

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-148**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (EC/ECT/E&C)**  
**Optical Fiber Communication**  
**(REVISED)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B i) Q. No2 from section A & Q. No 7 from section B are compulsory.  
 ii) Attempt any two questions from remaining questions of each section.

## Section A

- |     |  |    |
|-----|--|----|
| Q.1 | (a) Explain optical fibre communication technique in detail.                 | 08 |
|     | (b) Explain various types of optical fibers with its construction.           | 07 |
| Q.2 | (a) Explain photo detector parameter in detail.                              | 05 |
|     | (b) Explain propagation of optical fibre in detail.                          | 05 |
| Q.3 | (a) Explain photodiode and photo transistor in detail.                       | 08 |
|     | (b) Explain various losses in optical fiber communication system?            | 07 |
| Q.4 | (a) Explain scattering and dispersion of optical fibre communication system? | 08 |
|     | (b) Explain LED in optical fibre communication system in detail?             | 07 |
| Q.5 | Write any two short notes  | 15 |
|     | 1. Optoisolators   |    |
|     | 2. Splices   |    |
|     | 3. Optical fiber losses  |    |
|     | 4. Modulation techniques.  |    |

## Section B

- |     |  |    |
|-----|--|----|
| Q.6 | (a) Explain system design consideration of digital foc system. | 08 |
|     | (b) Explain WDM in detail.                                     | 07 |
| Q.7 | (a) Explain Network topologies.                                | 05 |
|     | (b) Explain OTDR measurement of OFC                            | 05 |
| Q.8 | (a) Explain optical fibre characteristics?                     | 08 |
|     | (b) Explain eye design test?                                   | 07 |
| Q.9 | (a) Explain optical time domain Reflectometer?                 | 08 |
|     | (b) Explain optical Ethernet in detail.                        | 07 |

Q.10

Attempt any two

- (1) SONET
- (2) Measurement standards in OFC
- (3) WDM network
- (4) SDK tracking

15

Total No. of Printed Pages:2

**SUBJECT CODE NO: H-230**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (ECT/E&C)**  
**Elective-II : Applied Digital Signal Processing**  
**(REVISED)**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- i) Q.No.1 and Q.No.6 are compulsory.
  - ii) Solve any two questions from Q.2 to Q.5
  - iii) Solve any two questions from Q.7 to Q.10
  - iv) Assume suitable data if necessary

**Section A**

- Q.1 Attempt any two questions from the following. 10
- i) Need of adaptive filters
  - ii) Lattice structure method
  - iii) Explain in brief why is the AR model widely used?
  - iv) Explain in brief characteristics of poly phase filters.
- Q.2
- a) Describe adaptive algorithms 07
  - b) Write main components of adaptive filter 08
- Q.3
- a) Describe forward and backward linear prediction 07
  - b) Explain in detail the L.M.S adaptive algorithm. 08
- Q.4
- a) Explain the different approaches for LPCs 08
  - b) Explain the multistage interpolation 07
- Q.5 Write short note on (any three) 15
- i) Sampling rate conversion by non-integer factors
  - ii) Autocorrelation method
  - iii) QMF bank
  - iv) RLS algorithm

## Section B

- Q.6 Attempt any two questions from the following 10
- i) Review of deterministic signal
  - ii) Application of DSP in audio system
  - iii) What is random signal? Write any two examples
  - iv) What is circular buffering? Explain in brief
- Q.7
- a) Describe in detail correlation function 08
  - b) Explain hardware architecture and pipelining concept of DSP processors 07
- Q.8
- a) Describe the power spectra 07
  - b) Write a method for removal and control of ocular artifacts for human EEGS 08
- Q.9
- a) Explain application of multi rate signal processing 08
  - b) Explain fixed and floating point representation in DSP architecture 07
- Q.10 Write a short notes on (any three) 15
- i) TMS320C54xx DSP
  - ii) Selection criteria of DSP
  - iii) SHARC processor
  - iv) MAC unit

Total No. of Printed Pages:02

**SUBJECT CODE NO: H-233**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (EC)**  
**Elective-II : Wireless & Mobile Communication**  
**(REVISED)**

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

- N.B
- 1) Q.1 & Q.6 are compulsory.
  - 2) Attempt any two questions from remaining questions from each section.

**SECTION - A**

- |     |  |    |
|-----|--|----|
| Q.1 | a) Compare TDMA & CDMA.                                    | 05 |
|     | b) Explain the concept of frequency reuse with an example. | 05 |
| Q.2 | a) Explain ISDN services in detail.                        | 08 |
|     | b) What is DTH? Where it is used?                          | 07 |
| Q.3 | a) Explain co – channel interference in detail.            | 08 |
|     | b) What is IMT – 2000? Explain UMTS.                       | 07 |
| Q.4 | a) Draw architecture of SS-7, explain in detail.           | 07 |
|     | b) Explain process steps in roaming.                       | 08 |
| Q.5 | Write short note on <u>any three</u> of the following.     | 15 |
|     | 1. 2G & 3G Technology.                                     |    |
|     | 2. GPRS  |    |
|     | 3. Hand off  |    |
|     | 4. Bluetooth   |    |

SECTION –B

- Q.6 a) Explain wireless Protocols & standards for IEEE. 05  
 b) Explain ios in detail. 05
- Q.7 a) Explain the process of intra – MSC handover is GSM. 08  
 b) What are the features of Android? What are its different versions? 07
- Q.8 a) What is DTH? What are its requirements? 08  
 b) Explain CDMA architecture. List out its features. 07
- Q.9 a) Explain the flow of message for MTC and MOC. 07  
 b) Explain WAP in detail. 08
- Q.10 a) Discuss the architecture of ZigBee in detail. 08  
 b) Explain IEEE 802.11 in detail. 07

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-288**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (EC/ECT/E&C)**  
**Elective-II: Satellite Communication**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- i) Q1 & Q6 are compulsory.
  - ii) Solve any two questions from Q. No.2,3,4 & 5.
  - iii) Solve any two questions from Q.No.7,8,9, & 10.

