

Roll No.

A

Total No. of Questions : 9]

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EC-302

**MICROWAVE AND RADAR ENGG.
(NEW)**

(B.Tech., 6th Semester, 2055)



Time : 3 Hours

Maximum Marks : 60

Note :- Section A is compulsory. Attempt any Four questions from Section B and any two questions from Section C.

Section-A Marks : 2 Each

1. (a) List the applications of microwaves.
- (b) What are cross field amplifiers ?
- (c) Name a broadband microwave device.
- (d) Define a microwave waveguide.
- (e) What is a microwave hybrid circuit ?
- (f) Where is 'Isolator' used ?

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Turn Over

K-38

(g) What is cavity resonator ?

(h) What are 'Range Ambiguities' ?

(i) Where is delay line canceller used ?

(j) What are range tracking systems ?

Section--B

Marks : 5 Each

2. Describe the construction, working and applications of a reflex Klystron.

3. A certain microwave tunnel diode has a negative resistance of $69 + j9.7 \Omega$. Determine the resonant circuit impedance so that the microwave tunnel diode amplifier will produce a power gain of 15 dB.

4. Compare the directional coupler, bends and corners.

5. Discuss the methods for microwave measurement.

6. Derive the Radar Range Equation.

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Section--C

Marks : 10 Each

7. An O-type helix TWT operates at 8 GHz. The slow wave structure has a pitch angle of 4.4° and an attenuation constant of 2 Np/m. Determine the propagation constant Γ of the travelling wave in the tube.

8. Describe the Scanning and Tracking techniques.

9. Write notes on the following :

(a) MTI Radar

(b) Directional Coupler.

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**Microwave & Radar Engg.
(EC-302, Dec-2005)**

Note: Section A is compulsory. Attempt any four questions from Section-B and any two from Section-C.

Section-A

1. a) List the range of microwave frequencies.
- b) What is bunching in reflex blystrins?
- c) What is a crossed electric magnetic field?
- d) Explain transferred electron effect.
- e) Define "Detection" of microwaves.
- f) Where is "circulator" used?
- g) List the four different modes of Microwave bipolar transistor.
- h) What is the need for matched termination?
- i) Explain "Blind speed"?
- j) What are Doppler tracking systems?

Section-B

2. Describe the construction, working and applications of a magnetron.
3. A microwave tunnel diode has a negative resistance R_n and the resonant circuit resistance R_t . Derive an equation for the gain of a microwave Tunnel diode amplifier.
4. Describe the analysis of MW components using sparameter.
5. Compare the methods for microwave measurements.
6. Explain the operations of a RADAR with a block diagram.

Section-C

7. An O-type TWT operates at 2 GHz. The slow wave structure has a pitch angle of 5.7° . Determine the propagation constant of the traveling wave in the tube. It is assumed that the tube is lossless.
8. Describe the Doppler radars.
9. Write notes on:
 - (a) Scanning techniques
 - (b) Advance transit time effect

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B.Tech. (Semester - 6th & 7th)
DIGITAL COMMUNICATION (EC -304)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:



- 1) Section - A is **compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 x 2 = 20)

- a) Explain the aliasing phenomenon when the sampling frequency is less than the twice of the maximum modulating frequency.
- b) What is slope overload in delta modulation? How it can be avoided?
- c) Explain the use of eye patterns in the signal analysis.
- d) Calculate the bit rate in T1 digital system when the number of channels are 32.
- e) Explain the difference between bit rate and baud rate.
- f) What is the advantage of MSK over QPSK?
- g) Compare Non-coherent and coherent FSK Detectors.
- h) Explain the structure of a basic digital PLL.
- i) What is the physical significance of Shannon limit for information capacity.
- j) Explain μ -law of companding.

Section - B

(4 x 5 = 20)

- Q2) Explain the block diagram of PCM system in brief. How it gives benefit over its analog counterparts.

P.T.O.

- Q3) Describe the use of PLL in Costas loop.
- Q4) 24 telephone channels, each band-limited to 3.4 kHz are to be time division multiplexed by using PCM. Calculate the bandwidth of PCM system for 128 quantization levels at 8 kHz sampling frequency.
- Q5) Calculate the probability of error of Amplitude Shift Keying.
- Q6) Explain the use of interleaving. Compare bit and word interleaving.

