Printed Pages:03
Paper Id: 1 2 0 6 0 3

Sub Code: NEE601
Roll No. 1 5 0 5 2 2 0 0 2 9

BTECH
(SEM-VI) THEORY EXAMINATION 2017-18
POWER SYSTEM ANALYSIS

Time: 3 Hours

Total Marks: 100

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a) What is single line diagram of power system from generating station to utilization level?
b) What is impedance and reactance diagram?
c) Define sub-transient reactance.
d) Write a short note on feeder reactors.
e) Explain the matrix partitioning in load flow study.
f) Define: Load bus, Generator bus and Slack bus.
g) Explain the methods of improving steady state stability.
h) Explain the swing curve.
i) Define: characteristic impedance loading and surge impedance loading.
j) Find the CIL of 200 kV transmission line.

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a) Obtain per unit reactance diagram of the power system shown in figure. The reactance data of the elements are given as –

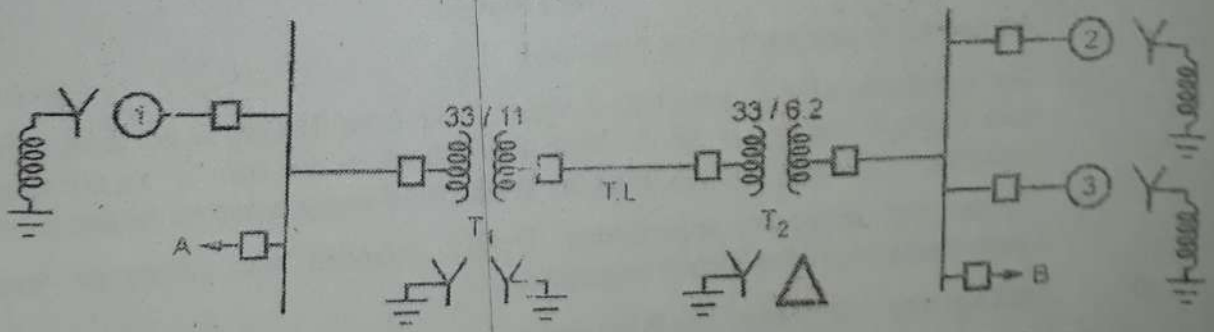


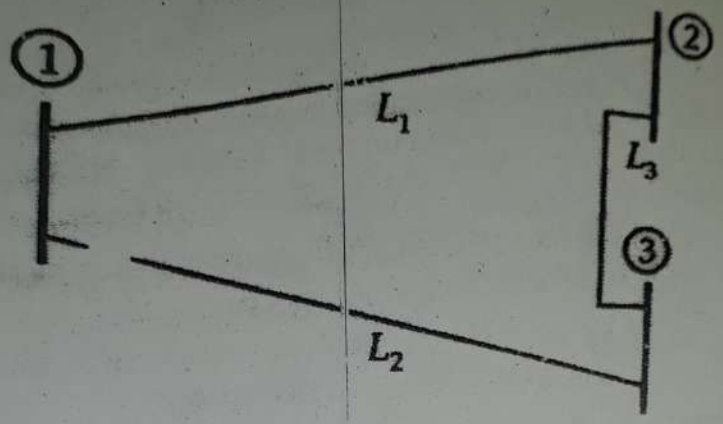
Fig. 1.4.2 One line representation of a simple power system

G1: 30 MVA	*10.5 kV*	*X'' = 1.6 Ω*
G2: 15 MVA	*6.6 kV*	*X'' = 1.2 Ω*
G3: 25 MVA	*6.6 kV*	*X'' = 0.56 Ω*
T1: 15 MVA	*33/11 kV*	*X = 15.2 Ω per phase on ht side*
T2: 15 MVA	*33/6.2 kV*	*X = 16 Ω per phase on ht side*
Transmission Line	*20.5 Ω per phase*	
Load A 40 MW	*11 kV (L-L)*	*0.9 lagging p.f.*
Load B 40 MW	*6.6 kV (L-L)*	*0.85 lagging p.f.*