## Section A

- Q.1 Answer any two questions from the following 10
- (a) The apogee & Perigee distance of a satellite orbiting in an elliptical orbits are respectively 45000 km 47000 km. Determine the following
    - (i) Semimajor axis of the elliptical orbit
    - (ii) Orbit eccentricity.
    - (iii) Distance between the center of earth and the center of elliptical orbit
  - (b) What are the orbital parameter of satellite?
  - (c) Explain Atmospheric losses.
- Q.2 a) A satellite of a distance of 40000 km from point on the surface radiated a power of 200 from 08 an antenna with gain of 17 dB in the direction of observer. Find the flux density at the Receiving point. Power received by an antenna with an effective area of 10m<sup>2</sup>. 08
- b) Explain Rain Attenuation & other impairments in detail 07
- Q.3 (a) What is Demand assigned TDMA? Explain. 08
- (b) Explain Tracking Techniques in detail. 07
- Q.4 (a) Explain SDMA in detail 08
- (b) Compare FDMA & TDMA. 07
- Q.5 Write Note on 15
- (a) Sun transit outage
  - (b) Spread spectrum and dispreading
  - (c) Antenna parameter.

Section-B

- Q.6 Attempt any two from the following 10
- (a) Explain the concept of spin stabilization.
  - (b) Explain look angles of satellite
  - (c) Attitude & orbit control of Satellite
- Q.7 (a) Explain Tracking telemetry & Command Subsystem 08  
 (b) Explain power supply subsystem of satellite. 07
- Q.8 (a) Explain scientific satellite and its application 08  
 (b) Compare LEO, MEO & GEO. 07
- Q.9 (a) Explain types of earth stations in detail. 08  
 (b) Explain the types of the Transponders & Transponder performance parameter. 07
- Q.10 Write Note on 15
- (a) Station Keeping
  - (b) GSM & GPS
  - (c) Satellite Television



Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-339**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (EC/ECT/E&C)**  
**Embedded Systems**  
**(REVISED)**

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

- N.B
- 1) Q.No.1 & Q.No.6 are compulsory.
  - 2) Solve any two questions from remaining from each section.
  - 3) Assume suitable data whenever necessary.
  - 4) Figure to right indicate full marks.

## Section A

- |     |   |          |
|-----|---|----------|
| Q.1 | Solve any two questions from following:-<br>a) Explain software design testing in embedded system.<br>b) Give significance of stack pointer register, link register and program counter register.<br>c) Explain RTC module in detail. | 10       |
| Q.2 | a) Explain different design challenges in embedded system.<br>b) Discuss in detail SPI protocol.  | 08<br>07 |
| Q.3 | a) Justify how barrel shifter increases power and flexibility of data processing operations.<br>b) Explain different registers in ARM core architecture.  | 08<br>07 |
| Q.4 | a) Explain Branching and Compare instructions of ARM7.<br>b) Write an ARM7 based program to transfer 16 bytes of data from one memory array to another memory array.  | 08<br>07 |
| Q.5 | Write short notes on:- (Any Three)<br>a) ARM Bus Architecture.<br>b) Recent trends and applications of embedded system.<br>c) Thumb Instruction set.<br>d) Pipelining.  | 15       |

## Section B

- |     |   |          |
|-----|---|----------|
| Q.6 | Answer any two questions from following.<br>a) Discuss features of $\mu$ cos-II<br>b) Explain task scheduling and functions of dispatcher.<br>c) Explain porting of RTOS.   | 10       |
| Q.7 | a) Draw neat diagram to interface 4 LED's and 4 switches with ARM 7 and write a embedded 'C' program to turn 'ON' 4 LED's when respective switch is closed.<br>b) Explain in brief need of interfacing and interfacing techniques in embedded system. | 08<br>07 |

- Q.8 a) Explain in detail memory management in  $\mu$ cos-II. 08  
b) Discuss in detail:- 07
  - i. ISR.
  - ii. Semaphore.
  
- Q.9 a) Explain in detail designing of ARM based smart card. 08  
b) Discuss in detail kernel and its architecture in RTOS. 07
  
- Q.10 Write short notes on:- (Any Three) 15
  - a) Message queue.
  - b) RTOS services.
  - c) Mail box.
  - d) Touch screen interfacing in ARM7

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-496**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (ECT/E&C)**  
**Antenna Theory & Wave Propagation [Elective-II]**  
**(REVISED)**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- 1) Que.No.1 and Que.No.6 are compulsory.
  - 2) Solve any two questions from remaining questions in each section.
  - 3) Assume suitable data wherever necessary.

**Section A**

- Q.1 Write a short note on(Any Two) 10
- a) Radiation.
  - b) Finite Length dipole.
  - c) Huygens Principle.
- Q.2 07
- a) Define antenna? Explain the detailed classification of antenna.
  - b) Explain the near & far field regions of radiation. 08
- Q.3 07
- a) Explain the radiation integrals & auxiliary potential functions.
  - b) What are the design considerations for reflector antenna? Also explain Babinet's principle. 08
- Q.4 07
- a) Explain the dipoles for Mobile communication.
  - b) Write a short note on small circular loop. 08
- Q.5 07
- a) With the help of neat diagram, explain casser gain antenna.
  - b) Explain the radiation from sectoral & pyramidal horns. 08

**Section B**

- Q.6 Write a short note on(Any Two) 10
- a) Yagi antenna.
  - b) Basic characteristics of micro strip.
  - c) Attenuation characteristics for ground wave propagation.
- Q.7 07
- a) What is smart antenna? Explain basic concepts of smart antenna.
  - b) Explain the feeding techniques of antenna array. 08
- Q.8 What is Patch antenna? Explain excitation modes, radiation mechanism, advantages & limitations of patch antenna. 15
- Q.9 07
- a) Explain the reflection characteristics of earth.
  - b) Explain the design equations for micro strip antenna & Patch antenna. 08

- Q.10 a) For sky wave propagation, explain the following.
- i. Effect of earth's magnetic field.
  - ii. Energy loss in the atmosphere due to collisions.
- b) With the help of neat diagram, explain duct propagation.

