

1(CCE.M)3

Electrical Engineering–II

(09)

Time : Three Hours]

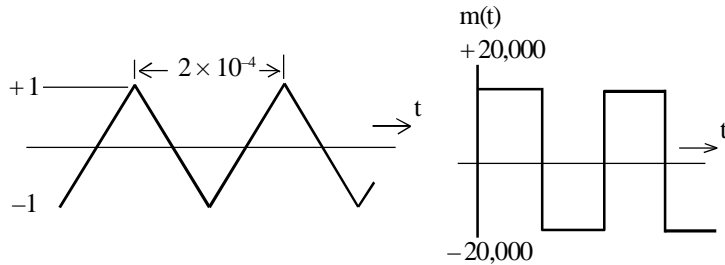
[Maximum Marks : 300

INSTRUCTIONS

- (i) Answers must be written in English.
- (ii) The number of marks carried by each question is indicated at the end of the question.
- (iii) The answer to each question or part thereof should begin on a fresh page.
- (iv) Your answer should be precise and coherent.
- (v) The part/parts of the same question must be answered together and should not be interposed between answers to other questions.
- (vi) Candidates should attempt Section–A and B or Section–A and C. Q.No. 1 of Section–A is compulsory. Candidates should attempt **one** more question from Section–A and any **three** more questions from Section–B or C.
- (vii) If you encounter any typographical error, please read it as it appears in the text-book.
- (viii) Candidates are in their own interest advised to go through the General Instructions on the back side of the title page of the Answer Script for strict adherence.
- (ix) No continuation sheets shall be provided to any candidate under any circumstances.

SECTION-C

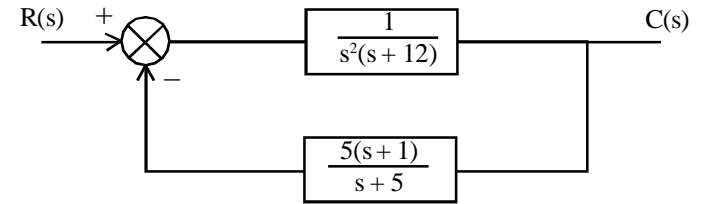
8. (a) What is power spectral density ? Derive an expression for power spectral density. What is the effect of transfer function on power spectral density ? 20
- (b) State and explain convolution theorem. 20
- (c) Discuss various properties of Fourier transform of signals. 20
9. (a) Estimate B_{FM} and B_{PM} for modulating signal $m(t)$ which is shown in figure below for $k_f = 2\pi \times 10^5$, $k_p = 5\pi$. 20



- (b) Draw a neat sketch showing constructional features of a cavity magnetron and explain why magnetron is called cross field device. 20
- (c) With suitable diagrams, explain various types of microwave strip lines. 20
10. (a) What are different techniques of measuring radiation pattern ? Explain at least two techniques in detail. 20
- (b) Sketch the circuit of difference amplifier. Derive the expression for V_o . Explain the principle. 20
- (c) Discuss the following applications of OPAMP :
 (i) Inverting amplifier
 (ii) Integrator. 20

- (d) Draw the circuit of Class-A dc-dc converter. Derive expression for maximum period for which thyristor coil be in conduction. 20

2. (a) Consider the system :



Determine steady state errors for unit step, unit ramp, unit parabolic inputs. 20

- (b) State and explain Mason's gain formula for signal flow graph reduction. 20
- (c) Define the terms : Absolute stability, relative stability. Distinguish between absolute and relative stability. 20
3. (a) Explain the operation of a 3 phase fully controlled rectifier. Draw its output voltage waveform. 20
- (b) Determine appropriate firing angles and emf of dc machine, when it is fed from a single phase fully controlled rectifier.
 $V = 230 \text{ V, } 50 \text{ Hz, } V_{dc} = 120 \text{ V,}$
 $R_a = 1 \Omega, I_a = 10 \text{ A}$
 Rectifier is connected to armature with field separates excited. 20
- (c) Explain principle of operation of single phase bridge inverter circuit. 20

SECTION-B

4. (a) Explain why starter is necessary for a 3-phase induction motor.
How Y/ Δ starter is used to reduce starting current ? 20

- (b) A 3-phase, 200 HP, 3300-V, Y-connected induction motor has following parameters :

$$R_1 = R'_2 = 0.8 \Omega, \quad X_1 = X'_2 = 3.5 \Omega$$

Calculate slip at full load, if friction and windage loss is 3 kW.