(80)

b) Explain the switching operation in a series R-L circuit.

c) In the 3 bus system shown in figure the series and shunt impedances of line (L1) is (14.3+j97) ohm and (-j3274) ohm, line (L2) is (7.13+j48.60) ohm and (-j6547) ohm and line (L3) is (9.38+j64) ohm and (-j4976) ohm respectively, find [Y_{Bus}].



d) Derive the swing equation for a machine connected to an infinite bus in a power system.

e) Deduce the general wave equations for a loss less transmission line for propagation of voltage and current wave.

SECTION C

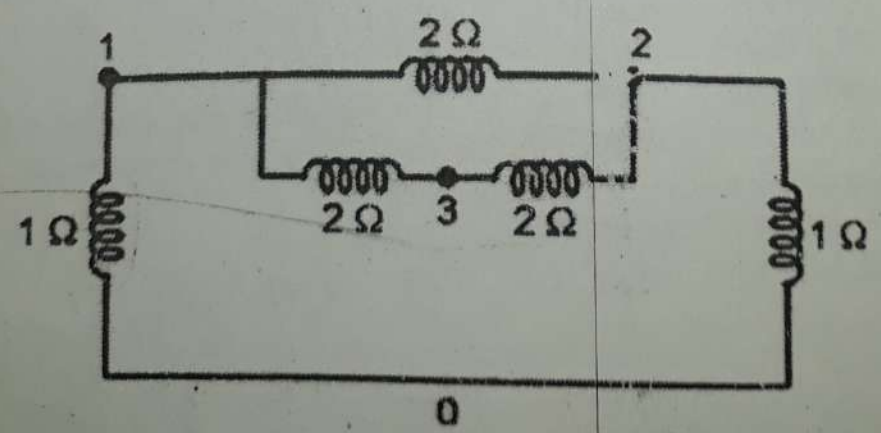
3. **Attempt any *one* part of the following:** 10 x 1 = 10

a) One conductor of a 3-phase line is open. The current flowing to the delta connected load through line 'a' is 10 A. With the current in the line 'a' as reference and assuming that line 'c' is open. Find the symmetrical components of the line current.

b) Explain the sequence impedances. Define balanced star connected load and transmission lines of sequence impedances.

4. **Attempt any *one* part of the following:** 10 x 1 = 10

a) Develop Z_{Bus} matrix for the network shown in figure.



b) Derive the relationship to determine the fault current for a single line to ground fault. Draw an equivalent network showing the interconnection of sequence networks to stimulate LG fault.

(8M)

5. Attempt any *one* part of the following: 10 x 1 = 10

a) Explain clearly the computational procedure for load flow solution using Newton-Raphson method when the system contains only PQ buses

b) Discuss the fast decoupled load flow method in load flow study

6. **Attempt any *one* part of the following:** **10 x 1 = 10**

a) Show that the steady state power which could be transmitted over a transmission line will be maximum when $X = \sqrt{3}\,R$, where X and R have their usual meaning.

b) Explain equal-area criterion for the stability of an alternator supplying infinite busbar via an inductive interconnector.

7. **Attempt any *one* part of the following:** **10 x 1 = 10**

a) Determine reflection co-efficient and transmission coefficient for receiving end of transmission line terminated by resistance.

b) Explain the Bewley's Lattice diagram. Write a note on surge phenomenon. Define the protection against overvoltages.

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Sub Code: NME603
Roll No. 1 5 0 8 2 4 0 0 5 5

B.TECH.
(SEM-VI) THEORY EXAMINATION 2017-18
DYNAMICS OF MACHINES

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. Choose any missing data suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a. What do you mean by piston effort?
b. Describe coefficient of fluctuation of energy.
c. Explain all planes and axes related to the gyroscopic effect.
d. Write equation of natural frequency of longitudinal vibration; also explain related terms.
e. What do you mean by partial balancing?
f. What are coupled and uncoupled locomotives?
g. Classify the governors.
h. Define terms related to governors: (i) Sensitiveness, (ii) Stability
i. Explain differential brake.
j. What do you mean by transmission type dynamometer?