07

08

Total No. of Printed Pages: 02

**SUBJECT CODE NO:- H-115**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (EC/ECT/E&C)**  
**Computer Communication Network**  
**[REV]**

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

- N. B
- 1) Q. 5 & Q. 10 are compulsory.
  - 2) Solve any two from Q. 1, Q. 2, Q. 3 and Q. 4.
  - 3) Solve any two from Q. 6, Q. 7, Q. 8 and Q. 9.

Section A

- |      |  |    |
|------|--|----|
| Q. 1 | a) Explain why seven layered protocol is adopted by ISO-OSI reference module. Also elaborate the important functions of each layer in ISO – OSI. | 08 |
|      | b) Define topology and give the different topologies of network.   | 07 |
| Q. 2 | a) With the neat diagram give the comparison of circuit switching & packet switching.  | 07 |
|      | b) Explain in detail one bit sliding window protocol.  | 08 |
| Q. 3 | a) How can the routing be classified? Explain in brief hierarchical routing.   | 08 |
|      | b) State the various design issues of data link layer.   | 07 |
| Q. 4 | a) Explain TCP segment header with neat diagram.   | 08 |
|      | b) Explain in brief E- mail.   | 07 |
| Q. 5 | Write a short note on (any two)  | 10 |
|      | a) WWW   |    |
|      | b) UDP   |    |
|      | c) TCP / IP model  |    |
|      | d) Connection oriented and connectionless services.  |    |

Section B

- |      |   |    |
|------|---|----|
| Q. 6 | a) Draw the conceptual view of structure of ISDN and explain in brief.                            | 08 |
|      | b) Compare and contrast narrowband and broadband ISDN.  | 07 |
| Q. 7 | a) Explain in detail call control protocol architecture.  | 08 |
|      | b) What is the need for congestion control? Discuss on congestion control notification mechanism. | 07 |
| Q. 8 | a) Explain ATM adaptation layer in detail.  | 08 |
|      | b) Explain in brief frame mode protocol architecture at the user network interface.               | 07 |

- Q. 9 a) Perform decryption and encryption using RSA algorithm with  $p = 3$ ,  $q = 11$ ,  $e = 7$  &  $N = 5$  08  
b) Explain different methods of audio data hiding. 07
  
- Q. 10 Write a short note on (any two) 10
  - a) ISDN physical layer
  - b) ATM service categories
  - c) Steganography
  - d) Secret key algorithm

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-183**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (ECT/E&C)**  
**Consumer Electronics**  
**(Revised)**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

N.B

- 1) Q. No.1 & Q. No.6 are compulsory from both the section.
- 2) Solve any two questions from section 'A' & section 'B' from remaining.
- 3) Figures to right indicate full marks.

**SECTION – A**

- |     |   |          |
|-----|---|----------|
| Q.1 | Solve any two.  | 10       |
|     | <ol style="list-style-type: none"> <li>i) Explain biometric sensors.</li> <li>ii) Explain line current Harmonics.</li> <li>iii) Explain Blur ray DVD player.</li> </ol>   |          |
| Q.2 | <ol style="list-style-type: none"> <li>a) Explain Android technology and its applications.</li> <li>b) With the help or suitable diagram explain digital dolby system.</li> </ol>   | 08<br>07 |
| Q.3 | <ol style="list-style-type: none"> <li>a) Draw the block diagram of EpABX and explain its operation.</li> <li>b) Explain operating principle and working of microwave oven.</li> </ol>  | 08<br>07 |
| Q.4 | <ol style="list-style-type: none"> <li>a) What is HDTV? Explain HDTV with block diagram. State its advantages.</li> <li>b) How an audio signal extracted from a track on compact disc? List out typical specifications of CD player.</li> </ol> | 08<br>07 |
| Q.5 | <ol style="list-style-type: none"> <li>a) Draw block diagram of electronic calculator &amp; explain its operation.</li> <li>b) What is the principle of operation of vaccume cleaner? Explain in detail.</li> </ol>                             | 08<br>07 |

**SECTION – B**

- |     |  |          |
|-----|--|----------|
| Q.6 | Solve any two  | 10       |
|     | <ol style="list-style-type: none"> <li>i) Explain water purifier</li> <li>ii) State EMI/ EMC requirements.</li> <li>iii) Explain solar lamp.</li> </ol>                    |          |
| Q.7 | <ol style="list-style-type: none"> <li>a) With neat block diagram explain operation of EVM.</li> <li>b) Discuss the operation of LASER printer.</li> </ol>                 | 08<br>07 |
| Q.8 | <ol style="list-style-type: none"> <li>a) Discuss the standards related to electrical safety and fire hazards.</li> <li>b) With neat block diagram explain ATM.</li> </ol> | 08<br>07 |

- Q.9 a) What are product safety issues? Explain.
- b) Distinguish between CFL and LED lamps.

08  
07

- Q.10 a) Explain the working of scanner.
- b) Explain the technology used in photocopiers.

08  
07



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**SUBJECT CODE NO:- H-184**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (EC)**  
**Applied Digital Signal Processing**  
**(Revised)**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- i. Q.1 & Q.6 are compulsory.
  - ii. Attempt any two other questions from the remaining questions each section.

