| Course Code     | 16B1NPH632                     | Semester EVI   | EN          | Semester VI Session 2018 -2019<br>Month from January to June |         |  |  |
|-----------------|--------------------------------|----------------|-------------|--|---------|--|--|
| Course Name     | SOLID STATE ELE                | CTRONIC DEV    | ICES        |  |         |  |  |
| Credits         | 4                              | 4 Contact H    |             |  | 4       |  |  |
| Faculty (Names) | Coordinator(s)                 | Dr. Dinesh Tri | pathi & Dr. | Sandeep  | Chhoker |  |  |
|                 | Teacher(s)<br>(Alphabetically) | Dr. Dinesh Tri | pathi & Dr. | Chhoker  |         |  |  |

| COURSE   | OUTCOMES   | COGNITIVE LEVELS   |
|----------|--|--------------------|
| C302-7.1 | Define terminology and concepts of semiconductors with solid state electronic devices.                                       | Remembering (C1)   |
| C302-7.2 | Explain various electronic, optical and thermal properties of semiconductors; various techniques used in device fabrication. | Understanding (C2) |
| C302-7.3 | Solve numerical problems based on solid state electronic devices.  | Applying (C3)      |
| C302-7.4 | Examine the impact of various parameters on semiconductor devices and their performances.                                    | Analyzing (C4)     |

| Module<br>No.                  | Title of the<br>Module                               | Topics in the Module   | No. of<br>Lectures for<br>the module |  |  |  |  |
|--------------------------------|--|--|--------------------------------------|--|--|--|--|
| 1.                             | Energy band and<br>charges carriers in<br>conductors | Bonding forces and energy bands in solids, charge carriers<br>in semiconductors, carries concentrations, drift of carriers in<br>electric and magnetic fields, Invariance of the Fermi level at<br>equilibrium, optical absorption, Luminescence, Carrier<br>lifetime and photoconductivity, diffusion of carriers | 12                                   |  |  |  |  |
| 2.                             | Junctions  | Fabrication of p-n junctions, equilibrium conditions, steady<br>state conditions, reverse bias breakdown, recombination<br>and generation in the transition region, metal semiconductor<br>junctions, heterojunctions,   | 10                                   |  |  |  |  |
| 3.                             | Transistors  | Field effect transistor (FET), Metal-insulator FET, Metal-<br>insulator-semiconductor FET, MOS FET, Bipolar junction<br>transistors  | 08                                   |  |  |  |  |
| 4.                             | Devices  | Photodiodes, solar cell, light emitting diodes,<br>semiconductor lasers, Negative conductance Microwave<br>devices: Tunnel diode, IMPATT diode, Gunn diode   | 10                                   |  |  |  |  |
|                                |  | Total number of Lectures   | 40                                   |  |  |  |  |
| Evaluation                     | n Criteria   |  |                                      |  |  |  |  |
| Components                     |  | Maximum Marks  |                                      |  |  |  |  |
| T1                             |  | 20   |                                      |  |  |  |  |
| 12<br>End Semester Exemination |  | 20   |                                      |  |  |  |  |
| End Semester Examination       |  | 55 25 [2 Quiz (10) Attend (10) and Class performance (5)]  |                                      |  |  |  |  |
| Total                          |  | <b>100</b>   |                                      |  |  |  |  |

**Recommended Reading material:** 

| 1. | Donald A Neamen & Dhrubes Biswas, Semiconductor Physics and Devices, McGraw Hill Education |
|----|--|
| 2. | S. M. Sze, Physics of Semiconductor devices, Wiley-Interscience                            |
| 3. | Streetman and Banerjee, Solid State Electronic devices, PHI                                |
| 4. | Umesh Mishra and Jasprit Singh, Semiconductor Device Physics and Design,                   |

| Course Co                   | de   | 16B1NPH63                          | 3                 | Semester :Even Semester VI Session<br>Month: January to Ju   |               |            | Session 20<br>ary to June                         | 018 -2019   |                                      |
|-----------------------------|--|------------------------------------|-------------------|--|---------------|------------|---|---|--------------------------------------|
| Course Name Photovoltaic Te |  |                                    |                   | lues   |               |            |   |   |                                      |
| Credits                     |  |                                    | 4                 |  | Contact I     | Hours      |   | Z   | 1                                    |
| Faculty (N                  | ames)  | Coordinato                         | r(s)              | Dr. B. C. Joshi  | and Dr. Pr    | ashant Ch  | auhan   |   |                                      |
|                             |  | Teacher(s)                         |                   | Dr. B. C. Joshi  | and Dr. Pr    | ashant Ch  | auhan   |   |                                      |
| COURSE                      | OUTCO  | OMES                               |                   |  |               |            |   | COGNIT  | IVE LEVELS                           |
| C302-8.1                    | Classif<br>of pho  | fy various type<br>tovoltaic devic | of reneve.        | wable energy so  | urces and ex  | xplain wo  | rking   | Remembe   | ring (C1)                            |
| C302-8.2                    | Demor  | nstrate the use                    | of basic          | principles to mo   | odel photov   | oltaic dev | vices   | Understan   | ding (C2)                            |
| C302-8.3                    | Identif<br>various   | y challenges and stype of solar    | nd apply<br>cells | v strategies to op   | timize perfo  | ormance of | of  | Applying  | (C3)                                 |
| C302-8.4                    | Analyz<br>module   | ze Solar PV mo                     | odule, m          | ismatch parame   | ter and ratir | ng of PV   |   | Analyzing   | g (C4)                               |
| C302-8.5                    | Evalua<br>battery  | te the perform and AC and I        | ance of DC load   | various stand-al   | lone PV sys   | tems with  | 1   | Evaluating (C5)   |                                      |
| Module<br>No.               | Title of the<br>ModuleTo                                     |                                    |                   | ics in the Module  |               |            |   |   | No. of<br>Lectures for<br>the module |
| 1.                          | Review   | N                                  | Energy            | rgy issues, conventional energy sources, Renewable gy sources, Solar Energy  |               |            |   |   | 02                                   |
| 2.                          | Solar cell<br>fundamentals<br>Solar cell<br>fundamentals     |                                    |                   | mental of semiconductor, charge carriers and their<br>n in semiconductors, carriers generation and<br>ibination, p-n junction diode, introduction to solar<br>p-n junction under illumination, Current-Voltage (I-<br>pen circuit voltage ( $V_{OC}$ ), short circuit current ( $I_{SC}$ )<br>num power, current and voltage and Efficiency,<br>tum Efficiency |               |            |   |   | 10                                   |
| 3.                          | Design of solar Uppe<br>cells design                         |                                    |                   | limits of cell parameters, loses in solar cell, solar cell, design for high $I_{sc}$ , $V_{oc}$ , FF, solar simulators   |               |            |   | , solar cell<br>rs  | 08                                   |
| 4.                          | 4. Solar cell polyce<br>technologies cells),<br>technologies |                                    |                   | ction of Si, Si wafer based solar cell technology, thin<br>olar cell technologies (CIGS, microcrystalline and<br>ystalline Si solar cells, amorphous Si thin film solar<br>multijunction solar cells, Emerging solar cell<br>ologies: organics solar cells, Dye-sensitized solar cell<br>, GaAs solar cell   |               |            |   | blogy, thin<br>alline and<br>film solar<br>solar cell<br>solar cell | 12                                   |
| 5.                          | Photovoltaic conne<br>system Balan<br>Batter<br>and co       |                                    |                   | ystem : Introduction, Stand alone system, Grid<br>cted system, Hybrid system, Designing of PV system,<br>ce of system- BOS (Inverters, Controllers, Wiring,<br>ies) Photovoltaic Cells, Estimating PV system size<br>ost, Photovoltaic safety.   |               |            | em, Grid<br>V system,<br>s, Wiring,<br>ystem size | 08  |                                      |
|                             |  |                                    |                   |  | Т             | otal nun   | iber of   | f Lectures  | 40                                   |

| <b>Evaluation Criteria</b> |  |
|----------------------------|--|
| Components                 | Maximum Marks  |
| T1                         | 20   |
| T2                         | 20   |
| End Semester Examination   | 35   |
| ТА                         | 25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)] |
| Total                      | 100  |
|                            |  |

| <b>Recommended Reading material:</b> | Author(s), Title | , Edition, | Publisher, | Year of Publication etc. | ( Text books, |
|--------------------------------------|------------------|------------|------------|--------------------------|---------------|
| Reference Books, Journals, Reports,  | Websites etc. i  | n the IEE  | E format)  |                          |               |

| 1. | Tom Markvart and Luis Castaner, "Solar Cells: Materials, Manufacture and Operations," Elsevier, 2006 |
|----|--|
| 2. | Stuart R. Wenhem, Martin A. Green, M.E. Watt, "Applied Photovoltaics," Earthscan, 2007               |
| 3. | Jenny Nelson, "The Physics of Solar Cells" Imperial college press," 003. Aatec publications, 1995.   |
| 4. | C S Solanki, Solar Photovoltaics, PHI  |

| Course Code                         |   | 16B1NPH634                                      | 4  | Semester: Even                           |  | Semester VI Session 2<br>Month: from January to J |                                      |            | 018 -2019<br>une |
|-------------------------------------|---|---|--|--|--|---|--------------------------------------|------------|------------------|
| Course Na                           | me  | Applied Stati                                   | istical Mechanics  |  |  |   |                                      |            |                  |
| Credits                             |   |   | 4  |  | Contact H                              | Iours   |                                      | 4          | -                |
| Faculty (N                          | ames)   | Coordinato                                      | r(s)   | Dr. Navendu G                            | loswami                                |   |                                      |            |                  |
|                                     |   | Teacher(s)<br>(Alphabetica                      | ally)  | Dr. Navendu G                            | loswami                                |   |                                      |            |                  |
| COURSE                              | OUTCO   | OMES  |  |  |  |   |                                      | COGNIT     | IVE LEVELS       |
| C302-9.1                            | Define<br>Mecha   | the fundamen<br>nics.                           | tal para   | meters of Therm                          | odynamics                              | and Stati   | stical                               | Remember   | ring (C1)        |
| C302-9.2                            | Explain equation  | n the Thermod                                   | lynamic  | potentials, Max                          | well's equa                            | tions and   | Heat                                 | Understan  | ding (C2)        |
| C302-9.3                            | Apply<br>unders   | the concepts tand the phase                     | of them<br>space an  | modynamics and<br>nd distribution fu     | l statistical<br>inctions.             | ensembl   | es to                                | Applying   | (C3)             |
| C302-9.4                            | Detern<br>physica   | nine the distr<br>al and chemica                | ibution<br>Il ensem  | functions in cables.                     | ase of var                             | ious type   | es of                                | Evaluating | g (C5)           |
| C302-9.5                            | Evaluate the ideas of Entropy with respect to Probability and<br>Information Theory; and conclude Liouville's equation.Evaluating (C5)  |   |  |  |  | g (C5)  |                                      |            |                  |
| Module<br>No.                       | Title o<br>Modul  | Title of the<br>Module     Topics in the Module |  |  |  |   | No. of<br>Lectures for<br>the module |            |                  |
| 1.                                  | BasicOverview of basic laws of Thermodynamics; Mid<br>and macroscopic parameters, Thermodynamic point<br>Introduction to equilibrium and non-equilibrium<br>and related problems; Entropy and probability |   |  |  | s; Micr<br>nic pote<br>rium sy<br>ity; | oscopic<br>entials;<br>ystems                     | 3                                    |            |                  |
| 2.                                  | Statisti<br>Ensem   | ical<br>bles                                    | Conce<br>canoni  | pt of Statistical e<br>cal, Canonical, C | ensembles, I<br>Grand-canor            | Density of nical ems                              | f States<br>embles                   | s; Micro   | 5                |
| 3.                                  | Distrib<br>functio  | oution<br>ons                                   | Maxw<br>applica  | ell-Boltzmann, E<br>ations               | Bose-Einstei                           | in, Fermi-  | Dirac                                | and their  | 6                |
| 4.                                  | Non-eo<br>system  | quilibrium<br>Is                                | Liouvi<br>walk, S  | lle's equation, v<br>Stochastic metho    | on Neuman<br>ds;                       | n equatio   | n; Ran                               | dom        | 6                |
| 5.                                  | Modeling and<br>SimulationsIsing model and its applications, Molecular dynamics,<br>Monte-Carlo simulations and Multi-scale modeling for<br>materials properties and engineering applications.15          |   |  |  |  |   | 15                                   |            |                  |
| 6.                                  | Applic  | ations  | Applications of ensemble formalism in dynamics of neural<br>networks, ensemble forecasting of weather, propagation of<br>uncertainty over time, regression analysis of gravitational<br>orbits etc., |  |  |   |                                      |            | 5                |
|                                     |   |   |  |  | Т                                      | 'otal num   | ber of                               | Lectures   | 40               |
| <b>Evaluation</b><br>Componen<br>T1 | n Criteri<br>nts  | ia  | Maxim<br>20  | um Marks                                 |  |   |                                      |            |                  |

| T2                       | 20   |
|--------------------------|--|
| End Semester Examination | 35   |
| ТА                       | 25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)] |
| Total                    | 100  |

| <b>Reco</b><br>Refe | <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |  |  |  |  |  |
|---------------------|--|--|--|--|--|--|
| 1.                  | Frederick Reif, Fundamentals of Statistical and Thermal Physics, Waveland Pr Inc, 2008.  |  |  |  |  |  |
| 2.                  | Kerson Huang, Statistical Mechanics, Wiley, 2 <sup>nd</sup> Ed., 1987.   |  |  |  |  |  |
| 3.                  | R K Pathria, Paul D. Beale, Statistical Mechanics, Academic Press, 3rd Ed., 2011.  |  |  |  |  |  |
| 4.                  | Daniel V. Schroeder, An Introduction to Thermal Physics, Addison-Wesley, 1st Ed., 1999   |  |  |  |  |  |
| 5.                  | L D Landau, <i>Statistical Physics, Part 1: Volume 5 (Course of Theoretical Physics)</i> , Butterworth-<br>Heinemann, 3 <sup>rd</sup> Ed., 1980  |  |  |  |  |  |

| Course Co  | de  | 16B1NPH63  | 5  | Semester Even Sem<br>Mo                                   |                            | Semester VI Session 2018 -2019<br>Month from January to June |                    |                                      |            | Semester VISession201Month fromJanuary toJun |  | 018 -2019<br>ine |
|--|---|--|--|---|----------------------------|--|--------------------|--------------------------------------|------------|--|--|------------------|
| Course Na  | me  | Analytical Te  | echnique   | es for Materials  |                            |  |                    |                                      |            |  |  |                  |
| Credits  |   |  | 4  |   | Contact H                  | Iours  |                    | 4                                    | ŀ          |  |  |                  |
| Faculty (N   | ames)   | Coordinato   | r(s)   | Dr. Himanshu  | Pandey                     |  |                    |                                      |            |  |  |                  |
|  |   | Teacher(s)<br>(Alphabetica                               | ally)  | Dr. Himanshu  | Pandey                     |  |                    |                                      |            |  |  |                  |
| COURSE   | OUTC  | COMES  |  |   |                            |  |                    | COGNIT                               | IVE LEVELS |  |  |                  |
| C302-10.2  | I Ro  | ecall preliminary  | y conce<br>roperty   | pts of various c<br>relationship of n                     | haracterizat<br>naterials. | ion techn  | iques              | Remembe                              | ring (C1)  |  |  |                  |
| C302-10.2  | O<br>ba   | utline different<br>asic knowledge a                     | sophisti<br>bout wo  | cated character orking principle.                         | ization tool               | ls and ex  | plain              | Understan                            | ding (C2)  |  |  |                  |
| C302-10.3  | Id<br>ar<br>va  | entify character<br>alysis and solv<br>arious techniques | ization t<br>ve relate<br>s.   | ool as per the ne<br>ed problems ba                       | cessity of m<br>sed on cor | neasureme<br>ncepts use                                      | ent or<br>ed in    | Applying                             | (C3)       |  |  |                  |
| C302-10.4 Examine material specific technique  |   |  | 's prope<br>s.   | s properties and analyze the results in context of Analyz |                            |  | Analyzing          | ng (C4)                              |            |  |  |                  |
| Module<br>No.  | Title<br>Mod  | of the<br>ule  | Topics in the Module   |   |                            |  |                    | No. of<br>Lectures for<br>the module |            |  |  |                  |
| 1.   | Structural analysis<br>by X-rays X-rays and their properties, Production and detection of X-<br>rays, Safety precautions; X-ray interaction with matter,<br>Crystal structure, Different types of lattices, X-ray<br>Diffraction, Bragg's Law; X-ray spectroscopy, diffraction<br>methods, Scherrer formula, grain size, particle size, crystal<br>perfection; Determination of crystal structure (detailed<br>analysis only for cubic structures) X-ray reflectivity |  |  |   |                            | 10   |                    |                                      |            |  |  |                  |
| 2.   | Microstructural<br>analysisScanning electron microscopy, practical aspect of the<br>technique, Composition analysis by EDX; Transmission<br>electron microscopy and its analysis, sample preparation  |  |  |   |                            | 08   |                    |                                      |            |  |  |                  |
| 3.   | Mole<br>spect   | cular<br>roscopy   | cularRegions of spectrum, Spectroscopy (Microwave and<br>Infrared), Fourier transform IR, Raman spectroscopy08 |   |                            |  |                    | 08                                   |            |  |  |                  |
| 4.   | 4. Electronic spectroscopies of shifts, information about chemical state and elemental compositions   |  |  |   |                            | 05   |                    |                                      |            |  |  |                  |
| 5.Surface<br>Morphology<br>scanning<br>microscopyAtomic force microscopy (contact & non-contact mode),<br>wide areas of applications, AFM basics, Magnetic force<br>microscopy |   |  |  |   | 05                         |  |                    |                                      |            |  |  |                  |
| 6.   | Ther  | mal analysis   | Nomer<br>therma  | nclature, Therm<br>l analysis, Diffe                      | o gravimet rential scan    | ric analy<br>ning calor                                      | rsis, D<br>rimetry | vifferential                         | 04         |  |  |                  |
| Total number of Lectures   |   |  |  |   |                            | 40   |                    |                                      |            |  |  |                  |