Section - C

(2 x 10 = 20)

- Q7) Explain the Quadrature Phase Shift Keying way of digital modulation in detail. Derive all the mathematical equations to support your answer.
- Q8) (a) A Gaussian channel is having a bandwidth of 1 MHz. Calculate the channel capacity if the signal power to noise spectral density is 10^5 Hz. Also find the maximum information rate.
- (b) Explain the process of Adaptive Delta modulation. What is its advantage over delta modulation.
- Q9) Write short notes on the following :
- (a) Probability of error on FSK.
- (b) Codecs and Combo chips.

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Microwave & Radar Engg.
(EC-302, Dec-2007)

Note: Section A is compulsory. Attempt any four questions from Section-B and any two from Section-C.

Section-A

1. a) List the limitations of vacuum tubes.
- b) What is Gyrator?
- c) What is the need of slow wave structure in TWT?
- d) What is matched termination?
- e) What are the applications of BWO?
- f) An IMPATT diode has a pulsed operation voltage of 100V and a pulsed operating current of 0.9A. The efficiency is about 10%. Calculate (i) the output power and (ii) duty cycle, if the pulse width is 0.01ns and the frequency is 16GHz.
- g) What is multiple time around echoes?
- h) What is Radomes?
- i) How one can distinguish a stationary target and a moving target?
- j) Mention advantages and disadvantages of phased array radar?

Section-B

2. How does magnetron work as an oscillator? Discuss.
3. Discuss the applications of PIN diode.
4. Derive the equation given below for directional coupler & then give its S-matrix
 $p^2 + q^2 = 1$.
5. Draw the block diagram for measurement of Doppler direction using synchronous motor and discuss how it indicates the direction of the target.
6. Discuss the radar frequencies & its applications.

Section-C

7. Discuss the methods for measurement of SWR.
8. What is angle tracking system, discuss its various techniques.
9. Write short notes on:
 - (a) Isolator & Circulator
 - (b) TRAPATT diode

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Paper ID [EC302]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 6th&7th)

MICROWAVE AND RADAR ENGINEERING (EC - 302)

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) What is the basic difference between TWT and Magnetron?
- b) What is a Rat-race junction?
- c) For a radar operating at 10 GHz and PRF of 300 Hz, calculate the first, blind speed.
- d) For a radar, peak transmitted power is 1 MW, pulse width is 1 μ sec and PRF is 1kHz. Calculate the average transmitted power?
- e) Enlist the factors that determine the detection range of a radar.
- f) What is velocity Modulation?
- g) What is the basic difference between IMPATT and TRAPAT diodes?
- h) List the what is the main idea behind obtaining -ve Resistance in a Gunn diode biggest disadvantages of IMPATT diode?
- i) What is the main idea behind obtaining -ve Resistance in a Gunn diode?
- j) Why TEM waves not be propagated in waveguides?

Section - B

(4 × 5 = 20)

- Q2) Discuss the operation of a tunnel diode with its V-I characteristics.
- Q3) Write notes on the following :
- (a) Probes and loops
 - (b) Circulators and isolators.

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P.T.O.

- Q4)** A magnetron has following parameters.
Inner radius = 0.15 m
Outer radius = 0.45 m
Magnetic flux density = 1.2 mw/m².
Find hull's cut-off voltage, magnetic flux density if beam voltage is 6000 v and cyclotron frequency in GHz.
- Q5)** Consider a radar with multiple PRF ranging using $f_1 = 13.770$ kHz and $f_2 = 14.580$ kHz. Calculate the need of multiple PRF.
- Q6)** Write a brief technical note on an actual radar system.

Section - C

(2 × 10 = 20)

- Q7)** Derive an expression for blind speed of an MTI radar. Discuss the effect of large wavelength and large pulse repetition frequency on lowest blind speed of target. What is staggered pulse repetition frequency and what are its advantages?
- Q8)** What are Ferrites? Discuss behaviour of ferrites in isolators and circulators.
- Q9)** (a) Explain VSWR measurement in microwaves.
(b) Discuss method for measurement of low and high microwave power.



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[Total No. of Pages : 02

Paper ID [A0317]

(Please fill this Paper ID in OMR Sheet)

B.Tech. (Sem. - 6th)

MICROWAVE AND RADAR ENGINEERING (EC-302)

Time : 03 Hours

Maximum Marks :60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) What is dominant mode of a waveguide?
- b) Can a waveguide have more than one cut-off frequency?
- c) Which is the most desirable property of a cavity resonator?
- d) Define noise figure and noise temperature?
- e) What are ferrites and what special property do they have?
- f) Name three devices that can detect microwave power.
- g) Why is GaAs superior to Silicon as a microwave semiconductor material?
- h) Write three military related applications of RADARs.
- i) Name a RADAR which can simultaneously follow multiple targets.
- j) What is range ambiguity in measuring target distance?