## Section A

- |     |   |                     |
|-----|---|---------------------|
| Q.1 | Attempt any two   | 10                  |
|     | <ol style="list-style-type: none"> <li>i. Sampling rate increase &amp; sampling rate deduction.</li> <li>ii. Explain polyphase filter structures.</li> <li>iii. Limitations of LMS filters.</li> <li>iv. Explain covariance method in linear prediction.</li> </ol> |                     |
| Q.2 | <ol style="list-style-type: none"> <li>a) Explain Recursive least squares algorithm &amp; it's limitations.</li> <li>b) Explain in detail adaptive equalization.</li> </ol>   | <p>08</p> <p>07</p> |
| Q.3 | <ol style="list-style-type: none"> <li>a) Explain forward linear prediction.</li> <li>b) What is need of adaptive filter?</li> </ol>  | <p>07</p> <p>08</p> |
| Q.4 | <ol style="list-style-type: none"> <li>a) What is adaptive filtering? How it is used for noise cancellation.</li> <li>b) Explain the signification of backward linear prediction.</li> </ol>  | <p>08</p> <p>07</p> |
| Q.5 | Write a short notes on ( Any Three )  | 15                  |
|     | <ol style="list-style-type: none"> <li>i. ARMA model</li> <li>ii. GMF Bank</li> <li>iii. Lattice structure method</li> <li>iv. LMS algorithm</li> </ol>   |                     |

## Section B

- |     |   |                     |
|-----|---|---------------------|
| Q.6 | <ol style="list-style-type: none"> <li>a) What is difference between fixed point &amp; floating point representations?</li> <li>b) Explain selection criteria of DSP processors.</li> </ol>                 | <p>05</p> <p>05</p> |
| Q.7 | <ol style="list-style-type: none"> <li>a) Explain power spectrum estimation of correlation function.</li> <li>b) Explain Architecture for DSPs in detail.</li> </ol>  | <p>07</p> <p>08</p> |
| Q.8 | <ol style="list-style-type: none"> <li>a) Explain equalization of digital audio signals in audio processing.</li> <li>b) Explain Harvard architecture &amp; pipelining concept of DSP processor.</li> </ol> | <p>07</p> <p>08</p> |

- Q.9 a) Explain Welch method of power spectrum estimation.
- b) Explain MAC unit Barrel shifter in detail.

07  
08

- Q.10 Write short notes on any three
- i. AR, MA & ARMA
  - ii. Application of DSP
  - iii. Bartlett window
  - iv. Power spectrum estimation
  - v. What is periodogram?

15

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-237**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (EC/ECT/E&C)**  
**Elective – II : Analog Integrated Circuit Design**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

N.B Please check whether you have got the right question paper.

- N.B
- i) Q.No.1 and Q.No.6 are compulsory.
  - ii) Solve any two questions from Q.No.2 to 5.
  - iii) Solve any two questions from Q.No.7 to 10.
  - iv) Assume suitable data if necessary & state it clearly.
  - v) Figures to the right indicate full marks.

**Section A**

- |     |  |          |
|-----|--|----------|
| Q.1 | Write short notes (any two)  | 10       |
|     | <ol style="list-style-type: none"> <li>a) Transient simulation</li> <li>b) Electromagnetic simulation</li> <li>c) Harmonic Balance simulation</li> </ol>   |          |
| Q.2 | <ol style="list-style-type: none"> <li>a) Draw High Frequency Small Signal Model of a MOSFET. Explain briefly each parasitic.</li> <li>b) Draw the circuit of Wide Swing Cascode Current Mirror. Explain its operation.</li> </ol>                                   | 08<br>07 |
| Q.3 | <ol style="list-style-type: none"> <li>a) What are the input and output resistances of Common Gate Amplifier? Derive them using Kirchhoff's Current Law.</li> <li>b) Detail the methods to increase output resistance of Current Mirror.</li> </ol>                  | 08<br>07 |
| Q.4 | <ol style="list-style-type: none"> <li>a) Draw a simple PMOS current Mirror. Derive its output resistance.</li> <li>b) What is body effect in MOSFET? How does it affect performance of a MOSFET?</li> </ol>   | 08<br>07 |
| Q.5 | <ol style="list-style-type: none"> <li>a) For an abrupt pn-junction diode, derive expression for Electric Field Intensity and Electric Potential as a function of distance x.</li> <li>b) Derive diode current equation for a forward biased pn-junction.</li> </ol> | 08<br>07 |

**Section B**

- |     |  |          |
|-----|--|----------|
| Q.6 | Write short notes (any two)  | 10       |
|     | <ol style="list-style-type: none"> <li>a) AM-AM conversion</li> <li>b) Efficiency of a power Amplifier</li> <li>c) Gain of a power amplifier</li> </ol>  |          |
| Q.7 | <ol style="list-style-type: none"> <li>a) Draw the circuit diagram of classical 2-stage OpAmp with Lead Compensation.</li> <li>b) Current flowing in differential stage and output stage of OpAmp is 500 <math>\mu</math>A. Overdrive voltage of each transistor is 0.1V and compensation capacitance is 2.2Pf. Determine its Unity Gain Bandwidth and Slew Rate.</li> </ol> | 08<br>07 |

- Q.8 a) What is ACPR of a power amplifier? Explain with the help of a diagram. 08  
b) Explain spectral re-growth in a non-linear power amplifier. 07
- Q.9 a) What is error vector magnitude or EVM? Explain with the help of a diagram. 08  
b) Draw the diagram of PTAT current reference and explain its operation. 07
- Q.10 a) Draw circuit diagram of Gilbert Cell Mixer. Explain its operation. 08  
b) List the Third Order Mixing products terms for two tone inputs  $f_1$  and  $f_2$ . Which terms cannot be filtered using filter? 07

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-236**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (ECT)**  
**Elective – II : Solar Photo Voltaics Design**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

- N.B Please check whether you have got the right question paper.
- i) Q.No.5 and Q.10 are compulsory.
  - ii) Solve any two questions from remaining questions from each section.
  - iv) Assume suitable data if necessary.