| <b>Evaluation Criteria</b> |  |
|----------------------------|--|
| Components                 | Maximum Marks  |
| T1                         | 20   |
| T2                         | 20   |
| End Semester Examination   | 35   |
| ТА                         | 25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)] |
| Total                      | 100  |
|                            |  |

| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc | . ( Text books, |
|---|-----------------|
| Reference Books, Journals, Reports, Websites etc. in the IEEE format)                       |                 |
|   |                 |

| 1. | B. D. Cullity, <i>Elements of X- ray Diffraction</i> , Addison-Wesley Publishing Company, Inc. |
|----|--|
|----|--|

| 2. C. Kittel, Introduction to Solid State Physics, Wiley-Inc |
|--|
|--|

3. Colin N. Banwell&Elaine M. McCas, *Fundamentals of Molecular Spectroscopy*, Tata McGraw-Hill.

4. Elton N. Kaufmann, *Characterization of Materials (Vol.1)*, John Wiley & Sons.

5. Williams, David B., Carter, C. Barry, *Introduction to Transmission electron microscopy*, Springer.

| Course Co                          | ode  | 16B19PH692     Semester Even     Semester VI     Session     2018 - 2019       Month from:     January to June  |   |                             |                 |           |                                      | 2018 -2019<br>June |               |
|------------------------------------|--|---|---|-----------------------------|-----------------|-----------|--------------------------------------|--------------------|---------------|
| Course Na                          | ime  | Light Emittir   | ng Diode  | es: Basics & Apj            | plications      | I         |                                      |                    |               |
| Credits                            |  | V   | alue Ad   | ded                         | Contact Hours 2 |           |                                      |                    |               |
| Faculty (N                         | ames)  | es) Coordinator(s) Dr. Bhubesh Chander Joshi  |   |                             |                 |           |                                      |                    |               |
|                                    |  | Teacher(s)<br>(Alphabetica  | ally)   | Dr. Bhubesh C               | Chander Josl    | hi        |                                      |                    |               |
| COURSE                             | OUTCO  | OMES  |   |                             |                 |           |                                      | COGNIT             | IVE LEVELS    |
| C305-6.1                           | Recall junctio   | the basic conc<br>on diode and lig  | cepts of ght emitt  | semiconducting ting diodes. | materials,      | working c | of p-n                               | Remen              | mbering (C1)  |
| C305-6.2                           | Explai<br>fabrica  | n the various tion of LEDs.   | physica   | ll parameters in            | nvolved in      | designing | g and                                | Unders             | standing (C2) |
| C305-6.3                           | Solve various problems related to efficiency, emission intensity and Applying (C3)                         |   |   |                             |                 |           | lying (C3)                           |                    |               |
| C305-6.4                           | Analyse the problems in designing & fabricating blue, white and green Analyzing (C4) high brightness LEDs. |   |   |                             |                 |           | yzing (C4)                           |                    |               |
| Module<br>No.                      | Title o<br>Modu  | Title of the Module     Topics in the Module  |   |                             |                 |           | No. of<br>Lectures for<br>the module |                    |               |
| 1.                                 | Histor   | y of LEDs   | History<br>LEDs.  | y of SiC, GaA               | s, GaAsP,       | GaInP, G  | aN, a                                | nd InGaN           | 4             |
| 2.                                 | Theory<br>Recom  | Cheory of<br>Recombination'sRadiative and non-radiative recombination's, Low-level<br>and high-level excitations, Bio-molecular rate equation for<br>quantum well structure, Van Roosbroeck-Shockley Model,<br>Einstein Model.  |   |                             |                 |           |                                      | 6                  |               |
| 3.                                 | LED E  | ED Basics Electrical properties: I-V characteristics, parasitic 6<br>resistances, carrier distribution in homo and hetero<br>junctions, carrier losses, carrier overflow in heterojunctions,<br>Optical properties: Internal, external, extraction and power<br>efficiencies, Emission spectra, escape cone and temperature<br>dependency |   |                             |                 |           |                                      | 6                  |               |
| 4.                                 | Growt<br>Fabric  | h &<br>ations   | LED materials, Organic LEDs, Growth, Fabrication and 4<br>Characterization Techniques   |                             |                 |           |                                      | 4                  |               |
| 5.                                 | Applic   | ations  | Solid state lighting, White LEDs, HB LEDs, Color Mixing10and Rendering, LED Drivers, Display Devices, AMOLED,<br>Communication, High Voltage LEDs10 |                             |                 |           |                                      | 10                 |               |
|                                    |  |   |   |                             | ſ               | otal num  | ber of                               | Lectures           | 30            |
| Evaluation<br>Componen<br>Mid Term | n Criter<br>nts<br>Examina   | <b>ia</b><br>ntion  | Maxim<br>30   | um Marks                    |                 |           |                                      |                    |               |

| End Semester Examination | 40   |
|--------------------------|--|
| ТА                       | 30 [Presentation/project (15 M) + Attendance (15 M)] |
| Total                    | 100  |

| Reco<br>Refe | <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |  |  |  |  |  |  |
|--------------|--|--|--|--|--|--|--|
| 1.           | . Text 1: Light-Emitting Diodes, Schubert E. Fred, Cambridge University Press, 3rd Edition 2018.   |  |  |  |  |  |  |
| 2.           | <b>Reference:</b> Introduction to Light Emitting Diode Technology and Applications, Held Gilbert, Auerbach Publications, 2008.   |  |  |  |  |  |  |
| 3.           | <b>Reference:</b> Light-Emitting Diodes; Materials, Processes, Devices and Applications, Editors: Jinmin Li, G. Q ZHANG, Springer, 2019  |  |  |  |  |  |  |

| ń                                |  |  |  | Eccoure while B  | casup  |   |                                    |  |  |
|----------------------------------|--|--|--|--|--|---|------------------------------------|--|--|
| Course Co                        | de   | 18B12MA611                                   |  | Semester Even  | Semester VI<br>Month from  | Sessi<br>Jan                            | ion 2018 -2019<br>2019 - June 2019 |  |  |
| Course Na                        | me   | Operations Res                               | searc  | h  |  |   |                                    |  |  |
| Credits                          |  | 4  |  | Cor  | ntact Hours  | 3-1-0                                   |                                    |  |  |
| Faculty                          |  | Coordinator(                                 | s)   | Dr. Pato Kumari  |  |   |                                    |  |  |
| (Names)                          |  | Teacher(s)                                   |  | Prof. A. K. Aggarwal   |  |   |                                    |  |  |
|                                  |  | (Alphabeticall                               | y)   | Dr. Amita Bhagat   |  |   |                                    |  |  |
| COURSE                           | OUTC   | COMES  |  |  |  |   | COGNITIVE<br>LEVELS                |  |  |
| After pursuing the above mentior |  |  |  | ourse, the students will b   | e able to:   |   |                                    |  |  |
| C302-3.1                         | const<br>linear<br>meth  | ruct mathematic<br>programming<br>od.        | cal n<br>prol  | nodels for optimization<br>blems (LPP) using gra   | problems and<br>aphical and sir  | solve<br>mplex                          | Applying Level (C3)                |  |  |
| C302-3.2                         | apply<br>progr   | linear                                       | Applying Level (C3)                                  |  |  |   |                                    |  |  |
| C302-3.3                         | make use of sensitivity analysis to linear programming problems.   |  |  |  |  |   | Applying Level (C3)                |  |  |
| C302-3.4                         | solve transportation, assignment and travelling salesman problems.   |  |  |  |  |   | Applying Level (C3)                |  |  |
| C302-3.5                         | <b>5</b> apply cutting plane and branch & bound techniques to integer programming problems.  |  |  |  |  |   | Applying Level (C3)                |  |  |
| C302-3.6                         | examine optimality conditions and solve multivariable nonlinear problems.  |  |  |  |  | linear                                  | Analyzing<br>Level (C4)            |  |  |
| Module<br>No.                    | Title<br>Mod   | of the<br>ule                                | Тор  | pics in the Module   |  |   | No. of Lectures for the module     |  |  |
| 1.                               | Preli  | ninaries                                     | Intr<br>Pha  | oduction, Operations ses and Scope of O.R. S   | Research Metudies.   | odels,                                  | 3                                  |  |  |
| 2.                               | Linear Convex Sets, F<br>Programming Problems (LPP) Two Phase Meth<br>Method.  |  |  |  | ex Sets, Formulation of LPP, Graphical<br>ions, Simplex Method, Big-M Method,<br>Phase Method, Special Cases in Simplex<br>od. |   |                                    |  |  |
| 3.                               | Duali<br>Sensi   | ty and tivity Analysis                       | Prir<br>Sim  | nal-Dual Relationship  | o, Duality,<br>y Analysis.   | Dual                                    | 8                                  |  |  |
| 4.                               | Transportation<br>ProblemsIntroduction, Matrix Form, Applications, Basic<br>Feasible Solution- North West Corner Rule,<br>Least Cost Method, Vogel's Approximation<br>Method. Degeneracy, Resolution on<br>Degeneracy, Optimal Solution, Maximization TP<br>Model. |  |  |  | 5  |   |                                    |  |  |
|                                  |  |  | Met<br>Deg<br>Mo                                     | thod. Degeneracy,<br>generacy, Optimal Soluti<br>del.  | Resolution<br>on, Maximization   | on<br>on TP                             |                                    |  |  |
| 5.                               | Assig<br>Probl   | gnment<br>ems                                | Met<br>Deg<br>Mo<br>Def<br>Sale                      | thod. Degeneracy,<br>generacy, Optimal Soluti<br>del.<br>inition, Hungarian<br>esmen Problems.   | Resolution<br>on, Maximizatio<br>Method, Trav  | on<br>on TP<br>veling                   | 4                                  |  |  |
| 5.<br>6.                         | Assig<br>Probl<br>Integ<br>Progr<br>Probl  | gnment<br>ems<br>er Linear<br>camming<br>ems | Met<br>Deg<br>Mo<br>Def<br>Sale<br>Pur<br>Pro<br>Bou | thod. Degeneracy,<br>generacy, Optimal Soluti<br>del.<br>inition, Hungarian<br>esmen Problems.<br>e and Mixed Integer<br>blems, Cutting Plane 1<br>and Method. | Resolution<br>on, Maximizatio<br>Method, Trav<br>Linear Program<br>Method, Branch  | on<br>on TP<br>veling<br>nming<br>h and | 6                                  |  |  |

|      |                             | for<br>Progr | inequality       | constraints,<br>fe's Method | Quadratic      |                     |
|------|-----------------------------|--------------|------------------|-----------------------------|----------------|---------------------|
| Tota | l number of Lectures        | 11051        | unning wor       |                             |                | 42                  |
| Eval | uation Criteria             |              |                  |                             |                |                     |
| Com  | ponents                     | Maxir        | num Marks        |                             |                |                     |
| T1   |                             | 20           |                  |                             |                |                     |
| T2   |                             | 20           |                  |                             |                |                     |
| End  | Semester Examination        | 35           |                  |                             |                |                     |
| TA   |                             | 25 (Ç        | Quiz , Assignm   | ents, Tutorials)            |                |                     |
| Tota | 1                           | 100          |                  |                             |                |                     |
| Reco | ommended Reading materi     | al: Aut      | hor(s), Title, I | Edition, Publisher          | , Year of Pub  | lication etc. (Text |
| book | s, Reference Books, Journal | s, Repo      | rts, Websites o  | etc. in the IEEE fo         | ormat)         |                     |
| 1.   | Taha, H. A Operations R     | esearch      | n - An Introduc  | ction, Pearson Edu          | ucation, 2005. |                     |
| 2.   | Hadley, G Linear Program    | nming,       | , Massachusett   | ts: Addison-Wesle           | ey, 1962.      |                     |
| 3.   | Hiller, F.S. and Lieberman, | G. J         | Introduction t   | o Operations Res            | earch, San Fra | ancisco, 1995.      |
| 4    | Wagner, H. M Principle      | s of O       | perations Rese   | earch with Applic           | ations to Mar  | nagerial Decision,  |
| т.   | PHI, 1975.                  |              |                  |                             |                |                     |
| 5.   | Vohra, N. D., Quantitative  | Techni       | ques in Manag    | gement, Second E            | dition, TMH,   | 2003.               |
| 6.   | Taha, H. A Operations R     | esearch      | n - An Introduc  | ction, Pearson Edu          | ucation, 2005. |                     |

| Subject Co  | ode  | 18B12M                    | IA612  | Semester Even Semester VI Ses<br>Month from Jan2   |                                  | sion 2018-2019<br>2019 to June 2019           |                             |                                |
|---|--|---------------------------|--|--|----------------------------------|---|-----------------------------|--------------------------------|
| Subject Na  | ame  | Applied                   | Mathematica  | al Methods   |                                  |   | in Jun                      | 2019 to 9tille 2019            |
| Credits   |  | 4                         |  |  | Conta                            | ct Hours                                      | 3-1-0                       |                                |
| Faculty (N  | lames)   | Coordi                    | nator(s)   | Dr. Puneet Ran   | na                               |   | 1                           |                                |
|   |  | Teacher<br>(Alphab        | r(s)<br>petically)   | Dr. Puneet Ran   | na, Dr. N                        | leha Ahlawa                                   | t                           |                                |
| COURSE  | OUTCO  | OMES                      |  |  |                                  |   |                             |                                |
| After pursu   | ing the  | above me                  | ntioned cours  | se, the students w   | vill be al                       | ole to:                                       |                             | COGNITIVE<br>LEVELS            |
| C302-4.1 explain the functional and its variations required to optimize the physical problem. |  |                           |  |  |                                  |   | Understanding<br>Level (C2) |                                |
| C302-4.2  | C302-4.2apply different forms of Euler–Lagrange equation on the various<br>variational problems with fixed boundaries. |                           |  |  |                                  |   |                             | Applying Level (C3)            |
| C302-4.3  | <b>2-4.3</b> explain different types of integral equations including their conversions from IVP and BVP.               |                           |  |  |                                  |   |                             | Understanding<br>Level (C2)    |
| C302-4.4  | solve Volterra and Fredholm integral equations using various analytical methods.                                       |                           |  |  |                                  |   |                             | Applying Level (C3)            |
| C302-4.5  | C302-4.5 explain various numerical methods along with their stability analysis.  |                           |  |  |                                  |   | sis.                        | Understanding<br>Level (C2)    |
| C302-4.6 apply different numerical methods for solving differential equations.                |  |                           |  |  | ns.                              | Applying Level (C3)                           |                             |                                |
| Module<br>No.   | Title<br>Modu  | of the<br>le              | Topics in t  | he Module  |                                  |   |                             | No. of Lectures for the module |
| 1.  | Functivits Var   | onal and<br>iation        | Introduction<br>geodesics,<br>properties,<br>extrema of  | Introduction, problem of brachistochrone, problem of geodesics, isoperimetric problem, variation and its properties, comparison between the notion of extrema of a function and a functional |                                  |   |                             | 8                              |
| 2.  | Variati<br>Proble<br>Fixed<br>Bound  | ional<br>ms with<br>aries | nal<br>s with Euler's equation, the fundamental lemma of the<br>calculus of variations, examples, functionals in the<br>form of integrals, special cases containing only some<br>of the variables, examples, functionals involving<br>more than one dependent variables and their first<br>derivatives, the system of Euler's equations. |  |                                  |   |                             | 5                              |
| 3.  | Variati<br>Proble<br>(contir   | ional<br>ms<br>nued)      | Functionals<br>the depend<br>functionals   | depending on<br>lent variables, containing sever   | the high<br>Euler- 1<br>ral inde | ner derivativ<br>Poisson equ<br>pendent varia | es of ation, ables,         | 5                              |

|              |  |   | Ostrogradsky equation, Variational problems in parametric form, applications to differential equations.                                |                     |  |  |  |
|--------------|--|---|--|---------------------|--|--|--|
| 4            | •  | Fredholm and Volterra                               | Introduction and basic examples, Classification,<br>Conversion of Volterra Equation to ODE   | 8                   |  |  |  |
|              |  | Integral  |  |                     |  |  |  |
|              |  |   |  |                     |  |  |  |
|              |  |   |  |                     |  |  |  |
| 5            |  | Numerical<br>Methods                                | Finite difference method, derivation from Taylor's polynomial, Accuracy and order, explicit method,                                    | 8                   |  |  |  |
|              |  |   | implicit method, Crank–Nicolson method and applications,   |                     |  |  |  |
| 6            |  | FEM and its   | Galerkin finite element method for one dimensional   | 8                   |  |  |  |
|              |  | comparison  | functions, stiffness matrix, assembly of equations,  |                     |  |  |  |
|              |  | handling of the boundary conditions, triangular and |  |                     |  |  |  |
|              |  |   | rectangular elements, stiffness matrices and assembly Comparison of FEM and FDM  |                     |  |  |  |
| Tota         | num  | her of Lectures                                     | assembly. Comparison of TEW and TEW.   | 42                  |  |  |  |
| Eval         | uation   | Criteria  |  |                     |  |  |  |
| Com          | ponen  | its   | Maximum Marks  |                     |  |  |  |
| T1           | _  |   | 20   |                     |  |  |  |
| T2           |  |   | 20   |                     |  |  |  |
| End S        | Semes  | ter Examination                                     | 35   |                     |  |  |  |
| TA           | _  |   | 25 (Quiz, Assignments, Tutorials)  |                     |  |  |  |
| Tota         |  |   |  |                     |  |  |  |
| Reco<br>book | mmer<br>s. Refe  | ided Reading ma<br>erence Books, Jou                | <b>Iterial:</b> Author(s), Title, Edition, Publisher, Year of Publisher, Year of Publisher, Reports, Websites etc. in the IEEE format) | lication etc. (Text |  |  |  |
| 1.           | <b>Hilderbrand, F.B.,</b> Methods of Applied Mathematics. 2ndEdition. Prentice Hall, 1969.                   |   |  |                     |  |  |  |
| 2.           | . Gupta, A.S., Calculus of Variations with Applications, Prentice Hall of India, 1997.                       |   |  |                     |  |  |  |
| 3.           | 3. Gelfand, I.M., Fomin, S.V. Calculus of Variations, Prentice Hall, 1963.                                   |   |  |                     |  |  |  |
| 4.           | <b>4. Elsgolts, L.,</b> Differential Equations and the Calculus of Variations, Mir Publishers, Moscow, 1973. |   |  |                     |  |  |  |
| 5.           | Petro  | ovsky, I.G., Lectu                                  | res on the Theory of Integral Equations, Mir Publishers,   | Moscow, 1971.       |  |  |  |
| 6.           | Zien   | kiewicz, O.C., M                                    | organ, K., Finite Elements and Approximation, John Wi  | iley, 1983.         |  |  |  |
| 7.           | Smit<br>Oxfo   | <b>h, G. D.</b> ., Numer<br>rd University Pres      | rical solution of partial differential equations: finite diss, 1985  | fference methods.   |  |  |  |

