Mizoram
MES
Previous Year Paper
Electrical Engg. - II Aug, 2018

MIZORAM PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. UNDER POWER & ELECTRICITY DEPARTMENT, AUGUST, 2018.

ELECTRICAL ENGINEERING
PAPER - II

Time Allowed : 3 hours FM : 200

SECTION - A *(Multiple Choice questions)*

(100 Marks)

All questions carry equal mark of 2 each. Attempt all questions.

*This Section should be answered only on the **OMR Response Sheet** provided.*

1. The steady state error due to a ramp input for a type two system is equal to

(a) Zero
(b) Infinite
(c) Constant
(d) Data is insufficient

2. Consider a system with the transfer function $G(S)=\frac{S+6}{KS^2+S+6}$. Its damping ratio will be 0.5 when the value of K is

(a) 2/6
(b) 3
(c) 1/6
(d) 6

3. The transfer function is $\frac{1+0.5S}{1+S}$. It represents a

(a) Lead network
(b) Lag network
(c) Lag-lead network
(d) Proportional network

4. The effect of adding poles and zeros can be determined quickly by

(a) Nichol's chart
(b) Requisite plot
(c) Bode plot
(d) Root-locus

5. A linear discrete time system has the characteristics equation $Z^3-0.81Z=0$, the system is

(a) Stable
(b) Marginally stable
(c) Unstable
(d) Stability cannot be assessed from the given information

6. The value of 'K' for which the unity feedback system $G(S)=\frac{K}{S(S+2)(S+4)}$ crosses the imaginary axis is

(a) 24
(b) 42
(c) 64
(d) 48

7. The phase angle for the transfer function $G(S)=\frac{1}{(1+ST)^3}$ at corner frequency is

(a) -45^0 (b) -90^0

(c) -135^0 (d) -270^0

8. The open loop transfer function of a feedback control system is $G(S)H(S)=\frac{1}{(S+1)^3}$, the gain margin of the system is

(a) 2 (b) 4

(c) 8 (d) 16

9. Nichol's chart is useful for detailed study and analysis of

(a) Close loop frequency response

(b) Open loop frequency response

(c) Close loop and open loop frequency response

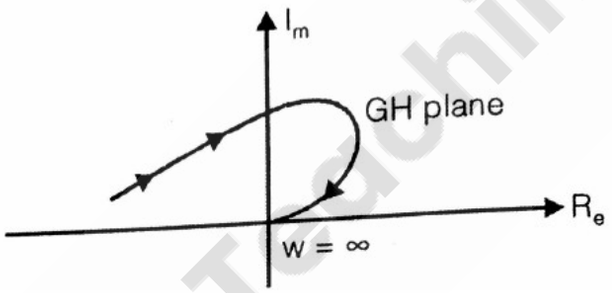
(d) None of these

10. Signal flow graph is used to find

(a) Stability of the system (b) Controllability of the system

(c) Poles of the system (d) Transfer function of the system

11. The Nyquist plot of a control system is shown in below. For this system $G(S).H(S)$ is equal to



(a) $\frac{K}{S(1+ST_1)}$ (b) $\frac{K}{S^2(1+ST_1)}$

(c) $\frac{K}{S^3(1+ST_1)}$ (d) $\frac{K}{S^2(1+ST_1)(1+ST_1)}$

12. Derivate feedback control

(a) Increase feedback time (b) Increase overshoot

(c) Decrease steady state error (d) Does not affect the steady state error

13. With negative feedback in a closed loop control system, the system sensitivity to parameter variations

(a) Increases (b) Decreases

(c) Becomes zero (d) Becomes finite

14. If the magnitude of the polar plot at phase crossover is 'a', the gain margin is

(a) -a (b) 0

(c) a (d) 1/a

15. The initial slope of the bode-plot gives an indication of

(a) Type of the system
(b) Nature of the system time response
(c) System stability
(d) Gain margin

16. The induced e.m.f. in the armature conductors of a d.c. motor is

(a) Sinusoidal
(b) Trapezoidal
(c) Rectangular
(d) Alternating

17. Which of the following d.c. motor would be suitable for drives requiring high starting torque but only fairly constant speed such as crushers?