## Section A

- |     |   |    |
|-----|---|----|
| Q.1 | a) Draw and explain solar cell characteristics.   | 08 |
|     | b) Explain saw damage removal & surface texturing.  | 07 |
| Q.2 | a) What are carrier generation & recombination mechanism? Which of recombination mechanism is most important iSSi & GAAS? | 08 |
|     | b) Explain Electric field and Energy band bending in detail?  | 07 |
| Q.3 | a) What are cell parameters? Explain  | 08 |
|     | b) What are the Routs of purification & usage of Si?  | 07 |
| Q.4 | a) Explain PN Junction diode - Equilibrium and Non equilibrium conduction?  | 08 |
|     | b) Enlist and explain design criteria for obtaining high VOC of cell?   | 07 |
| Q.5 | Write short note on any two   |    |
|     | a) Si wafer production  | 05 |
|     | b) Sun tracking   | 05 |
|     | c) 1V equation and solar cell characteristics   | 05 |

## Section B

- |     |  |    |
|-----|--|----|
| Q.6 | a) Draw and explain cdTe cell fabricated in superstrate arrangement. | 08 |
|     | b) Explain Maximum power point tracking.                             | 07 |
| Q.7 | a) Design PV system for specified daily water requirement.           | 08 |
|     | b) List standalone PV system & explain any two.                      | 07 |
| Q.8 | a) What are the factors affecting battery performance?               | 08 |
|     | b) Explain GAAS solarcell.   | 07 |
| Q.9 | a) Explain in detail Life cycle costing.                             | 08 |
|     | b) Explain Sputtering concept of cell.                               | 07 |

- Q.10 Write short notes on any two
- a) Hot spots
  - b) Electrochemical cell
  - c) Thin film polycrystalline

05  
05  
05

Total No. of Printed Pages: 02

**SUBJECT CODE NO:- H-235**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. ( EC/ ECT/ E&C)**  
**Elective – II : Advanced Industrial Automation -II**  
**(Revised)**

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

- N. B
1. Q. No. 1 and 6 are compulsory.
  2. Solve any two questions from section 'A' and solve any two from section 'B' from remaining.

## Section A

- |      |   |          |
|------|---|----------|
| Q. 1 | Solve any five  | 10       |
|      | <ol style="list-style-type: none"> <li>a) What is EMC?</li> <li>b) Classify control panel.</li> <li>c) 5 Bar----- PSI.</li> <li>d) Why cascade method are used?</li> <li>e) Classify pneumatic valves.</li> <li>f) What are different safety standards to design control panel?</li> <li>g) Enlist component installed over control panel.</li> </ol> |          |
| Q. 2 | <ol style="list-style-type: none"> <li>a) Develop <math>A^+ B^- B^+ A^-</math> Pneumatic control circuit using cascade method.</li> <li>b) What is P-I diagram? Explain the role of different Engineers in drawing P-I diagram.</li> </ol>  | 07<br>08 |
| Q. 3 | <ol style="list-style-type: none"> <li>a) Explain electro- pneumatic system in detail.</li> <li>b) Explain SCADA systems with its functions.</li> </ol>   | 07<br>08 |
| Q. 4 | <ol style="list-style-type: none"> <li>a) Explain comprehensive security levels for general SCADA system.</li> <li>b) Draw pneumatic position control circuit for <math>A^+ B^+ C^+ A^- B^- C^-</math> operation.</li> </ol>  | 07<br>08 |
| Q. 5 | <ol style="list-style-type: none"> <li>a) Explain the mounting &amp; installation guide line of control panel design.</li> <li>b) What are different SCADA protocols? Explain in detail.</li> </ol>   | 08<br>07 |

## Section B

- |      |  |    |
|------|--|----|
| Q. 6 | Solve any five   | 10 |
|      | <ol style="list-style-type: none"> <li>a) Define hydraulic leverage &amp; mechanical advantage.</li> <li>b) Classify hydraulic valves.</li> <li>c) Give significance of PRV valve.</li> <li>d) Enlist different Industrial Automation system.</li> <li>e) What do you mean by B.O.M.</li> <li>f) Enlist different position sensors used in Automation.</li> <li>g) Define pascal law.</li> </ol> |    |

- Q. 7 a) Develop hydraulic control circuit to generate the sequence of  $A^+ B^+ B^- A^-$  by using PRV. 08  
 b) Explain kiln Automation in detail. 07
- Q. 8 a) What is pascal law? Explain hydrostatic & hydrodynamics in detail. 08  
 b) Design yogurt mixer with the help of operational diagram. 07
- Q. 9 a) Explain irrigation Canal automation strategy with its block schematic. 08  
 b) Find out hydrostatic pressure in Bar at bottom of container filled with oil which has density of  $0.8 \text{ kg/ dm}^3$  & container height is 800m. 07
- Q. 10 a) Design carton sorting machine with the help of operational, Logic & panel design diagram. 10  
 b) Explain objectives of Automation system. 05



Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-305**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E.(ECT/EC/E&C)**  
**Digital Image Processing**  
**(Revised)**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- i. Q.5 and Q.10 are compulsory.
  - ii. Solve any two questions from remaining in each section.
  - iii. Assume suitable data if required.