| Course Code     | 16B1NHS631                     | Semester E   | ven | Semester 6 <sup>th</sup> Session 2018 -2019<br>Month from January 2019 to May 2019 |       |  |
|-----------------|--------------------------------|--|-----|--|-------|--|
| Course Name     | PROJECT MANAG                  | EMENT  |     |  |       |  |
| Credits         | 3                              | Contact Hou  |     |  | 2-1-0 |  |
| Faculty (Names) | Coordinator(s)                 | Dr. Santoshi Sengupta (Sec-62), Dr. Deepak Verma (Sec-128) |     |  |       |  |
|                 | Teacher(s)<br>(Alphabetically) | Dr. Deepak Verma, Dr. Santosh Dev, Dr. Santoshi Sengupta   |     |  |       |  |

| COURSE  | OUTCOMES   | COGNITIVE LEVELS    |
|---------|--|---------------------|
| 304-5.1 | Apply the basic concepts of project management such as features, objectives, life cycle, model and management, in a given context  | Apply Level (C3)    |
| 304-5.2 | Analyze projects and their associated risks by understanding the various theoretical frameworks, non-numerical and numerical models in order to make correct selection decisions | Analyze Level (C4)  |
| 304-5.3 | Evaluate the various stages of project management and identify and determine correct techniques for planning, scheduling, controlling and terminating the projects               | Evaluate Level (C5) |
| 304-5.4 | Evaluate project management processes, tools and techniques in order<br>to achieve overall project success   | Evaluate Level (C5) |

| Module<br>No. | Title of the<br>Module                 | Topics in the Module   | No. of<br>Lectures for<br>the module |
|---------------|--|--|--------------------------------------|
| 1.            | Project<br>Management:<br>Introduction | Characteristics of project; Life Cycle of Project; Project<br>Model; Project Management as discipline; Contemporary<br>aspects of Project Management | 4                                    |

| 2.  | Project Selection  | Theoretical Models; Non-numeric models; Numeric<br>Models; Financial Models; Project Portfolio process,<br>Significance and applicability of Monte Carlo simulation   | 6        |  |  |  |
|---|--|---|----------|--|--|--|
| 3.  | Project<br>Organization,<br>Manager and<br>Planning  | Pure Project organization; Functional Organizations; Mixed<br>organizations; Matrix organizations; Role, Attitudes and<br>Skills of Project Manager, Project Coordination, Systems<br>Integration, Work Breakdown Structure, Linear<br>Responsibility Charts.   | 4        |  |  |  |
| 4. Risk Management                                  |  | Theoretical Aspects of risk, Risk Management process,<br>Numeric Techniques, Hillier model, Sensitivity Analysis,<br>Certainty Equivalent approach and Risk adjusted discount<br>rates, Game theory.  | 4        |  |  |  |
| 5. Project Scheduling<br>and Resource<br>Allocation |  | Theoretical aspects-Importance, Focus Area-PERT/CPM,<br>AOA and AON charts, Probability Analysis, Gantt Charts,<br>Crashing of Projects- Time and Cost tradeoff, Basics-<br>Resource Leveling and Loading.  | 6        |  |  |  |
| 6.  | Budgeting, Control<br>and Project<br>Termination   | Estimating Project Budgets, Improving the process of cost<br>estimation, Basics, Importance, Purpose of control, Types<br>of Control, Desirable features of Control, Control Systems,<br>Critical Ratio Method, Control of creative activities,<br>Control of change and scope creep, Why Termination,<br>Types of termination, typical termination activities. | 4        |  |  |  |
| Tota  | l number of Lectures   |   | 28       |  |  |  |
| Eval  | uation Criteria  |   |          |  |  |  |
| Com<br>T1<br>T2<br>End S<br>TA<br>Tota              | ComponentsMaximum MarksT120T220End Semester Examination35TA25 (Assignment, Project, Oral Questions)Total100  |   |          |  |  |  |
| Reco<br>Refe  | <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |   |          |  |  |  |
| 1.  | Meredith, Mantel, Project Management-A Managerial Approach, 10 <sup>th</sup> Edition, Wiley Publications, First<br>Published 1985  |   |          |  |  |  |
| 2.  | Timmothy Kloppenborg,  | Contemporary Project Management, 1 <sup>st</sup> Edition, Cengage Learning  | ng, 2014 |  |  |  |
| 2   | Vohra, N. D., Quantitative Techniques in Management, 3 <sup>rd</sup> Edition, Tata McGraw Hill Publishing  |   |          |  |  |  |

**3.** Vohra, N. D., Qu Company, 2007

| Course Code | 16B1NHS635           | Semester: Eve | en | Semester: VI Session: 2018 - 2019<br>Month: Jan 2019 to June 2019 |  |  |
|-------------|----------------------|---------------|----|---|--|--|
| Course Name | Organizational Behav | vior          |    |   |  |  |
| Credits     | 3                    | Contact Hours |    | 3(2-1-0)  |  |  |

| Faculty (Names) | Coordinator(s)                 | Ms Puneet Pannu (Sec 62) & Dr Anshu Banwari (Sec 128) |  |  |  |
|-----------------|--------------------------------|---|--|--|--|
|                 | Teacher(s)<br>(Alphabetically) | Dr Anshu Banwari<br>Ms Puneet Pannu                   |  |  |  |

| COURSE   | COGNITIVE<br>LEVELS  |                  |
|----------|--|------------------|
| C304-6.1 | Identify dynamic human behavior through an insight into relationships between<br>individuals, groups and organizations | Apply<br>(C3)    |
| C304-6.2 | Analyze individual management style as it relates to influencing and managing behavior in the organization.            | Analyze<br>(C4)  |
| C304-6.3 | Decide and justify set of strategies for meeting the special challenges in the 21st century competitive workplace      | Evaluate<br>(C5) |
| C304-6.4 | Assess the potential effects of important developments in the external environment on behavior in organizations        | Evaluate<br>(C5) |

| Module | Title of the | Topics in the Module | No. of       |
|--------|--------------|----------------------|--------------|
| No.    | Module       |                      | Lectures for |

|  |  |  | the module |
|--|--|--|------------|
| 1  | Introduction to OB:<br>Challenges and<br>Opportunities   | Interdisciplinary Field, Concepts, Approaches, Responding<br>to Globalization; Improving Quality & Productivity;<br>Improving Customer Service; Improving People Skill;<br>Empowering People; Stimulating Innovation & Change;<br>Coping with Temporariness; Positive Organizational<br>Behavior, Working in Networked Organizations; Balancing<br>Work-Life Conflict  | 3          |
| 2  | Managing<br>Workforce<br>Diversity                       | Major forms of Workplace Diversity, Valuing Diversity,<br>Role of Disabilities, Discrimination, Diversity Initiatives,<br>Diversity Awareness and Affirmative Action, Diversity<br>Management and strategies to implement it Competitive<br>Advantage of Diversity Management<br>Generational Workforce  | 4          |
| 3.   | Job Design and<br>Flexible Job<br>Environment            | Job Design & its uses; Flexible Job Environment; Job Enrichment Model  | 2          |
| 4.   | Leadership:<br>Authentic<br>Leadership                   | Inspirational Approach to Leadership: Authentic, Ethical &<br>Servant Leadership Defining Authentic Leadership<br>through Intrapersonal, Interpersonal and Developmental<br>Aspects; Basic Model Of Authentic Leadership; Practical<br>Approach to Authentic Leadership through the research of<br>Terry and Bill George; Authentic Leadership: Trust and<br>Ethics, Dimensions of Trust, Counseling & Mentoring | 6          |
| 5.   | Power & Politics   | Concept of Power; Sources of Power<br>Contingencies of Power; Power Tactics; Measuring Power<br>Bases: Power Authority Obedience<br>Organizational Politics: Types<br>Factors contributing to Political Behavior; Consequences &<br>Ethics of Politics   | 5          |
| 6.   | Employee<br>Engagement                                   | Creating a Culture of Engagement, Models of engagement,<br>Benefits of Employee Engagement, Gallup Study, Methods<br>of engaging employees – from entry to exit, Managers Role<br>in Driving Engagement  | 2          |
| 7.   | Organizational<br>Culture &<br>Workplace<br>Spirituality | Creating Organizational Culture<br>Approaches to Organizational Culture; How employees<br>learn culture; Measuring Organizational Culture;<br>Spirituality & Organizational Culture  | 3          |
| 8.   | Organizational<br>Change &<br>Development                | Organizational Change: Meaning & Types; Technology &<br>Change; Resistance to Change v/s Inviting Change;<br>Approaches to Organizational Change; Planning &<br>Implementing Change;<br>Organizational Development; OD Interventions & Change  | 3          |
|  |  | Total number of Lectures   | 28         |
|  |  | Evaluation Criteria  |            |
| Componer<br>T1<br>T2<br>End Semes<br>TA<br>Total | nts<br>ter Examination                                   | Maximum Marks<br>20<br>20<br>35<br>25 (Oral Questions, Assignment, Project)<br>100   |            |

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books,

| Refe | rence Books, Journals, Reports, Websites etc. in the IEEE format)   |
|------|---|
| 1.   | S. Robbins, T. Judge, S. Sanghi, Organizational Behavior, 13th Ed, Prentice-Hall India, 2001  |
| 2.   | <b>P.Subba Rao</b> , Organizational Behavior: Text Cases & Games, 2 <sup>nd</sup> Edition, Himalaya Publishing House, 2015  |
| 3.   | <b>John R. Schermerhorn, Richard N. Osborne, Mary Uhl-Bien; James G. Hunt</b> , <i>Organizational Behavior</i> , 12 <sup>th</sup> Edition, Wiley India Pvt. Ltd, 2012 |
| 4.   | Debra L.Nelson and James C. Quick, Organizational Behavior, Cengage Learning, India Edition, 2009   |
| 5.   | <b>Steven L. McShane and Mary Ann Von Glinow</b> , <i>Organizational Behavior Essentials</i> , Tata McGraw Hill Publishing Company Ltd, 2007                          |
| 6.   | Jerald Greenberg, Behavior in Organizations, 10th Ed, PHI Learning Pvt Ltd  |

| Subject Code | 16B1NHS632                     |                                  | Semester: EVEN              | Semester VISession2018Month from Jan 2019 toJune 2019 |  |  |
|--------------|--------------------------------|----------------------------------|-----------------------------|---|--|--|
| Subject Name | COGNITIVE PSY                  | CHC                              | DLOGY                       |   |  |  |
| Credits      | 3                              |                                  | Contact Hours               | 2-1-0   |  |  |
| Faculty      | Coordinator(s)                 | Dr. Ruchi Gautam Dr. Badri Bajaj |                             |   |  |  |
| (Names)      | Teacher(s)<br>(Alphabetically) | Dr.<br>Dr.                       | Badri Bajaj<br>Ruchi Gautam |   |  |  |

| COURSE      | OUTCOMES  | COGNITIVE LEVELS      |
|-------------|---|-----------------------|
| After pursu | ing the above mentioned course, the students will be able to:                     |                       |
| 304-4.1     | Understand and apply the concepts of cognitive psychology in everyday life        | Applying Level (C3)   |
| 304-4.2     | Analyze the different models of various cognitive processes                       | Analyzing Level (C4)  |
| 304-4.3     | Evaluate cognitive psychology issues and recommend possible solutions             | Evaluating Level (C5) |
| 304-4.4     | Evaluate interventions/solutions for self-development through cognitive processes | Evaluating Level (C5) |

| Module No. | Subtitle of the Module     |    |           | Topics in the module              |  |                                     | No. of Lectures for the module |   |
|------------|----------------------------|----|-----------|-----------------------------------|--|-------------------------------------|--------------------------------|---|
| 1.         | Introduction<br>Psychology | to | Cognitive | Historical<br>modern<br>Approache | Background:<br>cognitive<br>s: Information | Emergence<br>Psycholo<br>Processing | of<br>ogy;<br>and              | 3 |

|  |  | PDP Model; Research Methods  |    |
|--|--|--|----|
| 3.   | Perceptual Processes   | Perceptual learning and development;<br>perception of shape, space and movement.   | 4  |
| 3.   | Attention  | Selective Attention and Divided Attention:<br>Meaning, Definition and Theories.  | 4  |
| 4.   | Memory   | Short Term Memory  | 3  |
| 5.   | Imagery  | Properties of mental images;<br>Representation of images and cognitive<br>maps.  | 3  |
| 6.   | Language   | Structure of language and its acquisition,<br>speech perception, factors affecting<br>comprehension.                                       | 4  |
| 7.   | Thinking and Problem<br>Solving                              | Types of thinking; Classification of<br>problems; Problems solving approaches,<br>Problems space theory by Newell and<br>Simon, Creativity | 4  |
| 8.   | Decision Making  | Logical reasoning types and errors in<br>reasoning processes.<br>Concept formation and categorization;<br>Judgment and decision making     | 3  |
| Total number o   | f Hours  |  | 28 |
|  | E  | valuation Criteria   |    |
| Components<br>T1<br>T2<br>End Semester E:<br>TA<br>Total | Maximum N<br>20<br>20<br>xamination 35<br>25 (Assignn<br>100 | Iarks<br>nent, Quiz, Oral Questions)   |    |

| <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |   |  |  |  |
|--|---|--|--|--|
| 1.   | Ronald T. Kellogg, Fundamentals of Cognitive Psychology, 2 <sup>nd</sup> Ed., Sage Publishing, 2012               |  |  |  |
| 2.   | Robert Solso, Otto Maclin, M. Kimberly Maclin, Cognitive Psychology, 8 <sup>th</sup> Ed., Pearson Education, 2013 |  |  |  |
| 3.   | Kathleen M. Galotti, Cognitive Psychology, 5th Ed., Sage Publishing, 2014   |  |  |  |

| Course Code | 16B1NHS636            | Semester : Eve      | en | Semeste<br>Month | r VI <b>Session</b> 2018 -2019<br>From Jan 2019 to June 2019 |
|-------------|-----------------------|---------------------|----|------------------|--|
| Course Name | Literature & Adaption |                     |    |                  |  |
| Credits     | 3                     | Contact Hours 2-1-0 |    | 2-1-0            |  |
|             |                       |                     |    |                  |  |

| Faculty (Names) | Coordinator(s)                 | Dr. Monali Bhattacharya (Sector 62)<br>Dr. Ekta Srivastava Sector (128) |
|-----------------|--------------------------------|---|
|                 | Teacher(s)<br>(Alphabetically) | Dr. Ekta Srivastava, Dr. Monali Bhattacharya.                           |

| COURSE   | COGNITIVE<br>LEVELS  |                          |
|----------|--|--------------------------|
| C304-3.1 | Understand and outline the elements and theories of adaptation and its various forms, and relate with the texts reflecting the cultural, moral and linguistic  | Understand<br>Level (C2) |
|          | changes in the contemporary society.   | × ,                      |
| C304-3.2 | Utilize visual literacy to analyze the language and style adopted in filmed texts<br>and examine them as reflections of Readers' and Audience' values and<br>perceptions in the context of myriad cultures and multidisciplinary settings<br>individually and in groups. | Apply Level (C3)         |
| C304-3.3 | Analyze texts and their adaptations beyond the surface level of narrative or<br>character as reflections of value systems of various cultures and times individually<br>and in a team.   | Analyse Level<br>(C4)    |

| C304-3.4 | Evaluate, interpret and document source texts and adaptations thematically and       | Evaluate | e Level |
|----------|--|----------|---------|
|          | stylistically to learn the nuances of language, culture and values of the society.   | (C5)     |         |
| C304-3.5 | Compose and make an effective presentation of a literary/non literary piece in any   | Create   | Level   |
|          | genre and design an ethical adaptation of any literary/non literary piece in another | (C6)     |         |
|          | form individually and in groups.   |          |         |