Section - B

(4 × 5 = 20)

- Q2)** What is transit time effect in conventional tubes at microwave frequencies and in which device this is utilized explain in detail?
- Q3)** Describe with schematic and applegate diagram generation of microwaves by multicavity klystron.
- Q4)** Describe with voltage and current waveforms working of TRAPATT diode.
- Q5)** What is a Directional coupler? Describe working of two hole directional coupler?
- Q6)** What is the basic principle on which an isolator works. Also discuss its applications.

Section - C

(2 × 10 = 20)

- Q7)** (a) Describe a method to measure very low microwave power?
(b) How high SWR is measured using a slotted line technique?
- Q8)** (a) What is PRF and range ambiguities and also discuss how they affect maximum Radar range?
(b) Explain with a block diagram basic principle of operation of MTI Radar.
- Q9)** (a) Discuss in detail Doppler tracking system.
(b) Describe conical scan technique for angle tracking system.



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B.Tech. (Sem. - 6th)
MICROWAVE AND RADAR ENGINEERING

SUBJECT CODE : EC - 302

Paper ID : [A0317]

[Note : Please fill subject code and paper ID on OMR]

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Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) What is cut off frequency of a waveguide?
- b) Which is the most desirable property of a cavity resonator?
- c) Write a cause of noise in microwave tubes.
- d) Can a waveguide have more than one cut-off frequency.
- e) Define Faraday rotation.
- f) Why is GaAs superior to Silicon as a microwave semiconductor material?
- g) Name a RADAR which can simultaneously follow multiple targets.
- h) How do insertion loss different from attenuation?
- i) What is Doppler effect in RADAR?
- j) Write three military related applications of RADARs.

Section - B

(4 × 5 = 20)

- Q2)** What is problems with conventional tubes at microwave frequencies?
- Q3)** Describe with schematic and applegate diagram generation of microwaves by two cavity klystron.
- Q4)** Describe different modes of operation for Gunn diodes.
- Q5)** What is the basic principle on which a circulator works. Also discuss it's applications.
- Q6)** What is a Directional coupler? Describe working of two hole directional coupler.

Section - C

(2 × 10 = 20)

- Q7)** (a) How SWR is measured using a slotted line technique?
(b) Describe a method to measure unknown microwave frequency.
- Q8)** (a) Derive the basic radar range equation and discuss the parameters on which maximum range depends.
(b) Explain with a block diagram CW Radar and also discuss it's limitations.
- Q9)** (a) Describe lobe switching technique for angle tracking system.
(b) Discuss in detail Doppler tracking system.



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B.Tech. (Sem. - 6th)

MICROWAVE & RADAR ENGINEERING

SUBJECT CODE : EC - 302

Paper ID : [A0317]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

Section - A

Q1)

(10 × 2 = 20)

- a) What are skin effect losses?
- b) Give the X-band frequency range.
- c) What is C ring tuning with respect to Magnetron?
- d) Name two important materials that are used in Schottky-barrier diode.
- e) What is Bolometer? Give two examples.
- f) Define minimum detectable signal.
- g) Why do blind speeds occur?
- h) State the properties of single delay line canceller that limit the utility of simple doppler filter.
- i) What is difference between search radar and tracking radar?
- j) What are the disadvantages of lobe scanning?

Section - B

(4 × 5 = 20)

- Q2) Explain the gain bandwidth product limitation & transit angle effects in conventional tubes at microwave frequencies.
- Q3) Explain bunching process & obtain expression for bunching parameter in a two cavity klystron amplifier.
- Q4) An IMPATT diode has drift length of 2 μm . Determine :
(a) Drift time of the carriers.
(b) Operating frequency of IMPATT diode.
- Q5) Draw the block diagram of radar and explain the function of each block.
- Q6) Why do blind speeds occur? Discuss the methods for reducing the effects of blind speeds.

Section - C

(2 × 10 = 20)

- Q7) How is bunching achieved in cavity magnetron? With a neat diagram explain the working of a multicavity magnetron.
- Q8) Explain the working of a circulator and hence obtain the scattering matrix of the circulator from the first principle.
- Q9) Draw the block diagram of conical scan radar and sequential lobing tracking radar and explain its operation.