**Section A**

- Q.1 a) Explain fundamental steps indigital image processing in detail. 08  
 b) Explain various file formats of an image. 07
- Q.2 a) Explain Walshand hadamardtransform. 08  
 b) Explain stereo imaging 07
- Q.3 a) Describe image enhancement using arithmetic and logical operators 07  
 b) Find the resultant when  $3 \times 3$  averaging mask is applied to given image. Assume zero padding 08

3	4	2	3
1	7	3	2
4	6	3	8
2	3	1	7

- Q.4 a) Explain image sharpening in spatial domain. 07  
 b) Explain image smoothing filters in spatial domain. 08
- Q.5 Write short note on (any two)
- a) Digital Image Representation 05
  - b) Distance measures 05
  - c) Contrast stretching 05

**Section B**

- Q.6 a) What is image segmentation? How line and point detection is done. 08  
 b) Explain region based segmentation 07
- Q.7 a) What is image compression? Explain image compression model. 08  
 b) Explain fidelity criteria in detail. 07

- Q.8 a) Explain opening and closing morphological operations with suitable example of each. 08  
b) Explain boundary descriptors in detail. 07
- Q.9 a) Explain region filling with suitable example. 08  
b) Explain lossless predictive coding in detail. 07
- Q.10 Write short notes on (any two)
  - a) Role of DIP in MRI 05
  - b) Dilation and erosion 05
  - c) Chain codes 05

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-462**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E.(EC)**  
**Elective – I : Consumer Electronic**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
1. Q.No.5 and Q.No.10 are compulsory
  2. Solve any two from remaining question from section 'A' & section 'B' each.
  3. Assume suitable data if required.

**Section A**

- |     |   |  |    |
|-----|---|--|----|
| Q.1 | a) Explain the features of Android technology.                            |  | 08 |
|     | b) Write comparison between CFL & LED.                                    |  | 07 |
| Q.2 | a) Draw & explain block diagram of EPBAX.                                 |  | 08 |
|     | b) Draw & explain vacuum cleaner & its types.                             |  | 07 |
| Q.3 | a) What are the different faults in color TV receiver? How do you repair? |  | 08 |
|     | b) Comparison between 2G & 3G technology in mobile.                       |  | 07 |
| Q.4 | a) Draw & explain 3D technology in TV in detail.                          |  | 08 |
|     | b) Draw & explain FAX machine & its specification.                        |  | 07 |
| Q.5 | Solve any two.  |  |    |
|     | a) Selection criteria for air-conditioner                                 |  | 05 |
|     | b) Digital Dolby system short note  |  | 05 |
|     | c) Short note on i-phone  |  | 05 |

**Section B**

- |     |   |  |    |
|-----|---|--|----|
| Q.6 | a) Comparison between LASER printer & inkjet printer.               |  | 08 |
|     | b) Explain solar lamp in detail                                     |  | 07 |
| Q.7 | a) Draw & explain B.D. of electronic voting machine.                |  | 07 |
|     | b) Explain blue ray DVD Player.                                     |  | 08 |
| Q.8 | a) Explain EMI/ EMC requirement & design techniques for compliance. |  | 08 |
|     | b) Draw & explain in detail water purifier system.                  |  | 07 |
| Q.9 | a) Draw & explain ATM.  |  | 08 |
|     | b) Enlist product safety issues in detail.                          |  | 07 |

Q.10 Write short notes on any two.

- a) Biometric sensors
- b) Home Automation System
- c) Electronic calculator

05  
05  
05

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-459**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E.( ECT/E&C)**  
**Elective-I : Wireless Mobile Communication**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
1. Q.No.1 from Section A and Q.No.6 from Section B are compulsory
  2. Assume suitable data wherever necessary.
  3. Figures to right indicate full marks.
  4. Solve any two questions from remaining in each section.

**Section A**

- |     |  |          |
|-----|--|----------|
| Q.1 | Write a short note on (any two).   | 10       |
|     | <ol style="list-style-type: none"> <li>a) Multiple access schemes</li> <li>b) Hand-off mechanism</li> <li>c) Wireless data services</li> <li>d) DECT</li> </ol>  |          |
| Q.2 | <ol style="list-style-type: none"> <li>a) Draw &amp; explain the architecture of cellular system.</li> <li>b) What is multiple access? Explain TDMA in detail.</li> </ol>  | 08<br>07 |
| Q.3 | <ol style="list-style-type: none"> <li>a) Explain the evaluation of mobile radio communication in detail.</li> <li>b) Explain the concept of frequency reuse in detail.</li> </ol>                                 | 08<br>07 |
| Q.4 | <ol style="list-style-type: none"> <li>a) How to improve coverage &amp; capacity in cellular system? Discuss.</li> <li>b) What is interference? Explain co-channel &amp; adjacent channel interference.</li> </ol> | 08<br>07 |
| Q.5 | <ol style="list-style-type: none"> <li>a) Discuss the overview of 1G &amp; 2G wireless networks.</li> <li>b) Write a short note on ISDN SS-7.</li> </ol>   | 08<br>07 |

**Section B**

- |     |  |          |
|-----|--|----------|
| Q.6 | Attempt any two:-  | 10       |
|     | <ol style="list-style-type: none"> <li>a) Explain mobile IP</li> <li>b) Explain features &amp; offer services of GSM</li> <li>c) Explain WAP</li> <li>d) Short note on: GSM frame structure</li> </ol> |          |
| Q.7 | <ol style="list-style-type: none"> <li>a) Explain GSM architecture in detail?</li> <li>b) What are types of handover in GSM?</li> </ol>  | 08<br>07 |
| Q.8 | <ol style="list-style-type: none"> <li>a) Explain CDMA technique in detail with examples.</li> <li>b) Explain architecture of DTH services.</li> </ol>   | 07<br>08 |

- Q.9 a) Explain IP & PRMA in detail? 08
- b) Compare & contrast RIM & iOS mobile operating systems? 07
  
- Q.10 a) Explain MTC & MOC with help of block diagram? 07
- b) Explain Zigbee protocol architecture in detail. 08

Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-374**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E.(EC/ECE/E&C)**  
**VLSI Design**  
**(Revised)**

[Time: Three Hours]

[Max. Marks:80]

N.B Please check whether you have got the right question paper.

- N.B
- i) Questions No.1 & Question No.6 are compulsory.
  - ii) Solve any two question form Q.No. 2 to Q.No.5.
  - iii) Solve any two questions from Q.No.7 to Q. No.10.
  - iv) Figure to the right indicate full marks.
  - v) Assume suitable data if necessary.