| Module<br>No.   | Title of the<br>Module           | Topics in the Module   | No. of<br>Lectures for<br>the module |
|---|----------------------------------|--|--------------------------------------|
| 1.  | Introduction<br>Literary Devices | Figures of speech, Character, Plotline, Conflict, Point of View  | 2                                    |
| 2.  | Literature &<br>Adaptation       | Understanding Cultural Contexts<br>Forms of Adaption<br>Cinematography & Narratology   | 4                                    |
| 3.  | Framework                        | Adaptation Theories; Reader Response & Audience<br>Response Theories   | 4                                    |
| 4.  | Play & adaptations               | The Pygmalion: George Bernard Shaw<br>Hamlet : William Shakespeare   | 6                                    |
| 5.  | Novel &<br>Adaptations           | Pride & Prejudice: Jane Austen<br>The Kite Runner: Khalid Hossenni<br>The Namesake: Jhumpa Lahiri<br>The Godfather: Mario Puzo | 12                                   |
|   | <u></u>                          | Total number of Lectures   | 28                                   |
| Evaluatio   | n Criteria                       |  |                                      |
| Components<br>T1<br>T2<br>End Semester Examination<br>TA<br>Total |                                  | Maximum Marks<br>20<br>20<br>35<br>25 (Assignment, Poster Presentation , Oral Questions)<br>100                                |                                      |

| 25 (Assignment, | Poster Presentation, Oral Questions) |
|-----------------|--------------------------------------|
| 100             |                                      |

| Reco | ommended Reading material:  |
|------|---|
| 1.   | Linda Hutcheon, A Theory of Adaptation, Routledge, 2006   |
| 2.   | Mark William Roche, Why Literature matters in the 21 <sup>st</sup> Century, 1 <sup>st</sup> edition, Yale University Press 2004           |
| 3.   | George Bernard Shaw, Pygmalion, Electronic Version, Bartleyby.com, New York, 1999   |
| 4.   | <b>Stanley Wills &amp; Gary Taylor</b> , <i>The Complete Works. The Oxford Shakespeare</i> (Compact ed.). Oxford: Clarendon Press., 1988. |
| 5.   | Jhumpa Lahiri, The Namesake, 1 <sup>st</sup> Edition, Houghton Mifflin US, 2003   |
| 6.   | Jane Austen, Pride & Prejudice, Reprint, Thomas Egerton, 2013   |
| 7.   | Mario Puzo, The Godfather, 1 <sup>st</sup> Edition, G. P. Putnam's Sons, USA, 1969  |
| 8.   | Khalid Hossenni, The Kite Runner, 1 <sup>st</sup> edition, Riverhead Books US, 2003   |

| Lecture-wise Dreakup |                                |                  |  |                                  |  |                                   |
|----------------------|--------------------------------|------------------|--|----------------------------------|--|-----------------------------------|
| Course Code          | 19B12HS612                     | Semester : Even  |  | Semester VI Session 2018-2019    |  |                                   |
|                      |                                |                  |  | Month from Jan 2019 to June 2019 |  | <b>from</b> Jan 2019 to June 2019 |
| Course Name          | Social Media and Soc           | ciety            |  |                                  |  |                                   |
| Credits              | 3                              | 3 Contact Hours  |  | 2-1-0                            |  |                                   |
| Faculty (Names)      | Coordinator(s)                 | Dr. Shirin Alavi |  |                                  |  |                                   |
|                      | Teacher(s)<br>(Alphabetically) | Dr. Shirin Alavi |  |                                  |  |                                   |

| COURSE O | UTCOMES  | COGNITIVE LEVELS      |
|----------|--|-----------------------|
| C304-1.1 | Infer the implications of digital change, and the concept of social<br>media and e-marketing in the context of the changing marketing<br>landscape | Apply Level(C3)       |
| C304-1.2 | Elaborate the implications of cyber branding and digitization on online marketing mix decisions  | Create Level (C6)     |
| C304-1.3 | Develop specific models related to social media and social media analytics   | Create Level (C6)     |
| C304-1.4 | Evaluate concepts related to Search Engine Marketing, Customer<br>Centric Web Business models and Web Chain Analysis                               | Evaluate Level(C5)    |
| C304-1.5 | Illustrate the new age marketing practices   | Understand Level (C2) |

| Mod<br>ule<br>No. | Title of the Module   | Topics in the Module   | No. of<br>Lectures for<br>the module |
|-------------------|---|--|--------------------------------------|
| 1.                | Introduction , Individuals<br>Online and Rules for<br>engagement for social media | What is social media marketing, the importance of<br>social media for influencing target audience, Patterns<br>of internet usage, Internet user demographics, The<br>Behavioural Internet, E-Marketing, The Virtual world,<br>the changing Marketing Landscape, E -Marketing-<br>Strengths and Applications, Online Marketing<br>Domains, Digital Marketing Optimization, The Need<br>for Digital Engagement   | 4                                    |
| 2.                | The Online Marketing Mix  | The Online Marketing Mix, Consumer Segmentation,<br>Consumer Traits, Consumers and Online Shopping<br>Issues, E-Product, E-Place, E-Price, E-Promotion,<br>Website Characteristics affecting online purchase<br>decision.  | 3                                    |
| 3.                | The Online Consumer and<br>Social Media   | The Digital Ecosystem, Online Consumer Behavior,<br>Cultural Implications of key web characteristics,<br>Models of website visits, Web 2.0 and Marketing, The<br>collaborative web, Network evolution, Network<br>science, Marketing with networks, Metcalfe's law,<br>Netnography, Social Media Model by McKinsey,<br>Social Media Tools-Blogs, Wikis, Online<br>Communities, Facebook, Twitter, You Tube, Flickr,<br>Microblogging.  | 4                                    |
| 4.                | Online Branding and Traffic<br>Building   | Cyberbranding, Online brand presence and<br>enhancement, The Digital Brand Ecosystem, Brand<br>Experience, Brand Customer Centricity, Brands and<br>Emotions, The Diamond Water paradox, Internet<br>Traffic Plan, Search Marketing Methods, Internet<br>Cookies and Traffic Building, Traffic Volume and<br>quality, Traffic Building Goals, Search Engine<br>Marketing, Keyword Advertising, Keyword value,<br>Internet Marketing Metrics, Websites and Internet<br>Marketing. | 4                                    |
| 5.                | Web Business Models<br>,Social Media Strategy<br>,Social Media Marketing<br>Plan  | The value of a Customer Contact, Customer Centric<br>Business Management, Web Chain of Events,<br>Customer Value Analysis and the Internet, Business<br>Models, Revenue Benefits, Value Uncertainty,<br>Purchase Importance, Define a social media plan,<br>explain the social Media marketing planning cycle, list<br>the 8C's of strategy development.   | 4                                    |
| 6.                | Market Influence analytics in<br>a Digital Ecosystem                              | Engagement Marketing through Content Management,<br>Online Campaign Management, Consumer<br>Segmentation, Targeting, and Positioning using Online<br>Tools, Market Influence Analytics in a Digital<br>Ecosystem, The Digital Ecosystem, Knowledge as a<br>value proposition, CGM and Consumer behavior, The<br>value of the power of influence, Amplifying Social<br>Media Campaigns.   | 4                                    |
| 7.                | The Contemporary Digital<br>Revolution and its impact on<br>society               | Online Communities and Co-creation, The<br>fundamentals of online community management<br>strategies, The World of Facebook, The Future of<br>Social media Marketing—Gamification and Apps,<br>Game based marketing The world of Apps, Apps and  | 3                                    |

|                          |  | the Indian Diaspora   |   |  |  |  |  |  |
|--------------------------|--|---|---|--|--|--|--|--|
| 8.                       | Integrating Mobile into<br>Social Media Marketing  | 2   |   |  |  |  |  |  |
| Total number of Lectures |  |   |   |  |  |  |  |  |
| Eval                     | uation Criteria  |   |   |  |  |  |  |  |
| Com                      | ponents Ma   | ximum Marks   |   |  |  |  |  |  |
| T1                       | 20   |   |   |  |  |  |  |  |
| T2                       | 20   |   |   |  |  |  |  |  |
| End                      | End Semester Examination 35  |   |   |  |  |  |  |  |
| TA                       | 25   | (Assignment and Class Test)   |   |  |  |  |  |  |
| Tota                     | <u>l 10</u>  | 0   |   |  |  |  |  |  |
| 1                        |  |   |   |  |  |  |  |  |
| Reco<br>Refe             | mmended Reading material: A rence Books, Journals, Reports,  | Author(s), Title, Edition, Publisher, Year of Publication etc.<br>Websites etc. in the IEEE format) | ( Text books,   |  |  |  |  |  |
| 1.                       | Social Media Marketing A Stra<br>Learning ,2017.   | tegic Approach, Melissa Barker, Donald Barker, Second Ed  | ition Cengage   |  |  |  |  |  |
| 2.                       | Digital Marketing ,Seema Gupta,First Edition ,Mc Graw Hill Education (India) Private Limited ,2018 |   |   |  |  |  |  |  |
| 3.                       | Digital Marketing, Vandana Ahuja, First Edition, Oxford University Press, 2015                     |   |   |  |  |  |  |  |
| 4.                       | Social Media Marketing, Liana  | "Li" Evans, First Edition, Pearson, 2011.   | Social Media Marketing, Liana "Li" Evans, First Edition, Pearson, 2011. |  |  |  |  |  |

| Course Code   |   | 19B12HS611  | Semester : EVENSemester : V(specify Odd/Even)Month from |               | VI Session 2018-2019<br>I: January- June |                  |                           |
|---|---|---|---|---------------|--|------------------|---------------------------|
| Course Name   |   | Econometric Analysi   | .S  |               |  |                  |                           |
| Credits   |   | 03  |   | Contact Hours |  |                  | 2-1-0                     |
|   |   |   |   |               |  |                  |                           |
| Faculty (Names)   |   | Coordinator(s)  | Manas Ranjan Behera                                     |               |  |                  |                           |
|   |   | Teacher(s)<br>(Alphabetically)  | Manas Ranjan Behera                                     |               |  |                  |                           |
|   |   |   |   |               |  |                  |                           |
| COURSE OUTCOMES   |   |   |   |               |  | COGNITIVE LEVELS |                           |
| After pursuing the above mentioned course, the                              |   |   | se, the students v                                      | will be able  | to:                                      |                  |                           |
| C304-2.1 <i>Demonstrate</i> the key concerned the properties of a set of da |   |   | cepts from basic<br>lata.                               | c statistics  | to underst                               | and              | Understanding Level –(C2) |
| C204.2.2  | A | Louisers Level Commence the Level of the second section of the Level (C2) |   |               |  |                  |                           |

| C304-2.2 | <i>Apply</i> Ordinary Least Square method to undertake econometric studies.   | Apply Level – (C3)      |
|----------|---|-------------------------|
| C304-2.3 | <i>Examine</i> whether the residuals from an OLS regression are well-behaved. | Analyze Level – (C4)    |
| C304-2.4 | <i>Evaluate</i> different model selection criteria for forecasting.           | Evaluation Level – (C5) |

| C304-   | -2.5   | Create models fo  | r prediction from a given set of data. Creation   | _evel – (C6)                         |  |
|---|--|---|---|--------------------------------------|--|
| Modu<br>No.   | ıle T<br>N   | Title of the<br>Module  | Topics in the Module  | No. of<br>Lectures for<br>the module |  |
| 1.  | S  | tatistical Inference  | Point and interval estimation; ;The Z distribution ;The Nul<br>and Alternate hypotheses ;The chi-square distribution; The<br>F distribution; The t distribution   | 3                                    |  |
| 2.  | F  | Regression<br>Analysis  | Two variable regression model; The concept of the PRF<br>Classical assumptions of regression; Derivation of the OLS<br>estimators and their variance; Properties of OLS estimators<br>under classical assumptions; Gauss-Markov Theorem<br>Tests of Hypothesis, confidence intervals for OLS<br>estimators; Measures of goodness of fit: R square and its<br>limitations; Adjusted R square and its limitations | ; 7                                  |  |
| 3.  | Econometric Model Identification: Structural and reduced form; Omitted Variables and Bias; Misspecification and Ramsay RESET; Specification test; Endogeneity and Bias |   |   |                                      |  |
| 4.  | F<br>A   | Failure of Classical<br>AssumptionsMulti-collinearity and its implications; Auto-correlation:<br>Consequences and Durbin-Watson test ;Heteroskedasticity:<br>Consequences and the Goldfeld -Ouandt test   |   |                                      |  |
| 5.  | F  | Forecasting         Forecasting with a)moving averages b) linear trend c)<br>exponential trend CAGR; Forecasting with linear<br>regression; Classical time series decomposition; Measures<br>of forecast performance: Mean square error and root mean<br>square error. Limitations of accompating forecasts |   |                                      |  |
| 6.  | T<br>A   | ime Series<br>Analysis  | Univariate Time Series Models: Lag Operator, ARMA<br>ARIMA models, Autoregressive Distributed Lag<br>Relartionship  | , <u>3</u>                           |  |
| 7.  | LinearLinear programming;Dual of a linear programmingProgrammingproblem; Simplex method Transportation   |   |   |                                      |  |
|   |  |   | Total number of Lecture   | s 28                                 |  |
| Evalu<br>Comp<br>T1<br>T2<br>End S<br>TA<br>TA<br>Total | ation C<br>ponents<br>Semester   | C <b>riteria</b><br>Examination   | Maximum Marks<br>20<br>20<br>35<br>25 (Quiz+ Assignment+Viva -Voce)<br>100  |                                      |  |
| Recor<br>Refere   | <b>mmend</b><br>ence Bo  | ed Reading materi<br>oks, Journals, Repo  | al: Author(s), Title, Edition, Publisher, Year of Publication et orts, Websites etc. in the IEEE format)  | c. ( Text books,                     |  |
| 1.  | Gujarat  | i, D.N. (2002), Basi  | ic Econometric (4 <sup>th</sup> ed.), New York: McGraw Hill.  |                                      |  |
| 2.  | Greene   | , W.H. (2003), Econ   | nometric Analysis, New Jersey: Prentice Hall.   |                                      |  |

Madala, G.S. (1992), Introduction to Econometrics (2<sup>nd</sup> ed.), New York: Macmillan.

3.

| Course Co             | de   | 18B12HS611                       |          | Semester :EVEN Semester VI S<br>Month from Ja   |               | <b>Session</b> 2018 -2019<br>an 2019 to June 2019 |       |           |                                      |  |
|-----------------------|--|----------------------------------|----------|---|---------------|---|-------|-----------|--------------------------------------|--|
| Course Name Marketing |  |                                  | anagem   | ent   |               |   |       |           |                                      |  |
| Credits               |  |                                  | 3        |   | Contact Hours |   | 2-1   | -0        |                                      |  |
| Faculty (N            | ames)  | Coordinato                       | r(s)     | Dr Swati Sharr  | na            |   |       |           |                                      |  |
|                       |  | Teacher(s)<br>(Alphabetica       | ally)    | Dr. Swati Shar  | ma            |   |       |           |                                      |  |
| COURSE                | OUTCO  | OMES                             |          |   |               |   |       | COGNIT    | IVE LEVELS                           |  |
| After pursu           | ing the a  | above mention                    | ed cours | se, the students v  | vill be able  | to:   |       |           |                                      |  |
| C304-7.1              | To illu<br>and ma  | strate the fur<br>arket research | ndament  | als of marketing  | g, marketin   | g enviror   | ment  | Understan | ding Level (C2)                      |  |
| C304-7.2              | To mo  | del the dynami                   | cs of ma | arketing mix  |               |   |       | Applying  | Level (C3)                           |  |
| C304-7.3              | To der<br>market   | monstrate the ing and emerg      | implica  | ttions of curren keting trends.   | t trends in   | social r  | nedia | Understan | ding Level (C2)                      |  |
| C305-7.4              | To appraise the importance of marketing ethics and social Evaluating(C5)   |                                  |          |   |               | g(C5)   |       |           |                                      |  |
| C-305-<br>7.5         | To conduct environmental analysis, design business portfolios and develop marketing strategies for businesses to gain competitive Creating (C6) advantage. |                                  |          |   |               | C6)   |       |           |                                      |  |
| Module<br>No.         | Title o<br>Modul   | f the<br>le                      | Topics   | s in the Module   |               |   |       |           | No. of<br>Lectures for<br>the module |  |
| 1.                    | Under<br>New A   | standing<br>.ge                  | De<br>Th | efining Marketing For 21 <sup>st</sup> Century<br>he importance of marketing and marketing's role |               | 's role in  | 5     |           |                                      |  |

|                        | Marketing  | business and society.<br>Introduction to Digital Marketing.<br>Online Communication Tools.<br>The Social Media-Conversations, Community and<br>Content.<br>Affiliate Marketing and Mobile Engagement.<br>The Digital Campaigns  |    |
|------------------------|--|---|----|
| 2                      | Marketing<br>Environment and<br>Market Research<br>and insights  | Internal and external forces impacting marketers.<br>Marketing and Customer Value.<br>Gathering Information and Scanning the environment.<br>Company's Micro and Macro Environment<br>Responding to the Marketing Environment   | 3  |
| 3                      | Strategic Planning<br>and the marketing<br>Process               | <ul> <li>Explore the impact of social forces on marketing actions.</li> <li>Describe how technological change affects marketing.</li> <li>Designing the business Portfolio</li> <li>Discuss the Strategic Planning Process and Strategic Marketing Process.</li> </ul>                      | 5  |
| 4                      | Consumer and<br>Business Buyer<br>Behavior                       | Consumer Markets and consumer buyer behaviour.<br>The buying decision process.<br>Business Markets and business buyer behaviour.<br>Discuss the modern ethical standards.   | 5  |
| 5                      | Branding   | <ul> <li>Brand Image, Identity and Association.</li> <li>Product brands and Branding decisions.</li> <li>Product line and mix decisions.</li> <li>Consumer Brand Knowledge.</li> <li>New Product Development and Product life cycle strategies.</li> </ul>                                  | 4  |
| 6                      | Pricing products:<br>Pricing<br>considerations and<br>strategies | Factors to consider when setting prices.<br>New product pricing strategies.<br>Product mix pricing strategies.<br>Price adjustments and changes.  | 4  |
| 7                      | The New Age<br>Social Marketing                                  | Ethics and social responsibility in marketing.<br>Ethical behavior in business.<br>Ethical decision making.<br>Social forces affecting marketing.<br>Impact of culture on marketing.<br>Discuss modern ethical standards.<br>Importance of marketing in CSR and business<br>sustainability. | 2  |
|                        |  | Total number of Lectures  | 28 |
| Evaluation<br>Componen | n Criteria   | Maximum Marks   |    |
| T1                     | 165  | 20  |    |

