EX/PE/T/323/2018

B.E Power Engineering 3rd Year 2nd Semester Examination – 2018
Subject: Non-conventional Power Generation

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

Module	Each module must be answered as per given instruction	Marks
[1]	**Answer *any ten* from this module**	**[10×2]**
(a)	State the main objectives of transition of our energy use from non renewable to renewable.	
(b)	What are the main limitations of renewable energy?	
(c)	Define solar constant.	
(d)	What is wind rose?	
(e)	Among solar thermal power generation schemes which one is point focusing & which one is line focusing?	
(f)	Name the main challenges have to be met for set up of Ocean thermal power plant.	
(g)	Define group velocity & phase velocity of wave power.	
(h)	Classify geothermal region mentioning temperature.	
(i)	Show different stages of biomass to biogas production in block diagram.	
(k)	What is main advantage of hybrid power generation?	
(l)	State the anode & cathode reaction of fuel cell.	
(m)	Classify solar cell with example.	
(n)	Name different energy storage methods.	
(o)	State different layers of solar pond with brief significance.	
[2]	**Answer *any one* from this module**	
(a)	Classify wind turbine & then describe constructional feature of any one type with a neat figure.	**[1×10]**
(b)	State advantages thin film solar cell over crystalline silicon type. Show major components of solar photovoltaic energy system with block diagram.	[2+8] [6+4]
[3]	**Answer *any two* from this module**	
(a)	Classify fuel cell. Briefly explain Proton exchange membrane fuel cell with figure.	**[2×10]**
(b)	Define faraday current & hall current. Briefly explain principle of operation of Magneto Hydrodynamic System.	[2+8] [4+6]
(c)	Name usable form of biomass. Briefly explain biogas production from waste biomass.	[2+8]
[4]	***Answer any two* from this module**	**[2×10]**
a)	Derive the expression of total wave energy per unit area of water surface of natural ocean wave resource.	[10]
b)	Classify electrical power generation schemes using geothermal power & briefly explain any one scheme with a neat figure.	[2+8]
(c)	Briefly explain major challenges have to be faced in setting up Ocean thermal power plant & how to control these.	[6+4]
[5]	**Answer *any three* from this module**	**[3×10]**
(a)	A horizontal axis wind turbine is installed at a location having wind speed of 17 m/s. The 40 m diameter rotor has two blades attached to the hub. Find the rotational speed of turbine for optimum energy extraction.	[10]
(b)	Calculate the following of a dry rock granite to a depth of 6.5 Km. Take the Geothermal temperature gradient is at 37°K/Km, minimum useful temperature is 160°K above the surface temperature T_o, rock density(ρ_r)=2900 kg/m^3, Specific heat capacity(C_r) =950 J/kg/°K. i) Useful heat content per square kilometer, ii) Time constant of heat extraction using water flow at a rate of 1.7 m^3/sec/km^2, iii) Useful heat extraction rate at initially & after 20 years. Assume water density 1000 kg/m^3& specific heat capacity 4200 J/kg/°K.	[10]
(c)	Calculate the volume of a cow dung & required number of cows for biogas plant, required for a school in a remote place, having 12 lamps each of 100 C.P that operate for 5 hours daily. 8 computers each of 300 W that operate for 4 hours daily & 5 H.P water pump for 2 hours daily driven by a duel fuel-engine driven generator & engine respectively. (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 40 m & amplitude 1.2 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]