Section – A

- |     |  |    |
|-----|--|----|
| Q.1 | Attempt any two from the following.  | 10 |
|     | <ol style="list-style-type: none"> <li>a) Draw VLSI design flow.</li> <li>b) What is the basic element of VHDL?</li> <li>c) Write VHDL Code for D Flip Flop.</li> <li>d) What is DFT and what is need of DFT.</li> </ol> |    |
| Q.2 | a) Explain the data object and data type in VHDL.  | 07 |
|     | b) Compare different types of modelling in VHDL.   | 08 |
| Q.3 | a) Draw and explain architecture of XC9500 CPLD family.  | 07 |
|     | b) Write VHDL Code for SR Flip Flop with its test bench.   | 08 |
| Q.4 | a) What is test bench? Write a test bench to verify design of NAND gate.   | 07 |
|     | b) Write a VHDL code to design 8:1 Multiplexer.  | 08 |
| Q.5 | Write short notes on any three.  | 15 |
|     | <ol style="list-style-type: none"> <li>i) Architecture of XC4000 FPGA</li> <li>ii) Package and Library</li> <li>iii) Stuck at fault model in details</li> <li>iv) TAP Controller</li> </ol>                              |    |

Section – B

- Q.6 Attempt any two from the following 10
- a) What body effect is CMOS?
  - b) State the power dissipation in CMOS.
  - c) What is DRC in CMOS fabrication and layout?
  - d) Explain Pass Transistor in CMOS.
- Q.7
- a) What is channel length modulation in CMOS explain in details. 07
  - b) Explain with the help of neat diagram operation of CMOS inverter. 08
- Q.8
- a) What are types of CMOS Logic families and define ratios circuit. 07
  - b) Sketch schematic for the following equation using CMOS  $Y = ABC + \bar{A} \bar{B} C$  08
- Q.9
- a) Draw layout of CMOS inverter circuit and explain the layout DRC. 07
  - b) Design 2:1 Multiplexer using Transmission Gate and Explain weak and Strong 0's and 1's 08
- Q.10 Write short notes on (any three) 15
- a) Velocity Saturation
  - b) Noise Margin & Power delay Product
  - c) nMos and pMos Fabrication Process
  - d) Transmission Gates



Total No. of Printed Pages:2

**SUBJECT CODE NO:- H-231**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (ECT/E&C)**  
**Elective – II : Robotics**  
**(Revised)**

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
1. Assume suitable data if necessary.
  2. Q.No.1 and Q.No.6 are compulsory. Then solve any two questions from the remaining four questions in each section A & section B.

Section A

- |     |   |              |
|-----|---|--------------|
| Q.1 | Answer in very short.<br>a) Define robotic arm.<br>b) Give four typical applications of Robotics.<br>c) What is dynamic constraints?<br>d) What are vector operations?<br>e) What are matrix operations?  | 10           |
| Q.2 | a) Explain the classification of robotic arm.<br>b) Give specifications of robotic arm in detail.   | 08<br>07     |
| Q.3 | a) Explain components of robotic arm.<br>b) Explain Newton's & ruler's equations.   | 08<br>07     |
| Q.4 | a) Explain D-H matrix in detail.<br><br>b) Consider a vector $J = 3i + 3j + 5k$ . Give its homogeneous representation with $s = 0, 1, 2$ & $-10$  | 07<br><br>08 |
| Q.5 | a) A frame F has been moved eight units along the x axis & 4 units along the z axis of the set frame. Find the new location & the frame.<br><br>$F = \begin{bmatrix} .527 & -.574 & .628 & 5 \\ .369 & .819 & .439 & 3 \\ -.766 & 0 & .643 & 8 \\ 0 & 0 & 0 & 1 \end{bmatrix}$<br><br>b) If $\bar{x} = i + j + 3k$ & $\bar{y} = 4i + 4j + 4k$ find $\bar{x} \cdot \bar{y}$ & $\bar{x} \times \bar{y}$ in homogeneous coordinate system. | 08<br><br>07 |

Section B

- Q.6 Answer in very short. 10
- a) What are different end-effects?
  - b) Give classification of actuators.
  - c) What are external sensors?
  - d) What are basic control actions?
  - e) What is machine vision system?
- Q.7 08
- a) Explain object recognition system in detail.
  - b) Give need & applications of machine vision system. 07
- Q.8 08
- a) Explain fuzzy controller in robotics.
  - b) Explain Jacobian in term of D-H matrix. 07
- Q.9 08
- a) Explain magnetic gripper.
  - b) Explain any arc dc motor as actuator. 07
- Q.10 08
- a) Explain different proximity sensors? 08
  - b) Explain camera as a image sensor. 07

Total No. of Printed Pages: 02

**SUBJECT CODE NO:- H-232**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B. E. (EC)**  
**Elective – II : Microwave & Radar Engineering**  
**(Revised)**

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

- N. B
1. Question No. 1 from section A and Question No. 6 from section B are compulsory.
  2. Solve any two questions from Q. 2, Q. 3 Q. 4 & Q. 5
  3. Solve any two questions from Q. 7, Q. 8 Q. 9 & Q. 10
  4. Assume suitable data wherever necessary.