| T2                       | 20                       |
|--------------------------|--------------------------|
| End Semester Examination | 35                       |
| ТА                       | 25 (Assignment and Viva) |
| Total                    | 100                      |

| Reco<br>Book | <b>commended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Reference as, Journals, Reports, Websites etc. in the IEEE format) |
|--------------|---|
| 1.           | Kotler, Philip and Gary Armstrong, Principles of Marketing, 17 <sup>th</sup> Edition, New Delhi, Pearson Education, 2017.   |
| 2.           | Kotler, Philip., and Kevin Lane Keller, Marketing Management, 15 <sup>th</sup> Edition, New Delhi, Pearson Education, 2014.   |
| 3.           | Grewal D., &Levy Michael, Marketing, 5 <sup>th</sup> Edition, Mc graw Hill Education (India) Private Limited 2017.  |
| 4.           | Winer, Russell S., Marketing Management, 4 <sup>th</sup> Edition, Prentice Hall,2014.   |

| Course Code |  | 15B11CI611   |   | Semester Even                         |                            | Semester 6 <sup>th</sup> Session 2018 -2019 |              |           | 2018 -2019                 |
|-------------|--|--|---|---------------------------------------|----------------------------|---|--------------|-----------|----------------------------|
|             |  |  |   | (specify Odd/Even) Month from 3       |                            | January                                     |              |           |                            |
| Course Name |  | Theory of Co   | Theory of Computation and Compiler Design |                                       |                            |   |              |           |                            |
| Credits     |  |  | 4 (3-1-0)                                 |                                       | Contact Hours              |   |              | 2         | 1                          |
| Faculty (N  | ames)  | Coordinato   | r(s)                                      | (s) Ambalika Sarkar                   |                            |   |              |           |                            |
|             |  | Teacher(s)<br>(Alphabetica   | ally)                                     | Mukta Goel<br>Sanjeev Patel           |                            |   |              |           |                            |
| COURSE      | COURSE OUTCOMES COGNITIVE LEVELS   |  |   |                                       |                            |   | IVE LEVELS   |           |                            |
| C314.1      | Understand the regular expression, regular languages, context free Understand level (C2) languages and its acceptance using automata   |  |   |                                       |                            |   | d level (C2) |           |                            |
| C314.2      | Identif<br>constru   | entify the phases of compilers for a programming language and Apply Level (C3) |   |                                       |                            |   | vel (C3)     |           |                            |
| C314.3      | Build s  | syntax directed  | translat<br>g S-attri                     | tion schemes for<br>ibuted and L-attr | a given con<br>ibuted gran | ntext free nmars.                           |              | Analyze I | Level (C4)                 |
| C314.4      | Construct grammars and machines for a context free and context Apply Level (C sensitive languages.   |  |   |                                       |                            |   | vel (C3)     |           |                            |
| C314.5      | Generate the intermediate code and utilize various optimization Apply Level (C techniques to generate low level code for high level language program.                            |  |   |                                       |                            | vel (C3)                                    |              |           |                            |
| Madula      | Title  | ftha   | Topic                                     | in the Module                         |                            |   |              |           | No. of                     |
| No.         | Modu   | le   | Topics                                    | s in the woodule                      |                            |   |              |           | Lectures for<br>the module |
| 1.          | Unit-1       Finite automata:       14         Review of Automata, its types and regular expressions,       14         Equivalence of NFA, DFA and €-NFA, Conversion of       14 |  |   |                                       |                            | 14  |              |           |                            |

|   |                                       | automata and regular expression, Appl  | ications of Finite   |    |
|---|---------------------------------------|--|--|----|
| 2.  | Unit-2                                | PDA and Parser: Push down automata<br>grammars, top down and bottom up pa<br>programming specification [12 L]  | , Context Free<br>rsing, YACC                                    | 12 |
| 3.  | Unit-3                                | Chomsky hierarchy and Turing Machin<br>hierarchy of languages and recognizers<br>features like type checking, Turing Ma<br>acceptors and its design.[6L]                                       | ne: Chomsky<br>s, Context Sensitive<br>chine as language         | 6  |
| 4.  | Unit-4                                | Code generation and optimization: Syn<br>translation, S-attributed and L-attributed<br>Intermediate code generation, type con<br>equivalence of type expression, Code g<br>optimization. [10L] | atax directed<br>ed grammars,<br>versions, and<br>generation and | 10 |
|   |                                       |  |  |    |
|   |                                       | Total  | number of Lectures   | 42 |
| Evaluation  | n Criteria                            | Total  | number of Lectures   | 42 |
| Evaluation<br>Componer  | n Criteria<br>nts                     | Total<br>Maximum Marks   | number of Lectures   | 42 |
| Evaluation<br>Componen<br>T1<br>T2                                  | n Criteria<br>nts                     | Total<br>Maximum Marks<br>20<br>20   | number of Lectures   | 42 |
| <b>Evaluation</b><br><b>Componen</b><br>T1<br>T2<br>End Semes       | n Criteria<br>nts<br>ster Examination | Total<br>Maximum Marks<br>20<br>20<br>35<br>25 (Assignments  | number of Lectures   | 42 |
| <b>Evaluation</b><br><b>Componen</b><br>T1<br>T2<br>End Semes<br>TA | n Criteria<br>nts<br>ster Examination | Maximum Marks         20         20         35         25 (Assignments : Quizzes/Tutorial : )  | number of Lectures   | 42 |

| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text | books, |
|--|--------|
| Reference Books, Journals, Reports, Websites etc. in the IEEE format)                              |        |

| Text | Book(s):   |
|------|--|
| 1.   | Peter Linz, "An Introduction to Formal Languages and Automata," 3 <sup>rd</sup> Edition, Narosa Publisher 2005.  |
| 2.   | Alfred Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman, "Compilers: principles, techniques, and tools," 2 <sup>nd</sup> Edition, Pearson Education                 |
| Refe | rence Book(s):   |
| 3.   | John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", 2 <sup>nd</sup> Edition, Pearson Education Asia 2002 |
| 4.   | K. L. P. Mishra, N. Chandrasekaran, "Theory of Computer Science Automata, Languages and Computation", 3 <sup>rd</sup> Edition, PHI 2007                                  |
| 5.   | John C. Martin, "Introduction to Language and the Theory of Computation", TMH 2004   |
| 6.   | S.P.Eugene, "Theory of automata, formal language and computation", New Age International Publishers, New Delhi 2003  |
| 7.   | Sipser, M., Introduction to the Theory of Computation, Second Edition, Thomson Course Technology, 2007   |
| 8.   | ACM Transactions on Computation Theory   |

|    | ACM Journal on Theory of Computation  |
|----|---------------------------------------|
| 9. | ACM Journal on Theory of Computation. |
|    |                                       |

| Course Code     |  | 15B22CI621                     | Semester : Ev               | ren | Semeste                    | er 6 <sup>th</sup> Session 2018-2019 |  |
|-----------------|--|--------------------------------|-----------------------------|-----|----------------------------|--------------------------------------|--|
|                 |  |                                |                             |     | Month f                    | from Jan 19 to June 19               |  |
| Course Na       | me   | Data Mining And Web Algorithms |                             |     |                            |                                      |  |
| Credits         |  | 3                              | <b>Contact Hours</b> 4(3+1) |     |                            | 4(3+1)                               |  |
| Faculty (Names) |  | Coordinator(s)                 | Mahendra Kumar Gurve        |     |                            |                                      |  |
|                 |  | Teacher(s)<br>(Alphabetically) |                             |     |                            |                                      |  |
| COURSE OUTCOMES |  |                                |                             |     |                            | COGNITIVE LEVELS                     |  |
| C313.1          | <b>13.1</b> Understand the basics of data mining and pre-processing of data.   |                                |                             |     | Understand Level (Level 2) |                                      |  |
| C313.2          | Analyze the transactional data for finding frequent and interesting patterns using association rule mining techniques like Apriori and FP- |                                |                             |     |                            | Analyse LevelFP-(Level 4)            |  |

Growth.

| C313.3   | Apply a wide range of classification techniques like Naïve-bayes,<br>decision tree, and KNN for the numerous application including fraud<br>detection, target marketing, medical diagnosis, etc.Apply Level<br>(Level 3)   |   |                |                                      |  |  |
|--|--|---|----------------|--------------------------------------|--|--|
| C313.4   | Cluster the similar/di partitioning, hierarch  | Create Lev<br>Level 6)  | vel            |                                      |  |  |
| C313.5   | Analyze the link strue algorithms.   | analyse L<br>Level 4)   | evel           |                                      |  |  |
| C313.6   | Develop recommendatechniques   | Create Lev<br>Level 6)  | vel            |                                      |  |  |
| Module<br>No.  | Title of the<br>Module   | Topics in the Module  |                | No. of<br>Lectures for<br>the module |  |  |
| 1.   | Course overview  | ewWhat Motivated Data Mining? Why Is It Important? What<br>Is Data Mining? Data Mining—On What Kind of Data?<br>Data Mining Functionalities—What Kinds of Patterns Can<br>Be Mined? Are All of the Patterns Interesting? Data mining<br>process, Types of datasets and attributes, Major Issues in<br>Data Mining03 |                |                                      |  |  |
| 2.   | Data Preprocessing   | Getting To know your data, Data extraction, Data clear<br>Data Integration and transformation, Data reduction   | eaning,        | 06                                   |  |  |
| 3.   | Association Rule<br>mining   | Usability and Complexity Analysis of Apriori Algorit<br>Sampling Algorithm, Partitioning, Using multiple min<br>supports  | thm,<br>inimum | 05                                   |  |  |
| 4.   | Classification<br>Algorithms   | on Issues Regarding Classification and Prediction, Bayesian<br>Classification, Usability and Complexity Analysis of<br>Bayesian algorithm, Nearest Neighbor algorithm, Decision<br>Tree based algorithm   |                |                                      |  |  |
| 5.   | Clustering       Clustering Algorithms: Types of Data in Cluster Analysis,       08         Algorithms       Similarity Measures, A Categorization of Major Clustering       08         Methods, Partitioning Methods, Hierarchical Methods,       Usability and Complexity Analysis of Agglomerative       08         Hierarchical Algorithm,       k-means and K-Mediod       08 |   |                |                                      |  |  |
| 6.   | Web algorithms:  | Web algorithms: Link Based Search Algorithm, Web<br>Crawling, Indexing, Searching, Zone Indexing, Term-<br>Frequency, Link Analysis Algorithm.  | )<br>1-        | 04                                   |  |  |
| 7.   | Ranking<br>Algorithms:   | Ranking Algorithms: Page rank, Hits ranking algorith  | hms            | 03                                   |  |  |
| 8  | Web caching<br>Algorithm :   | Web caching Algorithm : LRV, FIFO, LRU, Random  | n, OPT         | 03                                   |  |  |
| 9  | Recommendation<br>Algorithms:Recommendation Algorithms: Collaborative Filtering,<br>Item-to-Item recommendation, Memory Based<br>Recommendation,03   |   |                |                                      |  |  |
|  |  | Total number of Le  | ectures        | 42                                   |  |  |
| Evaluation<br>Componen<br>T1<br>T2<br>End Semes<br>TA<br>Total |  |   |                |                                      |  |  |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

Jiawei Han, Micheline Kamber, Data Mining, Morgan Kaufmann Publishers, Elsevier, 2005

Kimball R. and Ross M, The Data Warehouse Toolkit", Wiley

Pujari, Arun K, Data mining and statistical analysis using SQL, Universities press

Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining

Soumen Chakrabarti, Mining the Web: Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier

Alex, Berson, Stephen J.Smith, Data Warehousing, data mining and OLAP, McGraw-Hill, 2004

Inmon W.H.,Building the Data Warehouse ,4th Edition, Wiley

Anahory S. and Murray D, Data Warehousing in the Real World, Addison-Wesley

Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall,2003

Mattison R., Web Warehousing and Knowledge Management", Tata McGraw-Hill.

David Hand, Heikki Mannila and Padhraic Smyth ,Principles of Data Mining,PHI

Transactions on Database Systems (ACM)

IEEE Transactions on Knowledge & Data Engineering

The VLDB Journal The International Journal on Very Large Data Bases

Detailed Syllabus Lab-wise Breakup

| Course Code 15 | 5B28CI681 | Semester Even | Semester VI | Session | 2018 - 2019 |  |
|----------------|-----------|---------------|-------------|---------|-------------|--|
|----------------|-----------|---------------|-------------|---------|-------------|--|

|                 |                                |   |            | Month f | from Jan – June 2019 |  |  |
|-----------------|--------------------------------|---|------------|---------|----------------------|--|--|
| Course Name     | Data Mining And We             | b Algorithms Lab                                |            |         |                      |  |  |
| Credits         | 0-0-1                          | Contact Hours 2                                 |            |         |                      |  |  |
| Faculty (Names) | Coordinator(s)                 | Dr Dharmveer                                    | Singh Rajp | oot     |                      |  |  |
|                 | Teacher(s)<br>(Alphabetically) | Dr. Dharmveer Singh Rajpoot, Mr. Mahendra Gurve |            |         |                      |  |  |

| COURSE | OUTCOMES   | COGNITIVE<br>LEVELS |
|--------|--|---------------------|
| C375.1 | Apply the data pre-processing techniques on the dataset to handle missing information, duplicate information etc.  | C3                  |
| C375.2 | Implement association rule mining techniques like Apriori and FP-Growth to analyze frequent and interesting patterns in the transactional data.  | C3                  |
| C375.3 | Apply a wide range of classification techniques like Naïve-Bayes, decision tree,<br>and KNN for the numerous application including fraud detection, target<br>marketing, medical diagnosis, etc. | C3                  |
| C375.4 | Implement and validate the Clustering methods and outcomes of different methods like partitioning, hierarchical and density based clustering using SSE.  | C5                  |
| C375.5 | Analyze the link structure of web using page rank and HITS algorithms.   | C4                  |
| C375.6 | Develop a project using data mining technique to solve the real world problems like fraud detection, hand writing recognition, stock prediction etc.   | C5                  |

| Module No.              | Title of the Mo           | dule   | List of Experiments  |     | CO       |  |  |  |
|-------------------------|---------------------------|--------|--|-----|----------|--|--|--|
| 1.                      | Data Preprocess           | ing    | Explore the various data mining tools.   |     | C3       |  |  |  |
|                         |                           |        | Apply Data pre-processing i.e. Cleaning, Integration, and Missing  |     |          |  |  |  |
|                         |                           |        | Value etc.<br>Perform Data Similarity Measure (Euclidean Manhattan Distance)   |     |          |  |  |  |
|                         |                           |        | Implement Jaccard coefficient for documents similarity.  |     |          |  |  |  |
| 2.                      | Association Rul<br>Mining | e      | Develop Apriori algorithm to mine frequent item-sets.<br>Implement FP-growth algorithm to identify the frequent item sets.<br>Implement ECLAT algorithm for rule mining. |     |          |  |  |  |
| 3.                      | Clustering                |        | Develop K-Means Algorithm to generate clusters.  |     | C5       |  |  |  |
|                         |                           |        | Develop K-Medoids Algorithm to generate clusters.  |     |          |  |  |  |
| 4                       | Classification            |        | Do Practice of Decision Tree Algorithm for classification  |     |          |  |  |  |
| 4.                      |                           |        | Implement ID3, C4.5 and Naïve Bayes.   |     |          |  |  |  |
| 5.                      | Validity Measur           | es     | Implement Validity Measures to evaluate the quality of Data  |     |          |  |  |  |
|                         |                           |        | Mining Algorithms.   |     | <u> </u> |  |  |  |
| 6.                      | Web Application           | n      | Analyze the link structure of web using page rank algorithms.<br>Analyze the link structure of web using HITS algorithms.  |     |          |  |  |  |
|                         |                           |        |  |     |          |  |  |  |
| Evaluation Scheme Lab 7 |                           | Lab Te | est 1  | 20  | <u> </u> |  |  |  |
| L                       |                           | Lab Te | est 2  | 20  |          |  |  |  |
| I                       |                           |        | o-Day (Evaluations , Project, Attendance) 60   |     |          |  |  |  |
| Т                       |                           |        |  | 100 |          |  |  |  |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

| 1.  | Jiawei Han, Micheline Kamber, Data Mining, Morgan Kaufmann Publishers, Elsevier, 2005                    |
|-----|--|
| 2.  | Kimball R. and Ross M, The Data Warehouse Toolkit", Wiley  |
| 3.  | Soumen Chakrabarti, Mining the Web:Discovering knowledge from hypertext data", Morgan Kaufmann, Elsevier |
| 4   | Alex, Berson, Stephen J.Smith, Data Warehousing, data mining and OLAP, McGraw-Hill, 2004                 |
| 5.  | Inmon W.H.,Building the Data Warehouse ,4 <sup>th</sup> Edition, Wiley                                   |
| 6.  | Anahory S. and Murray D, Data Warehousing in the Real World, Addison-Wesley                              |
| 7.  | Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall,2003                    |
| 8.  | Mattison R., Web Warehousing and Knowledge Management", Tata McGraw-Hill.                                |
| 9.  | David Hand, Heikki Mannila and Padhraic Smyth ,Principles of Data Mining,PHI                             |
| 10. | Pujari, Arun K, Data mining and statistical analysis using SQL, Universities press                       |
| 11. | Transactions on Database Systems (ACM)   |
| 12. | IEEE Transactions on Knowledge & Data Engineering  |
| 13. | The VLDB Journal The International Journal on Very Large Data Bases                                      |