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a) Describe forces on different parts of a slider crank mechanism.
b) The following data are given for a vibratory system with viscous damping: Mass = 2.5 kg; spring constant = 3 N/mm and the amplitude decreases to 0.25 of the initial value after five consecutive cycles. Determine the damping coefficient of the damper in the system.
c) A shaft carries four masses in parallel planes A, B, C and D in this order along its length. The masses at B and C are 18 kg and 12.5 kg respectively, and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80 mm. The angle between the masses at B and C is 100° and that between the masses at B and A is 190°, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine: 1. The magnitude of the masses at A and D; 2. The distance between planes A and D; and 3. the angular position of the mass at D.
d) Explain the terms and derive expressions for 'effort' and 'power' of a Porter governor.
e) Derive expression for the ratio of the maximum and minimum tensions of band and block brake.

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

a) Derive expression for dimensions of flywheel.
b) A vertical double acting steam engine has a cylinder 300 mm diameter and 450 mm stroke and runs at 200 r.p.m. The reciprocating parts have a mass of 225 kg and the piston rod is 50 mm diameter. The connecting rod is 1.2 m long. When the crank has turned through 125° from the top dead centre, the steam pressure above the piston is 30 kN/m^2 and below the piston is 1.5 kN/m^2. Calculate the effective turning moment on the crank shaft.

4. Attempt any *one* part of the following: **10 x 1 = 10**

a) Explain the gyroscopic effect on aero plane.

b) The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship: 1. when the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h. 2. When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.

5. Attempt any *one* part of the following: **10 x 1 = 10**

a) Explain the terms in detail (i) Variation in tractive effort; (ii) Swaying Couple and (iii) Hammer blow and safe speed of locomotive.

b) The following data refer to two cylinder locomotive with cranks at 90°: Reciprocating mass per cylinder = 300 kg; Crank radius = 0.3 m; Driving wheel diameter = 1.8 m; Distance between cylinder centre lines = 0.65 m; Distance between the driving wheel central planes = 1.55 m. Determine: 1. the fraction of the reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km/h ; 2. the variation in tractive effort ; and 3. the maximum swaying couple.

6. Attempt any *one* part of the following: **10 x 1 = 10**

a) In a Porter governor, the upper and lower arms are each 250 mm long and are pivoted on the axis of rotation. The mass of each rotating ball is 3 kg and the mass of the sleeve is 20 kg. The sleeve is in its lowest position when the arms are inclined at 30° to the governor axis. The lift of the sleeve is 36 mm. Find the force of friction at the sleeve, if the speed at the moment it rises from the lowest position is equal to the speed at the moment it falls from the highest position. Also, find the range of speed of the governor.

b) In a spring loaded governor of the Hartnell type, the mass of each ball is 1kg, length of vertical arm of the bell crank lever is 100 mm and that of the horizontal arm is 50 mm. The distance of fulcrum of each bell crank lever is 80 mm from the axis of rotation of the governor. The extreme radii of rotation of the balls are 75 mm and 112.5mm. The maximum equilibrium speed is 5 per cent greater than the minimum equilibrium speed which is 360 r.p.m. Find, neglecting obliquity of arms, initial compression of the spring and equilibrium speed corresponding to the radius of rotation of 100 mm.