## Section A

- |      |  |          |
|------|--|----------|
| Q. 1 | Write short notes on any two.<br>a) Directional coupler<br>b) Microwave imaging<br>c) IMPATI Diode<br>d) Parametric Amplifier  | 10       |
| Q. 2 | a) Explain the propagation of TE mode in rectangular wave guide. Also drive the expression of cutoff frequency.<br>b) For a rectangular waveguide of internal dimension $7.214 \times 3.404$ cm operating at 5 GHz find out propagation constant and phase velocity for TE <sub>10</sub> and TE <sub>11</sub> Mode of propagation. | 07<br>08 |
| Q. 3 | a) With the help of I-V characteristics explain working of PIN diode. Also explain application of PIN diode as a switch.<br>b) Explain the working of H-plane Tec along with its scattering matrix.  | 07<br>08 |
| Q. 4 | a) Why Gunn diodes called are transferred electron devices? Give the mechanism of negative resistance in Gunn diode, along with different modes of operation.<br>b) Explain with diagram how is TWT used as a microwave oscillator.  | 08<br>07 |
| Q. 5 | a) Explain EMI & EMC in detail.<br>b) Explain<br>1) Microwave IC fabrication<br>2) Effect of microwave on human body.  | 07<br>08 |

## Section B

- |      |   |    |
|------|---|----|
| Q. 6 | Write short notes on (any two)<br>a) Radar applications.<br>b) Integration of Pulses.<br>c) Staggered Frequencies<br>d) Sequential Lobing | 10 |
|------|---|----|

- Q. 7 a) Explain clutter attenuation and show with frequency response of single and double delay. 07  
 b) What is the principle of operation used in conical scanning and sequential lobing? Draw & explain block dia. Of conical scan tracking radar. 08
- Q. 8 a) Draw and explain the block diagram of CW Doppler radar and Pulsed radar with its significant equation. 07  
 b) Draw & explain the block diagram of amplitude comparison mono pulse tracking. 08
- Q. 9 a) What are difference between MTI radar and Pulse Doppler radar? Also explain the block diagram of MTI radar. 07  
 b) What do you mean by digital MTI processing? Explain the advantages of digital MTI processing over analog MTI processing. 08
- Q. 10 a) Explain the working of monopulse tracking radar. 07  
 b) What do you mean by radar? Explain the block diagram of radar in detail. 08

Total No. of Printed Pages: 02

**SUBJECT CODE NO:- H-409**  
**FACULTY OF SCIENCE & TECHNOLOGY**  
**B.E. (EC)**  
**Robotics**  
**(Revised)**

[Time: Three Hours]

[Max. Marks: 80]

- N. B Please check whether you have got the right question paper.
- i) Q. No. 1 from section A and Q. No. 6 from section B are compulsory.  
 ii) Solve any two questions from Q. No. 2,3,4,5 and solve any questions from Q. No. 7,8,9,10.

## SECTION – A

- Q. 1 Write a short notes (Solve any Two): 10  
 A) Euler Equations  
 B) Classification of robots  
 C) Overview of robot sub system
- Q. 2 A) Explain different components used in robotic system. 07  
 B) Classify robots on the basic of co – ordinate system. 08
- Q. 3 A) For the following frame, find the values of the missing elements and complete the matrix representation of the frame: 07
- $$F = \begin{bmatrix} ? & 0 & ? & 5 \\ 0.707 & ? & ? & 3 \\ ? & ? & 0 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$
- B) Consider a vector  $V = 3i + 4j + 5k$  08  
 Give its homogeneous representation with  $S = 0, 1, 2$  &  $-10$ .
- Q. 4 A) Explain different vector operations & different matrix operations. 07  
 B) Explain D-H matrix. 08
- Q. 5 A) If  $x = 1 + 2j + 3k$  &  $y = 4i + 5j + 6k$ . Find  $x \cdot y$  &  $x \times y$  in homogeneous coordinate system. 07  
 B) Explain basic structure of robots. 08

## SECTION – B

- Q. 6 Write a short notes (Solve any Two): 10  
 A) Object recognition  
 B) Fuzzy controller  
 C) Machine Vision system

- Q. 7      A) Explain Jacobean in terms of D- H matrix.      08  
             B) Explain fuzzy controller?      07
- Q. 8      A) Explain different types of actuators.      08  
             B) Explain ‘Camera’ related to robotics sensor.      07
- Q. 9      A) What is the use of image processing in robotics? Explain with suitable example.      08  
             B) What do you understand by intelligent sensor & object recognition?      07
- Q. 10     A) Explain relocking and acceleration profile.      08  
             B) Explain control loops for robotic system.      07

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-506**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**B.E. (ECT)**  
**Elective-I: Internet Of Things Embedded System**  
**(Revised)**

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

- N.B
- 1) Q. No. 1 from Section A and Q. No. 6 from Section B are compulsory.
  - 2) Solve any two questions from Q. No. 2,3,4,5 and solve any two questions from Q. No. 7,8,9,10.

## Section A

- |     |  |          |
|-----|--|----------|
| Q.1 | Write Short Note On (any two)<br>A) Raspberry Pi 3<br>B) List and Dictionary in Python<br>C) Arduino Ethernet Shield   | 10       |
| Q.2 | A) What is loop? Elaborate different types of loops in C with syntax.<br>B) Explain function declaration and function calling in python.   | 07<br>08 |
| Q.3 | A) Explain pin configuration of Arduino UNO Board.<br>B) Write a program to Interface digital sensor to Arduino UNO.   | 07<br>08 |
| Q.4 | A) Write steps to install operating system on Raspberry Pi and configure it for newly install operating system.<br>B) Write a program to interface servo motor to raspberry Pi3. | 07<br>08 |
| Q.5 | A) Write a program to interface DC motor to NodeMCU.<br>B) Write steps to configure Ethernet and Wi-Fi to Raspberry Pi 3 using command prompt.                                   | 07<br>08 |

## Section B

- |     |  |          |
|-----|--|----------|
| Q.6 | Write short note on (any two):<br>A) Raspberry Pi 3 Interfacing to Whatsapp<br>B) Data Distribution Services<br>C) Smart Farming | 10       |
| Q.7 | A) Explain MQTT protocol message format.<br>B) Explain XMPP protocol.  | 08<br>07 |
| Q.8 | A) Write a program to interface NodeMCU to web services.<br>B) Write steps to interface Raspberry Pi to tweeter.                 | 08<br>07 |

- Q.9           A) Explain waste management system using IoT.           08
- B) Explain Home Automation using IoT.           07
  
- Q.10         A) Write a program to interface Ethernet Shield to connect web services?   08
- B) Explain concept of Internet Connected smart water system.   07