| Course Co                 | rse Code     16B1NCI643     Semester EVEN, 2019     Semester VI     Session     2018 - 2       Month from January to June   |                                    |  |  |  |  | 2018 -2019<br>June                     |                        |                |
|---------------------------|---|------------------------------------|--|--|--|--|--|------------------------|----------------|
| Course Na                 | me  | Computation                        | al Intelli   | igence   |  |  |  |                        |                |
| Credits                   |   |                                    | 4  |  | Contact H  | Hours  |  | 3-                     | +1             |
| Faculty (N                | ames)   | Coordinato                         | r(s)   | Parul Agarwal  |  |  |  |                        |                |
| Teacher(s)<br>(Alphabetic |   |                                    | ally)  | Parul Agarwal  |  |  |  |                        |                |
| COURSE                    | OUTCO   | OMES                               |  |  |  |  |  | COGNIT                 | IVE LEVELS     |
| C330-1.1                  | Infer y<br>fuzzy l  | agueness, amb<br>ogic concepts.    | oiguity a  | ind uncertainty i  | n natural la   | nguage us  | ing                                    | Understan<br>(Level-2) | nding Level-   |
| C330-1.2                  | Apply the intelligent techniques using rough set theory, fuzzy Logic,<br>genetic and hybrid techniques to solve different type of real world<br>problems.   |                                    |  |  |  |  | Level-3)                               |                        |                |
| C330-1.3                  | Analyz<br>applica   | the principle<br>ations in differe | es of fuzzient set of                                      | zification, defuz<br>f problems.   | zification a   | nd their   |  | Analyze-               | (Level-4)      |
| C330-1.4                  | Integra<br>engine   | te and develop                     | hybrid<br>on.  | Intelligent techr  | niques for re  | eal time   |  | Create Le              | evel (Level-6) |
| C330-1.5                  | Comp<br>writing   | are and conclu<br>g technical repo | de the re<br>orts  | esults of differer   | nt technique   | s through  |  | Evaluate(              | (Level-5)      |
| Module<br>No.             | Title of the<br>ModuleTopics in the Module  |                                    |  |  |  | No. of<br>Lectures for<br>the module                       |  |                        |                |
| 1.                        | IntroductionIntroduction to CI: Pitfalls of AI, formal definition of CI,<br>synergism in soft computing, Types of Adaptation and<br>learning, Computational intelligence as Adaptation and Self<br>organization03   |                                    |  |  |  | 03   |  |                        |                |
| 2.                        | Methods of       Rough Set Theory, Fuzzy sets and Fuzzy relations, methods         Knowledge       of knowledge representation  |                                    |  |  |  | 04   |  |                        |                |
| 3.                        | Fuzzy Inference<br>System with<br>applicationsRule-Based Expert Systems and Fuzzy Expert Systems:09 |                                    |  |  |  |  | 09                                     |                        |                |
| 4.                        | Neural<br>with A  | Network<br>pplications             | Pattern<br>unsupe<br>identif<br>Unsup<br>feature<br>networ | n recognition and<br>ervised learning,<br>ication and spee<br>ervised learning<br>e maps, Radial b<br>ck, case studies | l neural net<br>machine pe<br>ch recogniti<br>neural netv<br>pasis functio | works: Su<br>erception,<br>ion<br>vorks: self<br>on networ | object<br>object<br>f-organ<br>ks , AF | ed and<br>izing<br>RT  | 9              |
| 5.                        | Evolut<br>Compu   | ionary<br>itations                 | Introdu<br>ACO.  | uction to evolution  | onary comp   | outing: GA   | A, DE,                                 | PSO,                   | 8              |

| 6.         | Intelligent Systems | Hybrid Intelligent systems:                           | 9  |
|------------|---------------------|---|----|
| 0.         |                     | Evolutionary algorithms in designing neural networks, |    |
|            |                     | Evolutionary algorithms vs. fuzzy system              |    |
|            |                     | Neuro Fuzzy Systems concepts and applications         |    |
|            |                     | Total number of Lectures                              | 42 |
| Evaluation | n Criteria          |   |    |
| Componer   | nts                 | Maximum Marks   |    |
| T1         |                     | 20  |    |
| T2         |                     | 20  |    |
| End Semes  | ter Examination     | 35  |    |
| ТА         |                     | 25 ()   |    |
| Total      |                     | 100   |    |

| Reco<br>Refe | <b>Demmended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, rence Books, Journals, Reports, Websites etc. in the IEEE format) |
|--------------|--|
| 1.           | Ross, Timothy J. Fuzzy logic with engineering applications. John Wiley & Sons, 2005.   |
| 2.           | Poole, David Lynton, Alan K. Mackworth, and Randy Goebel. <i>Computational intelligence: a logical approach</i> . Vol. 1. New York: Oxford University Press, 1998.               |
| 3.           | Jang, Jyh-Shing Roger, Chuen-Tsai Sun, and Eiji Mizutani. "Neuro-fuzzy and soft computing; a computational approach to learning and machine intelligence." (1997).               |
| 4.           | Konar, Amit. Computational intelligence: principles, techniques and applications. Springer Science & Business Media, 2006.   |
| 5.           | Rutkowski, Leszek. Computational intelligence: methods and techniques. Springer Science & Business Media, 2008.  |
| 6.           | Eberhart, Russell C., and Yuhui Shi. <i>Computational intelligence: concepts to implementations</i> . Elsevier, 2011.  |
| 7.           | Fulcher, John. "Computational intelligence: an introduction." In <i>Computational intelligence: a compendium</i> , pp. 3-78. Springer, Berlin, Heidelberg, 2008.                 |
| 8.           | Cox, Earl, Michael O'Hagan, Rodman Taber, and Michael O'Hagen. <i>The fuzzy systems handkbook with cdrom</i> . Academic Press, Inc., 1998.                                       |
| 9.           | Haykin, Simon. Neural networks: a comprehensive foundation. Prentice Hall PTR, 1994.   |
| 10.          | De Jong, Kenneth A. Evolutionary computation: a unified approach. MIT press, 2006.   |

# Detailed Syllabus

|                 | Lecture-wise Breakup           |  |               |                                      |       |  |  |
|-----------------|--------------------------------|--|---------------|--------------------------------------|-------|--|--|
| Course Code     | 16B1NCI631                     | Semester Even  |               | Semester VI Session 2019-2020        |       |  |  |
|                 |                                | (specify Odd/Even)   |               | pecify Odd/Even) Month from Jan 2019 |       |  |  |
| Course Name     | Advanced Data Struc            | ctures and Applications                                    |               |                                      |       |  |  |
| Credits         | 4                              |  | Contact Hours |                                      | 3-1-0 |  |  |
| Faculty (Names) | Coordinator(s)                 | Mr. Prantik Bi   | swas, Prof.   | Krishna A                            | Asawa |  |  |
|                 | Teacher(s)<br>(Alphabetically) | Prof. Krishna Asawa, Mr. Prantik Biswas, Mr. Vimal Kumar K |               |                                      |       |  |  |

| COURSE   | OUTCOMES: At the completion of the course, students will be able to  | COGNITIVE LEVELS              |
|----------|--|-------------------------------|
| C330-2.1 | Comprehend insights of various variants of string processing and space partitioning data structures.       | Understand level<br>(Level 2) |
| C330-2.2 | Build efficient storage and sorting mechanisms for large datawith the help of k-way merge-sort algorithm.  | Apply Level<br>(Level 3)      |
| C330-2.3 | Analyse various advanced data structures-<br>BST Variants, Heap variants, Indexed Trees, Disjoint Set etc. | Analyse Level<br>(Level 4)    |
| C330-2.4 | Compare performance of various Hashing algorithms.   | Evaluating Level (Level 5)    |
| C330-2.5 | Propose solutions for the real life problems with the aid of suitable data structures.                     | Creating Level<br>(Level 6)   |

| Module<br>No. | Title of the<br>Module   | Topics in the Module  | No. of<br>Lectures for<br>the module |
|---------------|--------------------------|---|--------------------------------------|
| 1.            | Amortized Analysis       | Aggregate, Accounting and Potential Method, Dynamic tables  | 3                                    |
| 2.            | External Sorting         | Introduction to external sorting. Selection trees & k-way merging. Run generation. Optimal merging of runs. | 3                                    |
| 3.            | Binary Trees<br>Variants | Optimal Binary Search Tree, Splay tree,<br>AA-Tree, Treap.  | 5                                    |
| 4.            | Indexed Tree             | T-tree, Dancing tree, Queaps  | 3                                    |

| 5.                       | String Processing  | Rope, Tries, Suffix Tree, Ternary search                  | 4  |
|--------------------------|--------------------|---|----|
|                          | Data Structures    | tree,Gap buffer   |    |
| 6                        | Disjoint SetData   | Disjoint-set operations, representation of disjoint sets, | 6  |
| 0.                       | Structures         | Disjoint-set forests                                      |    |
| 7.                       | Heaps              | Pairing heap, Beap, Leftist tree.                         | 3  |
| 8                        | Space partitioning | Binary space partitioning, KD tree, Quad tree, Interval   | 6  |
| 0.                       | tree               | Tree, Segment Tree, Priority Search Tree.                 |    |
| 0                        | Hashes             | Introduction, Perfect hash function - Cuckoo hashing,     | 5  |
| ,                        |                    | Coalesced hashing, Universal Hashing.                     |    |
| 10                       | Applications       | Searching, Memory Indexing, Computer Graphics, Image      | 4  |
| 10.                      |                    | Data Structures, Computational Biology.                   |    |
|                          |                    | Total number of Lectures                                  | 42 |
| Evaluation               | n Criteria         |   |    |
| Compone                  | nts                | Maximum Marks   |    |
| T1                       |                    | 20  |    |
| T2                       |                    | 20  |    |
| End Semester Examination |                    | 35  |    |
| ТА                       |                    | 25 ()   |    |
| Total                    |                    | 100   |    |
|                          |                    |   |    |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

| 1  | HananSamet: Foundations of Multidimensional and Metric Data Structure, Morgan Kaufman, 2006                                  |
|----|--|
| 2  | Kurt Mehlhorn: Data Structures and Algorithms 3, Springer, 1984  |
| 3  | Dinesh P Mehta, SartajSahani: Handbook of Data Structure and Applications, Chapman & Hall, 2004                              |
| 4  | Langsam, Augestein, Tenenbaum: Data Structures using C and C++, 2nd Edition, PHI, 2001                                       |
| 5  | Sahni: Data Structures, Algorithms and applications in C++, Universities press, Hyderabad, 2005                              |
| 6  | Kruse, Tonso, Leung: Data Structures and Program Design in C, 2rd Edition, Pearson Education Asia, 2002                      |
| 7  | Weiss, Mark Allen: Data Structures and Algorithm Analysis in C/C++, 2nd Edition, Pearson Education Asia, 2003                |
| 8  | Cormen et al: Introduction to Computer Algorithms, 2nd edition, PHI New Delhi 2003   |
| 9  | Aho, Hopcraft, Ullman: Data Structures and Algorithms, Pearson Education Asia (Adisson Wesley), New Delhi, 2001              |
| 10 | Standish: Data Structures in Java, Pearson Education Asia (Adisson Wesley), New Delhi, 2000                                  |
| 11 | Knuth: The Art of Computer programming Vol I, Vol III, 2nd edition, Pearson Education Asia (Adisson Wesley), New Delhi, 2002 |
| 12 | Heileman: Data Structures, Algorithms and Object Oriented Programming, Tata Mc-Graw Hill, New Delhi, 2002                    |
| 13 | Sorenson and Tremblay: An Introduction to Data Structures with Algorithms, 2nd Edition, Tata Mc-Graw Hill, New Delhi, 2003   |

| Course Co   | ode  | 19B12CS312                                       | Semester Eve<br>(specify Odd/)   | en<br>Even) | Semeste<br>Month:          | er VI<br>from | Session 2018 -2019<br>January 2019 |
|---|--|--|--|-------------|----------------------------|---------------|------------------------------------|
| Course Na   | ime  | Blockchain Technolo                              | ogy  |             |                            |               |                                    |
| Credits   |  | 3  | Contact Hours  |             | 42                         |               |                                    |
| Faculty (N  | ames)  | Coordinator(s)                                   | Vikas Hassija  |             |                            |               |                                    |
| Teacher(s)<br>(Alphabetically)Vikas Hassija   |  |  |  |             |                            |               |                                    |
| COURSE OUTCOMES COGNITIVE LEVE!   |  |  | COGNITIVE LEVELS   |             |                            |               |                                    |
| C330-5.1 Define all the basic terminologies related to blockchain, bitcoin, decentralized applications and smart contracts. |  | Remember Level<br>(Level 1)                      |  |             |                            |               |                                    |
| C330-5.2  | Understand the pillar security featured in decentralized networks like<br>cryptography, digital signatures, proof of work and consensus<br>algorithms. |  | Understand Level<br>(Level 2)  |             |                            |               |                                    |
| C330-5.3  | Identif<br>world   | y the feasibility of app scenarios using differe | pplying blockchain security features in real Appendix App |             | Apply Level<br>(Level 3)   |               |                                    |
| C330-5.4  | Analyz<br>conser   | ze various consensus al<br>sus, Paxos consensus, | algorithms like PoW, PoS, PoB, Raft<br>(Level 4)<br>(Level 4)  |             | Analyze Level<br>(Level 4) |               |                                    |

| C330-  | -5.5 Evaluation of blockc<br>Byzantine fault toler  | hain based consensus algorithms namelyEvaance, proof of work etc.(   | luate Level<br>Level 5)              |  |  |
|--|---|--|--------------------------------------|--|--|
| Modu<br>No.  | le Title of the<br>Module   | Topics in the Module   | No. of<br>Lectures for<br>the module |  |  |
| 1.   | Blockchain defined  | We will introduce and define blockchain, explain the<br>structure and operational aspects of Bitcoin blockchain,<br>and compare different types of blockchains.  | 8                                    |  |  |
| 2.   | Ethereum<br>Blockchain  | We will discuss the innovation of the Ethereum blockchain,<br>review its protocol, and explore the payment model for<br>code execution.  | 6                                    |  |  |
| 3.   | Algorithms &<br>Techniques  | We will discuss the concept of asymmetric key encryption,<br>define the concept of hashing, and explain techniques that<br>use algorithms to manage the integrity of transactions and<br>blocks in blockchain.   | 6                                    |  |  |
| 4.   | Trust Essentials  | The purpose of this module is to introduce the reasons for a<br>smart contract and its critical role in transforming<br>blockchain technology from enabling decentralized<br>systems. We will explore the structure and basic concepts<br>of a smart contract through examples, and illustrate Remix<br>(remix.ethereum.org) web IDE for deploying and<br>interacting with a smart contract. | 7                                    |  |  |
| 5.   | Smart Contract<br>Basics  | The purpose of this module is to introduce the reasons for a<br>smart contract and its critical role in transforming<br>blockchain technology from enabling decentralized<br>systems. We will explore the structure and basic concepts<br>of a smart contract through examples, and illustrate Remix<br>(remix.ethereum.org) web IDE for deploying and<br>interacting with a smart contract. | 7                                    |  |  |
| 6.   | Decentralized<br>Applications<br>(Dapps)  | We will explore the notion of the blockchain server as the<br>foundation for a Decentralized Application. We will<br>demonstrate how to install the blockchain server and<br>establish a peer-to-peer network of nodes. It is a common<br>practice to develop and test a Dapp on a local test network<br>before deploying it on a public network.  | 4                                    |  |  |
| 7.   | Current challenges<br>and solutions   | We will explore just a few of the important challenges and solutions that are continuously innovating Blockchain.  | 4                                    |  |  |
|  |   | Total number of Lectures   | 42                                   |  |  |
| Evalu<br>Comp<br>T1<br>T2<br>End S<br>TA<br>TA<br>Total  | Evaluation CriteriaComponentsMaximum MarksT120T220End Semester Examination35TA25 (Attendance , Assignment and Quiz)Total100 |  |                                      |  |  |
| Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)         1.       Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World |   |  |                                      |  |  |

| 2. | Blockchain: Blueprint for a New Economy |
|----|---|
|----|---|

L

| 3. | The Truth Machine: The Blockchain and the Future of Everything |
|----|--|
| 4. | IEEE Transactions on vehicular technology                      |
| 5  | ACM Transactions on Blockchain                                 |

| Subject Code | 16B1NCI642        | Semester<br>(Even) | Semester VI Session 2018 - 19<br>Month from January to May |
|--------------|-------------------|--------------------|--|
| Subject Name | Wireless Networks |                    |  |
| Credits      | 3+1               | Contact Hours      | 3 Lectures +1 Tutorial                                     |
|              |                   |                    |  |
| Faculty      | Coordinator(s)    | Dr. Gagandeep Kaur |  |

| (Names)                        | Teacher(s)<br>(Alphabetically<br>)                                | 1. Dr. Gagandeep Kaur  |                               |
|--------------------------------|---|--|-------------------------------|
| COURSE OUTCOMES COGNITIVE LEVE |   |  |                               |
| C330-6.1                       | Define basic concepts & networks                                  | terms related to IEEE 802.11 wireless  | Remember Level<br>(Level 1)   |
| C330-6.2                       | Explain cellular concepts<br>networks, IEEE 802.11 a<br>protocols | s of mobile radio propagation in wireless<br>adhoc routing protocols and transport layer | Understand Level<br>(Level 2) |
| C330-6.3                       | Identify different categor<br>protocol                            | ries and design issues of IEEE 802.11 MAC  | Apply Level<br>(Level 3)      |
| C330-6.4                       | Analyze metrics of MAC simulators                                 | C & Mobile IP based routing protocols using  | Analyze Level<br>(Level 4)    |
| C330-6.5                       | Evaluate various security   | y parameters in wireless networks  | Evaluate Level<br>(Level 5)   |