7. Attempt any *one* part of the following: **10 x 1 = 10**

a) Explain and discuss following in detail with examples:
(i)Absorption type Brake Dynamometer; (ii) Transmission type Brake Dynamometer.

b) In a winch, the rope supports a load W and is wound round a barrel 450 mm diameter. A differential band brake acts on a drum 800 mm diameter which is keyed to the same shaft as the barrel. The two ends of the bands are attached to pins on opposite sides of the fulcrum of the brake lever and at distances of 25 mm and 100 mm from the fulcrum. The angle of lap of the brake band is 250° and the coefficient of friction is 0.25. What is the maximum load W which can be supported by the brake when a force of 750 N is applied to the lever at a distance of 3000 mm from the fulcrum?

(84)

Printed pages: 03
Paper Id: 140610

Roll No: Sub Code: NME 604

B. TECH.
(SEM–VI) THEORY EXAMINATION 2017-18
REFRIGERATION & AIR CONDITIONING

Time: 3 Hours Total Marks: 100

1. Attempt all Sections. If require any missing data; then choose suitably.
2. ***Use of steam tables, refrigerant's property tables and charts, psychrometric charts, and Enthalpy-concentration diagram is allowed.***

SECTION-A

1. Attempt ***all*** questions in brief. **(2x10=20)**

(a) Define Refrigeration.
(b) Differentiate between Refrigerator and Heat-pump.
(c) Give advantages of Vapor compression refrigeration system.
(d) List the advantages of Cascade system over single stage Vapor compression refrigeration system.
(e) Draw the schematic diagram of simple vapor absorption refrigeration system.
(f) What is an Azeotrope?
(g) Give chemical name of R-112.
(h) Define BPF and SHF.
(i) What is Duct? Why is it used?
(j) Define Dew point temperature.

SECTION-B

2. Attempt any three part of the following: **(10x3=30)**

a. In a refrigerator working on Bell-Coleman cycle, air is drawn into the cylinder of the compressor from the cold chamber at 1 bar and -30C. After reversible adiabatic compression to 5 bar, the air is cooled at constant pressure to a temperature of 170C, after subsequent polytropic expansion (pv1.25=C) to 1 bar in the expansion cylinder, the air is passed to the cold chamber. Sketch the p-v and T-s dig of the cycle and determine for unit mass flow of the air:
   i. Refrigeration effect
   ii. Work expended and
   iii. COP

b. The following data refer to a two stage compression ammonia refrigerating system with water intercooler. Condenser pressure=14 bar, evaporator pressure=2 bar, intercooler pressure=5 bar, load on the evaporator=10 TR. If the temperature of de-superheated vapor and sub-cooled liquid refrigerant are limited to 300C, find: (a) the power required to drive the system and (b) COP of the system. Use p-h chart.

c. Draw and explain practical vapor absorption refrigeration system.

d. The atmospheric air at 300C DBT and 75% RH enters a cooling coil at the rate of 200 m3/min. The coil dew point temperature is 140C and BPF of the coil is 0.1. Determine the (i) Temperature of the air leaving the cooling coil, (ii) The capacity of the cooling coil in TR and KW, (iii) The amount of water vapours removed per min and (iv)Sensible heat factor for the process.

e. What are different types of expansion devices generally used in refrigeration system? Describe Thermostatic expansion valve with neat sketch.

SECTION-C

3. **Attempt any *one* part of the following:** **10 x 1 = 10**

a. In an aircraft refrigeration unit of a cooling load of 12 TR, the atmospheric temperature and pressure are 120C and 0.9 bar respectively. This pressure increases to 1.01 bar due to ramming effect. The a is bled from the engine compressor at 3.5 bar and passed through the air cooled heat exchanger where its temperature is reduced by 500, the air is then expanded in the cooling turbine, delivered to the aircraft cabin and subsequently leaves the aircraft at 200C. The pressure in the cabin is 1.03 bar. Calculate the power required to undertake the cooling load and COP of the system.