(a) Shunt motor
(b) Series motor
(c) Compound motor
(d) Permanent magnet motor

18. Cogging of induction motor occurs due to

(a) Harmonic synchronous torque only
(b) Vibration torque
(c) Harmonic induction torque only
(d) Both synchronous and induction torque

19. At a slip of 4% the maximum possible speed of three phase squirrel cage induction motor is

(a) 1440 rpm
(b) 1500 rpm
(c) 2880 rpm
(d) 3000 rpm

20. Slip ring are made of

(a) Steel
(b) Copper
(c) Bakelite
(d) Mica

21. The efficiency of a 3 phase induction motor is approximately proportional to

(a) (1-S)
(b) S
(c) N
(d) Ns

22. A 6-pole, 50 Hz, 3 phase induction motor is running at 950 rpm and has rotor Cu loss of 5 kW. Its rotor input is

(a) 100 kW
(b) 10 kW
(c) 95 kW
(d) 5.3 kW

23. Distribution transformer have core losses

(a) More than full load copper loss
(b) Equal to full load copper loss
(c) Less than full load copper loss
(d) Negligible compared to full load copper loss

24. Transformer oil is used as

(a) An inert medium
(b) An insulant only
(c) A coolant only
(d) Both as an insulant and a coolant

25. The main purpose of using magnetic core in a transformer is to

(a) Prevent eddy current loss
(b) Eliminate magnetic hysteresis
(c) Decrease iron losses
(d) Decrease reluctance of the common magnetic flux path

26. The efficiency of a given transformer is maximum when

(a) It runs overload
(b) It runs at full load
(c) It runs at half full load
(d) It cu loss equals to iron loss

27. Damper winding are provided on

(a) Stator frame (b) Pole faces

(c) Motor Shaft (d) Separate armature

28. Synchronous motors for power factor correction operate at

(a) Normal load with no excitation (b) Normal load with low excitation

(c) No load and over excited (d) No load and under excited

29. Power factor of a synchronous motor varies when

1. Applied voltage is varied
2. Field excitation is varied
3. Load is changed
4. Supply frequency changed

From these, the correct answer is

(a) 1, 2, 3, 4 (b) 2, 3

(c) 2 only (d) 2, 3, 4

30. The rotor power output of 3 phase induction motor is 15 kW. The rotor copper losses at a slip of 4% will be

(a) 600 W (b) 625 W

(c) 650 W (d) 700 W

31. Which one of the following statement is correct?

In an induction motor, if the air gap is increased,

(a) Its speed will reduce (b) Its efficiency will improve

(c) Its power factor will reduce (d) Its breakdown torque will reduce

32. The normal value of the armature resistance of a d.c. motor is

(a) 0.005 (b) 0.5

(c) 5 (d) 50

33. A conductor carries more current on the surface as compared to core. This is called

(a) Permeability (b) Corona effect

(c) Skin effect (d) Unsymmetrical fault

34. If the frequency of a transmission system is changed from 50 Hz to 100 Hz, the string efficiency will be

(a) Increase (b) Decrease

(c) Remain unchanged (d) May be increase or decrease

35. For a good voltage profile under load conditions, a long line needs

(a) Shunt capacitor at receiving end (b) Shunt reactor at receiving end

(c) Shunt reactor at sending end (d) Shunt capacitor at sending end

36. Ferranti effect on long overhead line is experienced when it is

(a) Lightly loaded (b) On full load at upf

(c) On full load at 0.8 pf (d) On full load at zfp

37. Bundle conductors in a transmission line

(a) Increase radio-interference (b) Reduce radio-interference

(c) No effect (d) None of these

38. The most common type of unsymmetrical fault is
(a) Single line to ground (b) Double line to ground
(c) Line to line (d) Three phase

39. The value of diversity factor is
(a) Less than one (b) More than one
(c) Equal to one (d) None of these

40. The most commonly used material for insulators of overhead lines is
(a) Porcelain (b) Glass
(c) Mica (d) PVC

41. 3 phase, 4 wire ac system of distribution is used for
(a) Unbalanced load (b) Balanced load
(c) All type of load (d) None of these

42. How many relays are used to detect inter phase fault of a three line system?
(a) One (b) Two
(c) Three (d) Six

43. In a 3 phase, 5 kV, 5 MVA system, what is the base impedance?
(a) 5 ohms (b) 50 ohms
(c) 500 ohms (d) 0.5 ohm

44. Which relay is used to detect and protect internal faults of a transformer?
(a) Buchholz relay (b) Directional relay
(c) Thermal relay (d) Distance relay

45. Maximum efficiency of modern coal-fired steam-raising thermal power plants is restricted about 0.35 (a low value), mainly because of
(a) Low alternator efficiency
(b) High energy loss in boilers
(c) Low steam turbine mechanical efficiency
(d) High energy loss from turbine exhaust to condenser

46. The leakage resistance of a 50 km long cable is 1 MW. For a 100 km long cable it will be
(a) 1 MW (b) 2 MW
(c) 0.66 MW (d) None of these

47. For a fault at generator terminals the fault current is maximum for
(a) 3- phase fault (b) Line – line fault
(c) S-L-G fault (d) D-L-G fault

48. For variable heads of near about but less than 30 meters, which type of turbines is used in hydro power stations?
(a) Pelton (b) Kaplan
(c) Francis (d) None of these