| Module No. | Subtitle of the Module                               | Topics in the module   | No. of<br>Lectures<br>for the<br>module |
|------------|--|--|---|
| 1.         | Overview of Wireless<br>Communications &<br>Networks | Introduction to wireless communication & wireless<br>networks, principles and challenges of various<br>wireless communication generations; GSM, GPRS,<br>3G, 4G, and 5G  | 4                                       |
| 2.         | Data Link Layer                                      | Path Loss and Shadowing, The 802.11 MAC,<br>MAC Access Modes and Timing Section,<br>Contention-Based Access Using the DCF Section,<br>Fragmentation and Reassembly Frame Format.<br>Data Frames, Control Frames, Management<br>Frames, Contention-Based Data Service, Multi-<br>acces communication, Aloha and CSMA Protocols,<br>Other MAC Protocols, Multiple access<br>Interference, IEEE 802.11 wireless LAN, Medium<br>Access control, Interframe spaces, Virtual Carrier<br>Sensing and Network Allocation Vector, ARQ and<br>Atomic Operations, Backoff Procedure with the<br>DCF, Hidden and Exposed Stations, | 10                                      |
| 3.         | Network Layer  | Mobile IP, Network layer routing protocols, key<br>component mechanisms, link metric estimation and<br>neighborhood table management for proactive and<br>reactive routing protocols, opportunistic routing,<br>End-to-End Path Capacity, Mobility, Capacity of<br>Mobile Ad Hoc Networks  | 8                                       |
| 4.         | Transport Layer                                      | Transport layer protocols, with an emphasis on<br>congestion control, including TCP over wireless,<br>Feedback TCP, Adhoc TCP, Split TCP, congestion<br>sharing mechanisms, Explicit and precise rate<br>control,  | 8                                       |
| 5.         | Security in Wireless<br>Networks                     | Wireless security techniques, WEP, The Extensible<br>Authentication Protocol, Application based attacks,<br>Network Security Attacks, Transport Layer<br>Attacks, DLL Attacks, Cryptographic solutions   | 8                                       |

| 6.                  | Introduction to    | Network simulation software tools, MAC Protocol  | 4  |
|---------------------|--------------------|--|----|
|                     | Simulation Tools & | Performance Measures, Wireless networks security |    |
|                     | Performance        | performance measurement                          |    |
|                     | Measurement        |  |    |
|                     |                    |  | 42 |
| Evaluation Criteria |                    |  |    |
| Components          | Maximum            | Marks  |    |
| T1                  | 20                 |  |    |
| T2                  | 20                 |  |    |
| End Semester E      | xamination 35      |  |    |
| ТА                  | 25 (Assig          | nments+Attendance)                               |    |
| Total               | 100                |  |    |

| <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |  |  |  |  |  |
|--|--|--|--|--|--|
| 1.   | Matthew Gast, 802.11Wireless Networks: The Definitive Guide, O'Reilly.   |  |  |  |  |
| 2  | C. Siva Ram Murthy, B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols,<br>Prentice Hall Communications Engineering and Emerging Technologies Series |  |  |  |  |
| 3.   | James F. Kurose, Keith W. Ross, 'Computer Networking : A Top-Down Approach, 6 <sup>th</sup> Edition, Pearson   |  |  |  |  |
| 4.   | Ivan Marsic, Wireless Networks: Local and Ad Hoc Networks, 1 <sup>st</sup> Ed., Prentice-Hall, Englewood Cliffs, NJ, 1995.   |  |  |  |  |
| 5.   | Nupur Prasad Giri, Wireless Technology, Dreamtech Engineering Textbooks  |  |  |  |  |
| 6.   | Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, 'Wireless and Mobile Networks:<br>Concepts and Protocols, 1 <sup>st</sup> Edition, Wiley                          |  |  |  |  |
| 7.   | IEEE, ACM Transactions, Journals and Conference papers on "Wireless Communications & Networking."  |  |  |  |  |
| 8.   | NS2 Simulator, https://www.isi.edu/nsnam/ns/   |  |  |  |  |

| Course Code     | 16B1NCI634                     | Semester Even<br>(specify Odd/Even) |  | Semester: VI <sup>th</sup> Session 2018 -2019<br>Month from January to May |  |   |
|-----------------|--------------------------------|-------------------------------------|--|--|--|---|
| Course Name     | Agile Software Deve            | elopment                            |  |  |  |   |
| Credits         | 4                              | Cont                                |  | Contact Hours  |  | 4 |
| Faculty (Names) | Coordinator(s)                 | Indu Chawla                         |  |  |  |   |
|                 | Teacher(s)<br>(Alphabetically) | Indu Chawla                         |  |  |  |   |

| COURSE   | OUTCOMES   | COGNITIVE LEVELS              |
|----------|--|-------------------------------|
| C330-7.1 | Interpret the trade-offs between traditional software development<br>methods and agile software development methods for a software<br>project effectively.               | Understand level<br>(Level 2) |
| C330-7.2 | Identify and make use of an appropriate agile software engineering<br>approach viz. extreme programming, Scrum, Crystal techniques as a<br>part of software development. | Apply Level<br>(Level3)       |
| C330-7.3 | Apply Refactoring techniques on source code for improved design  | Apply Level<br>(Level3)       |
| C330-7.4 | Choose tools and construct the methods for testing Agile projects using various testing strategies   | Apply level<br>(Level3)       |
| C330-7.5 | List the Planning, tracking, estimation and monitoring of agile projects<br>with techniques like burn down charts, velocity calculation and task<br>boards etc.          | Analyze level<br>(level4)     |

| Module<br>No. | Title of the<br>Module      | Topics in the Module  | No. of<br>Lectures for<br>the module |  |  |
|---------------|-----------------------------|---|--------------------------------------|--|--|
| 1.            | Introduction                | Traditional software development methods,<br>Agile software development methods and lean software<br>development methods  | 3                                    |  |  |
| 2.            | Agile<br>Fundamentals       | gileAgile manifesto, Agile principles, Characteristics of Agile3ndamentalsprocesses, an iterative development process, Pros and cons<br>of incremental development and software prototyping.3 |                                      |  |  |
| 3.            | Requirements and Planning   | Anning User stories, agile estimation, planning techniques-<br>Prioritizing Themes, Financial prioritization, prioritizing<br>desirability  |                                      |  |  |
| 4.            | Scrum                       | Introduction, Scrum - Prioritizing, Estimating, and<br>Planning, The Scrum Experience (hands-on exercise)5  |                                      |  |  |
| 5.            | Extreme<br>Programming (XP) | Extreme Programming Values, Principles and Practices,<br>Pair programming, Embracing change, incremental change   | 5                                    |  |  |
| 6.            | Crystal                     | Crystal methodologies: project categories, complexity,  | 4                                    |  |  |

|                          |                               | family members, Crystal's seven properties, Crystal clear<br>development process cycle, Crystal yellow, crystal orange |    |  |  |
|--------------------------|-------------------------------|--|----|--|--|
|                          |                               | and crystal orange web.  |    |  |  |
| 7.                       | Kanban                        | The principles of kanban, Improving process with kanban,<br>Measure and manage flow, Emergent behavior                 | 4  |  |  |
| 8.                       | Feature-Driven<br>Development | Processes of feature driven development, practices and progress in FDD   | 2  |  |  |
| 9.                       | Testing                       | Agile testing strategy, automated unit test, test plan, test<br>driven development, alpha, beta and acceptance testing | 5  |  |  |
| 10.                      | Refactoring                   | Bad smells in code, properties of refactoring, refactoring7examples, benefits, cost and risk of reafctoring7           |    |  |  |
|                          |                               | Total number of Lectures   | 42 |  |  |
| Evaluatio                | on Criteria                   |  |    |  |  |
| Compone                  | ents                          | Maximum Marks  |    |  |  |
| T1                       |                               | 20   |    |  |  |
| T2                       |                               | 20   |    |  |  |
| End Semester Examination |                               | 35   |    |  |  |
| TA                       |                               | 25   |    |  |  |
| Total                    |                               | 100  |    |  |  |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

| 1. | Cohn, Mike. Agile estimating and planning. Pearson Education   |
|----|--|
| 2. | Beck, Kent. Extreme programming explained: embrace change. Addison-wesley professional                                       |
| 3. | Martin, Robert C. Agile software development: principles, patterns, and practices. Prentice Hall.                            |
| 4. | Shore, James. The Art of Agile Development: Pragmatic guide to agile software development. " O'Reilly Media, Inc.".          |
| 5. | Schwaber, Ken. Agile project management with Scrum. Microsoft press  |
| 6. | Stellman, Andrew, and Jennifer Greene. Learning agile: Understanding scrum, XP, lean, and kanban. "<br>O'Reilly Media, Inc." |
| 7. | Cohn, Mike. User stories applied: For agile software development. Addison-Wesley Professional                                |

|            |  | 1 (D 1) (C) (2)                |  | <b>G</b> ( <b>F</b>                 |                 | a             |                     |   | 2010 2010 |
|------------|--|--------------------------------|--|-------------------------------------|-----------------|---------------|---------------------|---|-----------|
| Course Co  | de   | 16B1NCI633                     |  | Semester Even Semester V            |                 | r VI          | 1 Session 2018-2019 |   |           |
|            |  |                                |  | (specify Odd/Even) Month from       |                 |               | January-June        | e |           |
| Course Na  | Course Name Introduction to Mobile Application Development   |                                |  |                                     |                 |               |                     |   |           |
| Credits    |  |                                | 3  | Contact Hours3(Lectures) + 1 (Tut)  |                 |               | ) + 1 (Tut)         |   |           |
| Faculty (N | Faculty (Names)     Coordinator(s)     Arpita Jadhav Bhatt   |                                |  |                                     |                 |               |                     |   |           |
|            |  | Teacher(s)<br>(Alphabetica     | ally)  | Arpita Jadhav Bhatt, Mradula Sharma |                 |               |                     |   |           |
| COURSE     | COURSE OUTCOMES COGNITIVE LEVELS   |                                |  |                                     |                 |               |                     |   |           |
| C330-8.1   | <b>30-8.1</b> Analyze functional aspects of Android mobile operating system for developing Android applications  |                                |  | r                                   | Analyze Le      | vel (Level 4) |                     |   |           |
| C330-8.2   | Explain how Android applications work, their life cycle, manifest,<br>Intents, event handling and using external resources   |                                |  | Understand                          | Level (Level 2) |               |                     |   |           |
| C330-8.3   | <ul> <li>B.3 Design and develop useful Android applications with compelling user interfaces by using, extending, and creating own layouts using different adapters and picker views, fragments, sending and receiving SMS and email</li> </ul> |                                |  | Create Leve                         | el (Level 6)    |               |                     |   |           |
| C330-8.4   | <b>8.4</b> Make use of Google Map API to develop location aware services through Internet for mobile environments  |                                |  | Apply Leve                          | l (Level 3)     |               |                     |   |           |
| C330-8.5   | Apply<br>applica   | functional aspeations using SQ | Dects of database handling to develop AndroidApply Level (Level 3)QLite database |                                     |                 | l (Level 3)   |                     |   |           |
| Module     | Title  | ftho                           | Tonia  | s in the Module                     |                 |               |                     |   | No. of    |

| Module<br>No. | Title of the<br>Module          | Topics in the Module   | No. of<br>Lectures for<br>the module |
|---------------|---------------------------------|--|--------------------------------------|
| 1.            | Introduction to App development | Introduction to app development process and its platforms<br>and development tools, Android Architecture, Setting up<br>the environment, SDK, Architectural components, Creating | 8                                    |

|  | simple Android applications, Activities, Intents an<br>manifest files, Life cycles of an activity, working<br>intents, using intent object to link activities and ty                   |   |   |                   |  |  |  |
|--|--|---|---|-------------------|--|--|--|
|  |  |   | intent, passing data using intents,   |                   |  |  |  |
| 2.   | Event Handling   |   | Handling buttons and action listener methods and events,<br>performing simple operations with button  | 6                 |  |  |  |
| 3.   | Designing and<br>handling Graphical<br>User Interface –I   |   | Views and View Groups, Types of Layouts, Textview,<br>EditText, XML layouts, Image View, List View, Grid<br>View, Spinners Navigation bar, tab bar, user inputs like<br>swipes, pinch, zoom etc. Adapter classes, model classes   | 10                |  |  |  |
| 4. Designing and<br>handling Graphical<br>User Interface –II |  | Designing and<br>handling Graphical<br>User Interface –II | <b>Part 1:</b> Handling different types of buttons: Radio button,<br>Check box button, toggle, progress bar view, displaying<br>pictures and menus with views, using menus with views<br>Designing interfaces with Views: Basic views, Picker views<br>: Date/Time,   | 8                 |  |  |  |
| 5. Designing and<br>handling Graphical<br>User Interface –II |  | Designing and<br>handling Graphical<br>User Interface –II | <b>Part 2:</b> Customizing List view, Enabling Filtering and<br>Multi-Item Support in the List View, Creating and Using a<br>List Fragment, customizing Grid and Spinner views by<br>defining row layouts, using GridView view, Sending and<br>receiving SMS programmatically, sending Email and<br>implementing location based services using map APIs | 7                 |  |  |  |
| 6.   |  | Mobile Databases  | Sqlite introduction, database Create, Retrive, Update, delete operations, backup of DB's  | 7                 |  |  |  |
|  |  |   | Total number of Lectures  | 46                |  |  |  |
| Eval<br>Com<br>T1<br>T2<br>End S<br>TA<br>TA                 | Evaluation CriteriaComponentsMaximum MarksT120T220End Semester Examination35TA25 (Project:15, Class Test:5, Attendance:5)Tatel100  |   |   |                   |  |  |  |
| Reco<br>Refer  | <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |   |   |                   |  |  |  |
| 1.   | Griffi<br>2017   | ths D, Griffiths D. He                                    | ad First Android Development: a brain-friendly guide. " O' Rei  | lly Media, Inc."; |  |  |  |
| 2.   | Burd BA. Android application development all-in-one for dummies. John Wiley & Sons; 2015 Jul 9.  |   |   |                   |  |  |  |
| 3.   | Annuzzi Jr J, Darcey L, Conder S. Introduction to Android application development: Android essentials.<br>Pearson Education; 2014.   |   |   |                   |  |  |  |
| 4.   | Meier R. Professional Android 4 application development. John Wiley & Sons; 2012.  |   |   |                   |  |  |  |
| 5.   | Lee WM. Beginning android 4 application Development. John Wiley & Sons; 2012 Feb 3.  |   |   |                   |  |  |  |
| 6.   | Darcey L, Conder S. Sams Teach Yourself Android Application Development in 24 Hours: Sams Teac<br>Your Andr Appl D_2. Pearson Education; 2011 Jul 25.                                  |   |   |                   |  |  |  |
| 7.   | Felker D. Android application development for dummies. John Wiley & Sons; 2010 Nov 17.   |   |   |                   |  |  |  |
| 8.   | Murphy, M. L. "The Busy Coder's Guide to Advanced Android Development: CommonsWare." (2009).   |   |   |                   |  |  |  |
| 9.   | Hashi  | imi SY, Komatineni S                                      | . Pro Android. Apress; 2009 Jun 22.   |                   |  |  |  |
| 10.  | Rogers R, Lombardo J, Mednieks Z, Meike B. Android application development: Programming with the Google SDK. O'Reilly Media, Inc.; 2009 May 26.  |   |   |                   |  |  |  |