b. A 15 ton aircraft refrigeration plant operates on Boot-strap cooling system. The conditions of ambient air are 170C and 0.95 bar. Due to isentropic ramming action, the pressure of air is increased to 1.2 bar. The pressures of air discharge from main compressor and auxiliary compressor are 3.2 bar and 4.2 bar respectively. 15% of the enthalpy of air discharged from main compressor is removed in the first heat exchanger and 35% of the enthalpy of the air discharged from the auxiliary compressor is removed in the second heat exchanger using rammed air. Subsequently, the air is expanded in the turbine with 85% isentropic efficiency and discharged into the cabin at 1.013 bar pressure. The air is finally exited to the atmosphere at a temperature which is not to exceed 250C. Assuming the isentropic efficiency of both the compressors 80%, determine (a) power required to take the cabin load (b) COP of the system.

4. **Attempt any *one* part of the following:** **10 x 1 = 10**

a. A vapour compression refrigerator uses R-40 and operates between temperature limits of -10 and 450C. At entry to the compressor, the refrigerant is dry saturated and after compression it aquires a temperature of 600C. Using properties from the table, find the COP of the refrigerator.

b. The following data refer to a two stage compression ammonia refrigerating system with water intercooler. Condenser pressure=14 bar, evaporator pressure=2 bar, intercooler pressure=5 bar, load on the evaporator=10 TR. If the temperature of de-superheated vapor and sub-cooled liquid refrigerant are limited to 300C, find:
(a) the power required to drive the system
(b) COP of the system. Use p-h chart.

5. **Attempt any *one* part of the following:** **10 x 1 = 10**

a. Explain advantages of vapour absorption refrigeration system.
A geothermal well at 1300C supplies heat at the rate of 100500 kJ/hr to an vapor absorption system. The environment is at 300C and the refrigerated space is maintained at -220C. Determine the maximum possible heat removed from the refrigerated space. With the help of psychrometric chart, explain following processes:
Cooling and adiabatic humidification process
(ii) Adiabatic mixing of two air streams

b. Describe Electrolux refrigeration system with the help of neat sketches.

(86)

6. **Attempt any *one* part of the following:** **10 x 1 = 10**

a. In an air-conditioning system, the inside conditions are DBT 250C, RH 50% and outside conditions are DBT 400C and WBT 270C. The room sensible heat factor is 0.8. 50% of the room air is rejected to atmosphere and an equal quantity of fresh air is added before air enters the air-conditioning apparatus. If the fresh air added is 100 m3/min, determine:

I. Room sensible and room latent heat load
II. Sensible and latent heat load due to fresh air
III. Apparatus dew point temperature
IV. Humidity ratio and DBT of air entering air-conditioning apparatus

Assume BPF as 0 and density of air 1.2 kg/m3 at a total pressure of 1.01325 bar.

b. With the help of psychrometric chart, explain following processes:

I. Sensible heating and sensible cooling processes
II. Cooling and dehumidification process

How are refrigerants classified? What are the desirable properties of refrigerants? Name some common refrigerants generally used in refrigeration system?

7. **Attempt any *one* part of the following:** **10 x 1 = 10**

a. Describe a cold storage in brief. What factors are considered in design of a cold storage?

b. A rectangular duct section of 500 X 350 mm2 size carries 75 m3/min of air having density of 1.15 kg/m3. Determine the equivalent diameter of a circular duct if (a) the quantity of air carried in both the cases is same; (b) the velocity of the air in both the cases is same. If f=0.01 for sheet metal, find the pressure loss per 100m length duct.

