

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Power Plant Equipment (EE703)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

Group A
(Electrical Part)

1. Explain with example how pump storage hydropower plant can be installed together with base load plant for efficient operation and to reduce peak generation loss. [10]
2. a) What do you mean by Isochronous generator? Describe its transient response for a step increase in load. [4]
- b) A power system consist of two generators operating in parallel and supplying a load of 1200 MW. Generator G_1 is rated as 900 MW with 2% drop regulation and generator G_2 is related as 450MW with 3% drop regulation. G_1 supplied 750 MW and G_2 supplies 450 MW and frequency is 60 Hz. When the load is increased by 150 MW, Calculate the new operating frequency and additional power generated by each generator. [8]
3. Explain the dynamic response of excitation system with suitable mathematical deduction. [8]
4. a) Two generators of capacities 40Mva, 11kv and 30 Mva, 11kv having their sub transient reactance of 5% and 4% respectively operating in parallel and supplying to a common load by single feeder of reactance 2 ohm. Calculate the value of reactor to be connected in series with feeder so as to reduce the fault label at the end of the feeder by 40%. [6]
- b) Describe how a SCADA can be implemented in a power system. [4]

Group B
(Mechanical Part)

5. a) Briefly illustrate the main components of a diesel power plant. [6]
- b) A single cylinder engine running at 1800 rpm develops a torque of 8 Nm. The indicated power of the engine 1.8 kW. Find the loss due to friction power as the percentage of indicated power. [4]
6. Discuss the methods to improve thermal efficiency of Gas Turbine Plant. [10]
7. a) What is the fundamental difference between the operation of impulse and reaction turbines? [5]
- b) What are the advantages and disadvantages of steam power plant? [5]
8. What are the advantages of gas and steam combined cycle? Briefly explain the three popular designs of the combination cycles. [10]

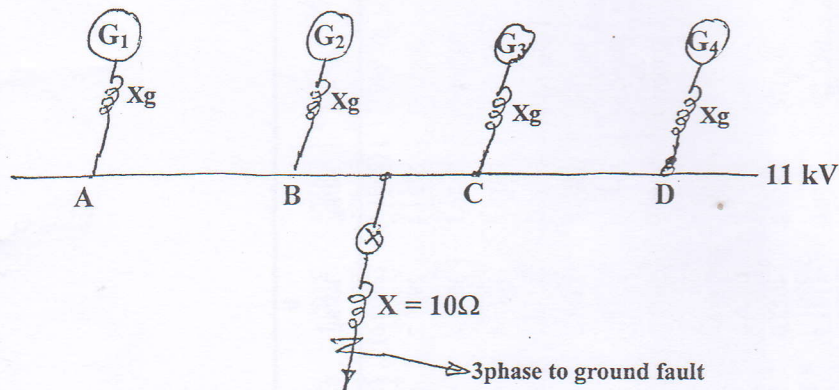
Exam.	Back	
Level	BE	Full Marks 80
Programme	BEL	Pass Marks 32
Year / Part	IV / I	Time 3 hrs.

Subject: - Power Plant Equipment (EE703)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Necessary Tables are attached herewith.
- ✓ Assume suitable data if necessary.

Electrical Part

- Explain the response of frequency during transient period in a turbine-generator couple system with Governor. [8]
 - Describe the phenomena of sharing common load by two alternators operating in parallel with individual speed-drop setting. [8]
- Two generating units of capacity 600Mva and 500Mva having droop of 4% and 6% are supplying 500Mva and 400Mva respectively to a common load of 900Mva at 60Hz. Calculate the new frequency and the new generation on each unit if load is increased to 1000Mva. [8]
- What is the function of excitation system in generating station? Derive the transfer function of an excitation system with stabilizing transformer. [2+6]
- Below figure shows 4 Nos of identical generators operating in parallel.



Each generator is rated as 1600 kVA, 11kV, $X_g = 0.2$ pu.