49. For a load flow solution, the quantities normally specified at a voltage controlled bus are
(a) P and Q (b) P and |V|
(c) Q and |V| (d) P and d

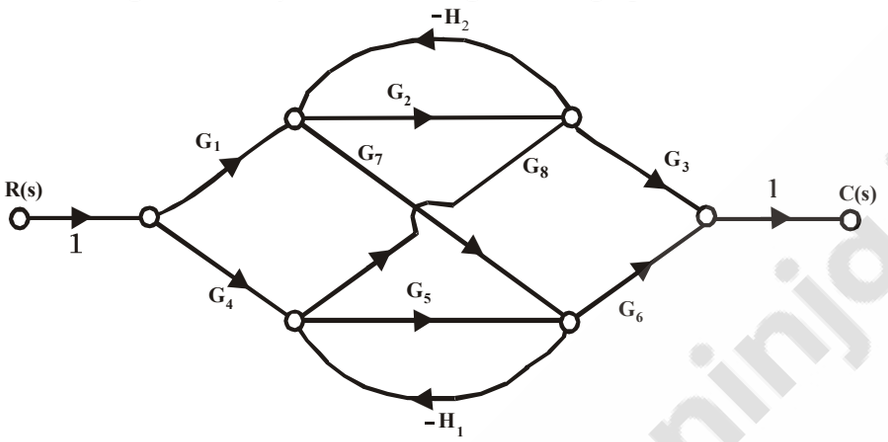
50. Sag of overhead line is proportional to square of
(a) Tension (b) Span
(c) Temperature (d) Weight

SECTION - B *(Short answer type question)*
(100 Marks)

All questions carry equal marks of ***5*** *each.*

This Section should be answered only on the ***Answer Sheet*** *provided.*

1. Find the overall gain of the system whose signal flow graph is shown in below. **(5)**



2. What is steady state error? Find the steady state error constant for unit step input and unit ramp input case. **(1+4)**

3. A certain feedback system is described by the following transfer functions

$$G(S)=\frac{12}{S^2+4S+16}, H(S)=KS$$

The damping factor of the system is 0.8. Determine the overshoot of the system. **(5)**

4. By Routh stability criterion determine the stability of the system represented by the characteristic equation, $9S^5-20S^4+10S^3-S^2-9S-10=0$. Comment on the location of roots of characteristic equation. **(5)**

5. The open loop transfer function of feedback system is $G(S)H(S)=\frac{K(1+S)}{(1-S)}$. Comment on its stability by using Nyquist plot. **(5)**

6. Sketch the root locus plot of unity feedback system with an open-loop transfer function **(5)**

$$G(S)=\frac{K}{S(S+2)(S+4)}$$

7. Derive an expression for the emf induced in a transformer winding. **(5)**

8. Write an expression for efficiency and develop a condition for maximum efficiency of a transformer. **(5)**

9. A three phase step down transformer having turns ratio per phase of 10 takes 10A when connected to 3.3 kV supply mains. Determine the secondary line voltage, line current and output when the transformer windings are connected in (i) star/delta and (ii) delta/star. **(5)**

10. What is armature reaction? Describe the effects of armature reaction on the operation of dc machines. **(1+4)**

11. An 8 pole 400 V shunt motor has 960 wave connected armature conductors. The full load armature current is 40 A and the flux per pole is 0.02 Wb. The armature resistance is 0.1 W and the contact drop is 1 V per brush. Calculate the full load speed of the motor. **(5)**

12. What is slip? Deduce a relationship between rotor current frequency and supply frequency in terms of slip. **(1+4)**

13. A 6 pole three phase induction motor is running at a speed 950 rpm when the input is 50 kW. At this condition the stator copper loss is 1.5 kW and the rotational loss is 1 kW. Determine the rotor copper loss, electromagnetic power developed by the rotor and the mechanical power output. **(5)**

14. Explain the various methods of starting of a synchronous motor. **(5)**

15. Explain the operation of a single phase induction motor on the basis of double revolving field. **(5)**

16. What is stability? Explain the different methods of improving stability of power system. **(1+4)**

17. Classify various types of buses in a power system for load flow studies and justify the classification. **(5)**

18. What are the positive, negative and zero sequence components of current/voltage and what are the relations between them. **(5)**

19. Briefly explain the advantages of HVDC systems over HVAC systems. **(5)**

20. In a short circuit test on a 132 kV 3-phase system, the breaker gave the following results: p.f. of the fault 0.4, recovery voltage 0.95 of full line value, the breaking current is symmetrical and restriking transient had a natural frequency of 16 kHz. Determine the rate of rise of restriking voltage. Assume that the fault is grounded. **(5)**

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