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Sub Code:NME-014

Roll No. 1 5 0 8 2 4 0 0 5 5

BTECH

(SEM VI) THEORY EXAMINATION 2017-18

MECHATRONICS

Time: 3 Hours

Total Marks: 100

Note: **1.** Attempt all Sections.
2. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a. Write down the advantages of mechatronics.
b. Differentiate between conventional and mechatronics system design.
c. Write down the names of control components in hydraulic actuator system.
d. What is counter?
e. What is A.C. Servomotor?
f. Define Actuator.
g. Give any two examples of mechatronics systems currently used now a day.
h. Define adaptive control
i. Explain block diagram of CNC machine
j. Explain building blocks of chasis of car as a result wheel moving along road

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. Explain:
   I. Analog to digital converter
   II. Digital to analog converter
b. Define sensor. Aiso explain the push pull sensors and capacitive proximity sensor
c. What is stepper motor or stepper servomotor? Write the advantages and disadvantages of stepper servomotor.
d. Describe the stages of mechatronics design process
e. Explain:
   I. Flexible manufacturing system
   II. Challenges in mechatronics production unit

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

(a) Write down the few examples of mechatronics systems in industry.
(b) Explain the term inversion of mechanism and different types of mechanisms used in mechatronics

4. Attempt any *one* part of the following: **10 x 1 = 10**

(a) What are logic gates? Draw and explain the various logic gates used in digital electronics.
(b) Explain programmable logic controller along with the ladder diagram.

5. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) Explain:
   I. Hydraulic actuator
   II. Pneumatic actuators

(b) Consider a circuit which has a resistance R in series with capacitance C. the input to the circuit is V and output is potential difference across the capacitor V_c The differential equation relating the input and output is:

$$V_c = RC\frac{dv_c}{dt} + V_c$$

   (a) Determine transfer function
   (b) Perform frequency response analysis

6. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) Discuss in detail the design of pick and place robot in perspective of mechatronics system design.

(b) Explain the automatic car parking system in the context of mechatronics

7. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) Explain
   I. Autotronics
   II. Bionics
   III. Avionics

(b) Explain :
   I. Computer integrated manufacturing
   II. JIT production systems

Printed Pages: 2
Paper Id: 1 4 0 6 1 2

Sub Code: NME021
Roll No.

B.TECH
(SEM VI) THEORY EXAMINATION 2017-18
FLUID MACHINERY

Time: 3 Hours *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. **Attempt *all* questions in brief.** **2 x 10 = 20**

a. What are Fluid machines or Hydraulic machines?
b. State the function of breaking jet in Pelton wheel turbine.
c. Why spiral casing of varying area is employed in reaction turbine?
d. What are the function of Draft tube?
e. What is meant by cavitation with reference to reaction turbine?
f. Differentiate between volute and vortex casing of a centrifugal pump.
g. What is meant by manometric head for centrifugal pump?
h. What is NPSH?
i. What is meant by positive displacement pump?
j. Define the term SLIP of Reciprocating pump.

SECTION B

2. **Attempt any *three* of the following:** **10 x 3 = 30**

a. Derive moment of momentum equation. Also explain its significance
b. Discuss the characteristic curves of hydraulic turbines in detail.
c. A Kaplan turbine develops 9000 KW under a net head of 7.5m. Overall efficiency of the turbine is 86%. The speed ratio based on the outer diameter is 2.2 and the flow ratio is 0.66. Diameter of the boss is 0.35 times the external diameter of the wheel. Determine the diameter of runner and the specific speed of the runner.
d. A centrifugal pump discharges 5 m^3/s under a head of 130 m running at 600 rpm. Outer diameter of impeller is 2 m and has a positive suction lift of 3.2 m including velocity head and friction losses in suction pipe. Experiments were conducted on a geometrically similar model of 0.4 m outer diameter of impeller under a head of 90 m. Vapour pressure of liquid is equal 0.35 m of head. Calculate the discharge, speed and suction lift for the model. Assume atmospheric pressure head = 10.2 m of water.
e. With a neat sketch, write down short notes on air lift pump.

SECTION C

3. **Attempt any *one* part of the following:** **10 x 1 = 10**

(a) A 7.5 cm diameter jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 450 to the axis of the jet. Find the normal pressure on the plate:
i) When the plate is stationary, and
ii) When the plate is moving with a velocity of 15 m/s and away from the jet.
Also determine the power and efficiency of the jet when the plate is moving