- Calculate fault current in outgoing feeder and fault current supplied by each generator.
- If reactors of 5 ohm each are connected between point A and B, point C and D respectively. Calculate fault current in outgoing feeder and fault current supplied by each generator. [4+4]

Mechanical Part

5. Explain the fuel supply system of a diesel power plant with neat diagram. [8]
6. A two stroke diesel engine was motored when the meter reading was 2.2 kW. Then the test on the engine was carried out for one hour and the following observations were recorded: Brake torque = 150 Nm; Speed = 800 rpm; Fuel used = 2.5 kg; calorific value of fuel = 40 MJ/kg;
- Determine:
- (a) Brake power
 - (b) Indicated power,
 - (c) Mechanical efficiency and
 - (d) Indicated thermal efficiency. [8]
7. List the common methods used for the performance improvement of the gas turbine power plants. Explain how inter-cooling increases efficiency of the plant. [8]
8. On a regenerative cycle, steam leaves the boiler and enters the turbine at 4 MPa, 400°C. After expansion to 400 kPa, some of the steam is extracted from the turbine to heat the feed water in an open feed water heater. The pressure in the feed water heater is 400 kPa, and the water leaving it is saturated liquid at 400 kPa. The steam not extracted expands to 10kPa. Determine the cycle efficiency.[Refer the attached table for the properties of steam] [12]
9. Sketch the basic components of a combine power plant with corresponding processes on T-S diagram. [4]

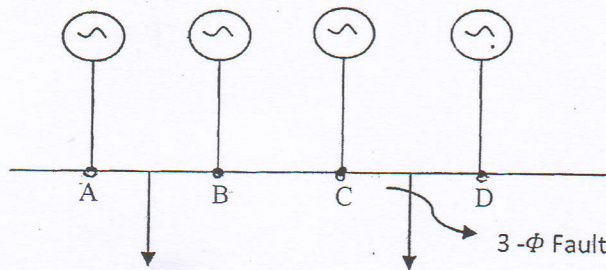
Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BEL	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Power Plant Equipment (EE703)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

Group A
(Electrical Part)

1. a) Describe the steady state and transient behavior of a turbine generator coupled system with governor. [6]
- b) Draw and explain the P-F and Q-V control loop of a hydrogenating system. [4]
2. a) Two generators are supplying power to a system. Their rating are 250 MW and 500 MW respectively. Each generator is half loaded and operating at a frequency of 60 Hz. If the system load is increased by 100 MW, the frequency drops to 59.5 Hz. What must be the individual droop of these generators so that they share the load according to their capacity? [5]
- b) What do you mean by isochronous governor? Write down its disadvantages when operated in parallel to supply a common load. [3]
3. a) Derive the transfer function of an excitation system with stabilizing transformer. [7]
- b) The figure below shows four identical generators, each rated 11 kV, 25 MVA and each having sub-transient reactance of 16% on its own rating. Find 3- ϕ fault level at one of the outgoing feeder. Also calculate the value of reactance to be connected in the bus bar between "B" and "C" so that fault level reduces by 40%. [5]



4. a) Why is reactor used in power system? Explain different types of reactor. [5]
- b) Describe the fire fighting system used in power station with necessary diagram. [5]

Group B
(Mechanical Part)

1. Explain fuel storage and supply system of a diesel power plant with a neat sketch. Also write down application of diesel power plants. [8]
2. The following observations were recorded during a trial of a four stroke engine with rope dynamometer. Engine speed = 650 rpm, Dia. of brake drum = 600 mm, Dia. of rope = 50 mm, Dead load on the brake drum = 32 kg, spring balance reading = 4.75 kg, Mechanical efficiency = 80%. Calculate the brake power and indicated power. [8]
3. An open cycle gas turbine plant uses heavy oil as fuel. The maximum pressure and temperature in the cycle are 500kPa and 650°C. The pressure and temperature of air entering into the compressor are 10⁵Pa and 27°C. The exit pressure of the turbine is also 10⁵Pa. Assuming isentropic efficiencies of compressor and turbine to be 80% and 85% respectively, find the thermal efficiency of the cycle. Take C_p (for air and gas) = 1kJ/kg°C and γ (for air and gases) = 1.4. If the plant consumes 5 kg of fuel per sec, find the power generating capacity of the plant. [10]
4. Explain how reheater increases the output of the steam turbine power plant along with neat sketch. Draw the layout and show the cycle in T-S diagram. [8]
5. Enumerate the advantages of a combined cycle plant. With the help of a neat diagram, explain the principle of working of a combined cycle plant to enhance the efficiency of electricity generation. [6]
