind energy?	
(e)	Which schemes is suitable for energy storage in large scale application using solar thermal power generation?	
(f)	Name & define the characteristic of heat transfer fluid that is used in Ocean thermal power plant.	
(g)	State the relation between wave energy & wave power.	
(i)	Define thermal gradient in geothermal region.	
(j)	What are the main disadvantages of biomass energy?	
(k)	Define combine heat & power in hybrid power generation scheme.	
(l)	Classify fuel cell.	
(m)	Classify thin film type solar cell & comment on its efficiency.	
(n)	Define MHD generation.	
(o)	State the efficiency level for power generation using solar pond.	
[2]	**Answer *any one* from this module**	[1×10]
(a)	Derive the wind power that can be extracted using wind turbine. Define power coefficient.	[8+2]
(b)	State principle of operation of solar photovoltaic cell. State the advantages of thin film type over poly crystalline type solar cell.	[4+6]
[3]	**Answer *any two* from this module**	[2×10]
(a)	State the operating principle of fuel cell. What are the problems of fuel cell?	[6+4]
(b)	Briefly explain the Magneto Hydrodynamic System with block diagram. Why electrodes are splited into a group of segments & they are skewed with perpendicular line?	[6+4]
(c)	Briefly explain power generation scheme from Municipal Solid Waste as biomass resource with a neat sketch.	[8+2]
[4]	***Answer any two* from this module**	[2×10]
a)	Derive the expression of total wave power per unit width across front of water surface of natural ocean wave resource.	[10]
b)	Derive the useful heat content per square kilometer of dry rock granite to deep under crust, time constant of heat extraction using water flow & heat extraction rate.	[10]
(c)	Briefly explain power generation scheme in Ocean thermal power plant with block diagram.	[8+2]
[5]	**Answer *any three* from this module**	[3×10]
(a)	In a horizontal axis wind turbine following data were measured: wind speed is 18 m/s at 1 atm & 30°C. The diameter rotor is 60 m & speed of rotor is 50 r.p.m. Find the torque produced at the shaft for maximum output of turbine.	[10]
(b)	Calculate the following of a dry rock granite to a depth of 7.5 Km. Take the Geothermal temperature gradient is at 40°K/Km, minimum useful temperature is 160°K above the surface temperature T_o, rock density(ρ_r)=2800 kg/m^3, Specific heat capacity(C_r)=850 J/kg/°K: i) Useful heat content per square kilometer, ii) Time constant of heat extraction using water flow at a rate of 1.5 m^3/sec/km^2, iii) Useful heat extraction rate at initially & after 10 years. Assume water density 1000 kg/m^3& specific heat capacity 4200 J/kg/°K.	[10]
(c)	A school in a remote place has the following energy requirements:- 20 lamps each of 100 CP that operate for 6 hours daily, 8 computers each of 250 watt those operate for 4 hours daily by a duel fuel engine driven generator, 1 H.P water pump is driven by duel fuel engine for 3 hours daily. Calculate the volume of cow dung in a biogas plant & also calculate the required number of cows to feed the plant. (Assume biogas required for each 100C.P lamp is 0.126m^3/hr., conversion efficiency for generator is 75%, thermal efficiency of engine is 20%, heating value of biogas is 25 MJ/m^3, cow dung production rate: 8kg/cow/day, cow dung having 18% solid mass content, biogas yield of 0.34m^3/kg of dry mass, slurry density: 1090kg/m^3, 1 H.P=746 watts).	[10]
(d)	Calculate the following for deep Atlantic Ocean wave having wave length 50 m & amplitude 1.5 m, water density1025kg/m^3: i) Phase velocity, ii) Group velocity, iii) Total energy per unit area of wave surface, iv) Power develops per unit width across wave front.	[10]