How much extra stator resistance would be necessary to increase slip to 3 times this value with full load torque maintained ?

20

- (c) Define armature reaction applied to synchronous generators.
What is the effect of pf on armature reaction ? Explain. 20

5. (a) Draw the circuit diagram used for the conduct of slip test.
Explain the procedure to conduct slip test. 20

- (b) A 3-phase, 8-pole, 50 Hz, 6600 V, Y-connected synchronous motor has a synchronous impedance of $(0.66 + j6.6) \Omega/\text{ph}$.
When excited to give an emf of 4500 V/ph, it takes an input of 2500 kW at unity power factor. Calculate the electromagnetic torque, input current and load angle. 20

- (c) Explain the effect of variation of excitation for a synchronous motor with its load on shaft unaltered. Use phasor diagram for drawing inferences. 20

6. (a) Explain the phenomenon of 'Corona' in transmission lines. Derive an expression for critical disruptive voltage. 20

- (b) An overhead line at a river crossing is supported from two towers of heights 30 m and 90 m above water level with a span of 300 m. The weight of conductor is 1 kg/m. and working tension is 2000 kg. Determine the clearance between conductor and the water level midway between towers. 20

- (c) Explain the principle of an impedance relay with the help of heat diagrams. Also explain the characteristics on R-X plane. 20

7. (a) Describe the construction, principle of operation and application of SF6 circuit breaker. How does this breaker essentially differ from air blast CB ? 20

- (b) Draw the constructional diagram of a Zinc Oxide lightning arrester. Explain how lightning surge is grounded using lightning arrestors. Compare the performance of ZnO arrester with SiC arrestors. 20

- (c) A 3-phase overhead line has per phase resistance and reactance of 6Ω , and 20Ω respectively. The sending end voltage is 132 kV when receiving end is maintained at 132 kV by synchronous modifier. Determine kVAR of modifier, when load at receiving end is 75 MW at 0.8 pf lagging. 20

- (x) Candidates shall put a cross (x) on blank pages of Answer Script.
- (xi) No blank page be left in between answer to various questions.
- (xii) No programmable Calculator is allowed.
- (xiii) No stencil (with different markings) is allowed.

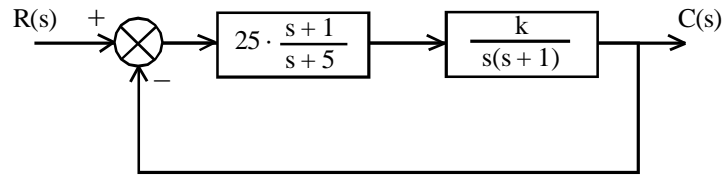
SECTION-A

1. Answer any **three** :

- (a) Sketch connections between different components of ac position control system. Derive $\frac{\theta_C(s)}{\theta_R(s)}$ for an ac position control system.

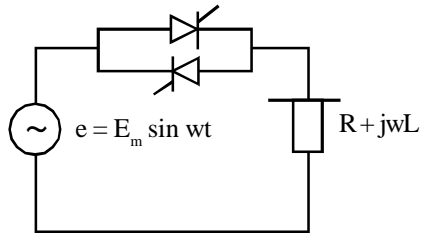
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- (b) Consider following feedback control system :



Evaluate sensitivity for variations in k. 20

- (c) Given the following circuit sketch the output voltage waveform.



Derive expression for o/p voltage. 20

11. (a) How does a phase locked loop demodulate FM signal with the help of a phase discriminator ? Describe with the help of an equivalent diagram. 20
- (b) What is the capture area of an antenna whose directive gain at 20 GHz is 15 dB ? 20
- (c) A sinusoidal carrier of 100 MHz is 40% amplitude modulated (double side) by a sinusoidal message of 1 kHz. What is the percentage increase in (i) total power of the signal and (ii) bandwidth of the signal ? 20