### **Detailed Syllabus**

| Subject Code | 19B16CS311              | Semester odd  | Semester Sixth Session 2018- 2019<br>Month from Jan to June |  |  |
|--------------|-------------------------|---------------|---|--|--|
| Subject Name | Neural network Workshop |               |   |  |  |
| Credits      | 0-0-4                   | Contact Hours | 4 lab hours   |  |  |

| Faculty | Coordinator(s)                 | Anuja Arora                              |                     |
|---------|--------------------------------|--|---------------------|
| (Names) | Teacher(s)<br>(Alphabetically) | Anuja Arora Archana Purwar<br>Vidhyarthi | Pawan Upadhay Ankit |
|         |                                |  |                     |

| SNO      | Description   | Cognitive Level<br>(Bloom Taxonomy) |
|----------|---|-------------------------------------|
| C305-8.1 | Understand the fundamentals and concepts of neural network, neural network architectures, and its paradigm. | Understand Level<br>(Level 2)       |
| C305-8.2 | Apply the neural network to solve practical problems  | Apply Level (Level 3)               |
| C305-8.3 | Examine the engineering applications that can learn using neural networks                                   | Evaluate Level (Level 5)            |

| C305-8.4 | Implement Neural network in context of problem solving and modelling in python | Analyze Level<br>(Level 4) |
|----------|--|----------------------------|
| C305-8.5 | To develop neural network applications on real-world tasks                     | Create Level (Level 6)     |

| Module No. | Subtitle of the Module                       | Topics in the module  | No. of Labs for<br>the module |
|------------|--|---|-------------------------------|
| 1.         | Overview of classification<br>and Regression | Linear Regression, Multiple Linear<br>Regression, KNN classifier, SVM<br>Classifier   | 4                             |
| 2.         | Neural Fundamental Concept                   | Neuron models, basic Learning rules,<br>Single Neuron NN, Single layer neural<br>network, Activation Function, Two Layer<br>Neural Network, error function  | 4                             |
| 3          | Basic neural network models                  | Multilayer Perceptron Learning Algorithm,<br>Stochastic gradient descent, Forward<br>Propagation, Backpropagation, Real life<br>case studies  | 8                             |
| 4          | Other Neural network models                  | Associative memory, Self-organizing<br>feature map, Neural network decision tree,<br>Data visualization with self-organizing<br>feature map   | 6                             |
| 5          | Convolution Neural Network                   | Fundamentals of convolution Neural<br>network and Object detection, introducing<br>tensor flow and keras libraries for CNN,<br>neural style transfer Case studies of<br>Convolution neural network. | 6                             |
|            |  | Total number of Lectures  | 28                            |

| <b>Recommended Reading material:</b> | Author(s), Title | , Edition, Publisher | , Year of Publication etc. | (Text books, |
|--------------------------------------|------------------|----------------------|----------------------------|--------------|
| Reference Books, Journals, Reports,  | Websites etc. ir | n the IEEE format)   |                            |              |

| 1. | S. Haykin, Neural Networks: A Comprehensive Foundation 2nd edition, (Prentice Hall, 1999)   |
|----|---|
| 2. | Rajasekaran, S., & Pai, G. V. (2003). Neural networks, fuzzy logic and genetic algorithm: synthesis and applications (with cd). PHI Learning Pvt. Ltd |
| 3. | C. Looney, Pattern Recognition Using Neural Networks, Oxford University Press, 1997   |
| 4. | Hagan, M. T., Demuth, H. B., Beale, M. H., & De Jesús, O. (1996). Neural network design (Vol. 20). Boston: Pws Pub                                    |
| 5. | Sivanandam, S. N., & Deepa, S. N. (2007). Principles of Soft Computing (With CD). John Wiley & Sons.  |

| Course Code                     | 18B16CS312                     | Semester Even<br>(specify Odd/Even)             |  | Semeste<br>Month f | r VI<br>rom J | Session 2018 -2019<br>Jan-Jun |
|---------------------------------|--------------------------------|---|--|--------------------|---------------|-------------------------------|
| Course Name                     | R Programming Wor              | cshop   |  |                    |               |                               |
| Credits                         | 0                              | Contact Hours 1-0-2 (3 hrs per week)            |  |                    |               |                               |
|                                 | -                              | 1   |  |                    |               |                               |
| Faculty (Names)                 | Coordinator(s)                 | Megha Rathi                                     |  |                    |               |                               |
|                                 | Teacher(s)<br>(Alphabetically) | Dr. Adwitiya Sinha, Kirti Aggarwal, Megha Rathi |  |                    |               |                               |
|                                 |                                |   |  |                    |               |                               |
| COURSE OUTCOMES COGNITIVE LEVEI |                                |   |  | COGNITIVE LEVELS   |               |                               |

| C305-9.1 | Define all tools and techniques used for Data Mining and Analysis.<br>Explain the basic & core concept of R | Understand Level<br>(Level 2) |
|----------|---|-------------------------------|
| C305-9.2 | Develop code for data extraction & loading. Apply data pre-processing techniques and build predictive model | Apply Level<br>(Level 3)      |
| C305-9.3 | Choose Data Visualization techniques for graphical representation of results                                | Apply Level<br>(Level 3)      |
| C305-9.4 | Analyze the results. Compare and contrast the results obtained to discover new pattern insight in data.     | Analyze Level<br>(Level 4)    |
| C305-9.5 | Design predictive models and techniques towards research initiatives  | Create Level<br>(Level 6)     |

| Module<br>No. | Title of the<br>Module                         | Topics in the Module   | No. of<br>Lectures for<br>the module |
|---------------|--|--|--------------------------------------|
| 1.            | Introduction to R                              | Introduction to R, Installation, Getting Started ,Some<br>Information on R Commands, Objects,Functions, Number<br>& Vector, Matrices & Array,Factors, Conditional<br>Statements, Loop, Scripts, R package.   | 1+3                                  |
| 2.            | List , Data Frames<br>& String Handling        | Introduction, Creating a List, List Operation, Recursive<br>List, Introduction to Data Frame, Creating Data Frame,<br>Data Frame Operations, lapply() and sapply() functions.<br>Introduction to String handling, String functions, String<br>Manipulation, Regular Expressions & Pattern Matching,<br>and Introduction to "stringr" package.  | 2+3                                  |
| 3.            | Object Oriented<br>Programming                 | Introduction, Object Oriented Programming Concepts, S3 classes, S4 classes, Reference Classes.   | 1+3                                  |
| 4.            | Import & Export                                | Introduction, Saving & Loading R data, Import and Export<br>to different file formats: Excel File, Binary File, XML File,<br>JSON File. Analyzing data & Reshaping the data.   | 1+3                                  |
| 5.            | R-working with<br>database (Mysql +<br>Hadoop) | Introduction to Databases, Introduction to SQL Commands,<br>RMySQL Package, Connecting R to MySQL, Import Table,<br>Querying Data, Export data to MySQL, Disconnect<br>Function. Introduction to Hadoop, Import and Export data<br>(Hadoop)  | 2+4                                  |
| 6.            | Data Preprocessing<br>using R                  | Data Pre-processing, forms of Data Pre-processing, Data<br>Cleaning Techniques, Data Redundancy- chi square test,<br>correlation analysis, covariance coefficient, Data<br>Transformation, Data Reduction- Principal Component<br>Analysis, R packages for Data Pre-processing.  | 2+4                                  |
| 7.            | Data Visualization                             | Visual Representation of statistical analysis, High level<br>plotting commands- create plots with axes, titles, labels and<br>others on the graphics device and Low level plotting<br>commands- add new features like extra labels, point or line.<br>Plots, Histogram, Scatter Plots, Pie chart, Box Plot, QQ<br>Plot, customized Plotting. Introduction to data visualization<br>packages: Ggobi & ggplot. | 2+3                                  |
| 8             | Classification and<br>Clustering<br>Algorithm  | Classification Techniques: Introduction to Classification,<br>Regression, Naïve Bayes, Decision Tree, KNN, Ensemble<br>Methods.<br>Clustering Techniques: Introduction to Clustering, K-<br>means, Hierarchical Clustering, DB Scan.   | 3+4                                  |
| 9             | Data Analytics                                 | Tools for Data Analytics by integrating R with Android or<br>web Interface, Introduction to shiny Package.   | 1+3                                  |

|   | 45   |  |   |               |
|---|--|--|---|---------------|
| Eval  | uation   | Criteria                                     |   |               |
| Com   | ponent   | ts   | Maximum Marks   |               |
| Lab   | Test1  |  | 30  |               |
| End   | Semeste  | er Examination                               | 40  |               |
| TA  |  |  | 30 (Quiz + Evaluative Assignment + Class Test + Attendance  | e)            |
| Tota  | l  |  | 100   |               |
|   |  |  |   |               |
| Reco<br>Refe  | mmen<br>rence B  | ded Reading materia<br>books, Journals, Repo | <b>al:</b> Author(s), Title, Edition, Publisher, Year of Publication etc.<br>rts, Websites etc. in the IEEE format) | ( Text books, |
| 1.  | Paul Teetor.R Cookbook - Proven Recipes for Data Analysis, Statistics, and Graphics. O'Reilly, 2011.   |  |   |               |
| 2.  | Alain F. Zuur, Elena N. Ieno, and Erik Meesters. A Beginner's Guide to R. Use R. Springer, 2009. ISBN: 978-0-387-93836-3.                                |  |   |               |
| 3.  | John Maindonald and John Braun. Data Analysis and Graphics Using R. Cambridge University Press,<br>Cambridge, 2nd edition, 2007. ISBN 978-0-521-86116-8. |  |   |               |
| 4. Advanced R, by Hadley Wickham, ISBN 9781466586963. |  |  |   |               |
| 5.  | Using R for Introductory Statistics, by John Verzani, Chapman & Hall/CRC, 2004, ISBN 1584884509  |  |   |               |
| 6.  | R Programming for Data Science, by Roger D. Peng,  |  |   |               |
| 7.  | Phil Spector. Data Manipulation with R. Springer, New York, 2008. ISBN 978-0-387-74730-9.  |  |   |               |

# **Detailed Syllabus**

| Subject Code | 18B16CS311                    | Semester: Even     | Semester VI Session 2018-2019    |  |
|--------------|-------------------------------|--------------------|----------------------------------|--|
|              |                               | (specify Odd/Even) | Month from January'19 to June'19 |  |
| Subject Name | Internet Of Things (Workshop) |                    |                                  |  |
| Credits      | 0-0-4                         | Contact Hours      | 4                                |  |

| Faculty | Coordinator(s)                 | Dr K. Rajalakshmi   |
|---------|--------------------------------|---|
| (Names) | Teacher(s)<br>(Alphabetically) | Dr K. Rajalakshmi<br>Dr. Prakash Kumar<br>Ms. Purtee Kholi<br>Mr. Vivek Kumar Singh |

| COURSE OUT  | COGNITIVE LEVELS   |                      |
|---|--|----------------------|
| C305-10.5.1 Define exiting IoT frameworks and techniques used for developing applications |  | Remember (level 1)   |
| C305-10.5.2   | Explain the uses of IoT edge devices & basic concept of Node-<br>RED platform.   | Understand (level 2) |
| C305-10.5.3   | Develop Java Script based IoT applications using functional nodes, flows and dashboard on Node-RED platform                      | Apply (level 3)      |
| C305-10.5.4   | Evaluate the data gathered using Node-RED functionalities and choose appropriate graphical user interface to output the results. | Evaluate (level 5)   |
| C305-10.5.5   | Analyze various communication protocols, network connectivity, and cloud services using Node-RED platform.                       | Analyze (level 4)    |

| Module<br>No. | Subtitle of the Module  | Topics in the module  | СО    |
|---------------|---|---|-------|
| 1.            | Java scripts for inbuilt<br>functional nodes and deploy it<br>in Node Red flows, types of | Setup and Install Node.js and Node-RED as IDE platform for IoT application development.                       | C1    |
| 2.            | Message   | I/O nodes, flows, third party palettes,<br>import/export of flows in Node-RED                                 | C1,C2 |
| 3.            | User defined functional nodes into Node-RED flows and                                     | Java scripts for user defined functional nodes and deploy it in Node-Red flows.                               | C2,C3 |
| 4.            | FRED cloud and using various dashboard UI interfaces                                      | User defined functional nodes into Node-RED flows and FRED cloud.   | C2,C3 |
| 5.            |   | UI modules for peripheral sensors and devices that<br>can be controlled through smart phones and web<br>pages | C2,C3 |
| 6.            | MQTT brokers for publishing<br>and subscribing between IoT<br>sensors and devices.        | MQTT brokers for publishing and subscribing between IoT sensors and devices.                                  | C4,C5 |
| 7.            | Using websocket for HTTP,<br>TCP and UDP traffic flow in                                  | HTTP, TCP and UDP traffic flow for IoT applications.  | C4,C5 |
| 8.            | 8. IoT applications. Using WebSocket through internet and cloud platforms.                |   |       |
|               | Total nur   | nber of Lab hours   | 56    |

| <b>Evaluation Criteria</b> |  |
|----------------------------|--|
| Components                 | Maximum Marks                              |
| Mid Term Evaluation        | 30   |
| D2D Evaluation             | 30 (Lab Evaluation (20) + Attendance (10)) |
| Final Evaluation           | 40   |
| Total                      | 100  |

| Reco<br>Refe | <b>commended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, rence Books, Journals, Reports, Websites etc. in the IEEE format) |
|--------------|--|
| 1.           | "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)  |
| 2.           | "Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud" Cuno<br>Pfister  |
| 3.           | The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)  |
| 4.           | https://www.raspberrypi.org/documentation/   |
| 2.           | https://www.arduino.cc/en/Tutorial/HomePage  |
| 3.           | https://nodered.org/docs/hardware/raspberrypi  |
| 4.           | https://nodered.org/docs/getting-started/installation  |
| 5.           | https://docs.oasis-open.org/mqtt/mqtt/v5.0/mqtt-v5.0.html  |
| 6.           | https://mosquitto.org/   |

| Course Co                               | de            | 19B16CS312  | 2  | Semester Even  |  | Semester VI Session 2018 -2019     |                               |                                      |             |
|---|---------------|---|--|--|--|------------------------------------|-------------------------------|--------------------------------------|-------------|
|   |               |   |  | (specify Odd/l   | Even)                                      | Month from Jan-Jun                 |                               |                                      |             |
| Course Name                             |               | Data Analytic   | Data Analytics Workshop  |  |  |                                    |                               |                                      |             |
| Credits                                 |               |   | 0  |  | Contact H                                  | Iours                              |                               | 1-0-2 (3 hr                          | s per week) |
| Faculty (N                              | ames          | ) Coordinato  | r(s)   | Dr. Adwitiya S   | Sinha                                      |                                    |                               |                                      |             |
|   |               | Teacher(s)<br>(Alphabetica  | ally)  | lly) Dr. Adwitiya Sinha, Megha Rathi   |  |                                    |                               |                                      |             |
| COURSE                                  | OUT           | COMES   |  |  |  |                                    |                               | COGNIT                               | IVE LEVELS  |
| C305-11.1                               |               | Demonstrate bas<br>analytical tools &   | sic & ad <sup>.</sup><br>& IDEs  | vance facets of a  | pplication-                                | based data                         | a                             | Understar<br>(Level 2)               | nd Level    |
| C305-11.2                               |               | Apply large scale   | e data sp  | panning over cor   | nplex struc                                | tures                              |                               | Apply Lev<br>(Level 3)               | vel         |
| C305-11.3                               |               | Analyze benchm<br>clustering and cl   | ark met assificat  | hods for pre-pro<br>ion algorithms   | cessing, inc                               | lexing,                            |                               | Analyze I<br>(Level 4)               | Level       |
| C305-11.4                               |               | Evaluate perform specific target de   | mance of innovated algorithms for application-<br>omains (Level 5)   |  |  | Evaluation (Level 5)               | n Level                       |                                      |             |
| C305-11.5                               |               | Design methods data sources   | to yield required information from real-world (Level 6)  |  |  | vel                                |                               |                                      |             |
| C305-11.6                               |               | Construct low-co<br>datasets  | complexity computation framework for massiveCreate Le<br>(Level 6)   |  |  | vel                                |                               |                                      |             |
| Module<br>No.                           | Title<br>Moo  | e of the<br>lule  | Topics   | Topics in the Module   |  |                                    |                               | No. of<br>Lectures for<br>the module |             |
| 1.                                      | Intro<br>Data | oduction to   | Overvi<br>Visual   | ew to Data & A<br>ization  | nalysis, Neo                               | eds for Ar                         | nalytic                       | s, Data                              | 1+0         |
| 2.                                      | Ana           | lytical Tools   | Matlab<br>Packag<br>Seabor<br>Pandas   | o, Gephi, Netlog<br>ges like – plotly,<br>n, Scikit-Learn,<br>SQL, Basemap   | o, Python, F<br>Matplotlib,<br>Scipy, Bear | R, Python,<br>Numpy,<br>utifulSouj | , Librar<br>Pandas<br>p, Boko | ries &<br>s,<br>eh, Urllib,          | 1+6         |
| 3. Data Collection & Extraction         |               | Data Crawling, Data Scrapping, Real-time Data Extraction,1+4Streaming Data, Authenticated Data Repositories1  |  |  |  |                                    |                               |                                      |             |
| 4. Data M                               |               | a Management  | Data Mining & Management, Data Cleaning, Data Pre-<br>processing, Spatial Data Representation, Demographic<br>Analysis |  |  | Pre-<br>phic                       | 1+4                           |                                      |             |
| 5. Descriptive & Inferential Statistics |               | Descriptive Statistics - Central Tendency & Data,<br>Distribution & Dispersion, Random Variables, Probability<br>Distribution, Inferential Statistics – Error Analysis,<br>Confidence Intervals, Regression, Logistic |  | 3+4  |  |                                    |                               |                                      |             |
| 6.                                      | Graț          | ph Analytics  | Rando<br>Probab<br>Theory<br>Analyt  | om Graphs, Bollobás Configuration Model, Isolation<br>bility, Giant Component, Strategic Networks, Game<br>y, Big Data Analytics, Social Networks, Web<br>tics, Google Analytics |  |                                    | 3+4                           |                                      |             |

| 7                 | 7. Supervised<br>Learning   |  | Linear Discriminant Analysis, Quadratic Discriminant<br>Analysis, Classification Trees, Support Vector Machines,<br>Random Forest        | 2+2             |  |  |
|-------------------|---|--|--|-----------------|--|--|
| 8                 | 3.  | Unsupervised<br>Learning                           | Clustering, Divisive & Agglomerative Clustering, Density-<br>based Clustering, Associative Rule Mining                                   | 1+2             |  |  |
| 9                 | ).  | Deep Learning                                      | Neural Networks, Feed Forward Neural Networks, Fuzzy<br>Logic, Recurrent Neural Nets, Convolutional Neural Nets,<br>Deep Neural Networks | 1+2             |  |  |
|                   |   |  | Total number of Lectures   | 42              |  |  |
| Eval              | uation  | 1 Criteria   |  |                 |  |  |
| Com               | ponen   | its  | Maximum Marks  |                 |  |  |
| End S             | Semes   | ter Examination                                    | 40   |                 |  |  |
| TA<br><b>Tota</b> | 1   |  | 30 (Quiz + Evaluative Assignment + Class Test + Attendance<br>100  | e)              |  |  |
| Reco              | mmer  | nded Reading materia                               | al· Author(s) Title Edition Publisher Year of Publication etc.   | ( Text books    |  |  |
| Refe              | rence l   | Books, Journals, Report                            | rts, Websites etc. in the IEEE format)   | (Text books,    |  |  |
| 1.                | Data  | Analytics by Anil Ma                               | heshwar, McGraw Hill Education, 2017   |                 |  |  |
| 2.                | Data  | Smart: Using Data Sci                              | ience to Transform Information into Insight, by J. W. Foreman,   | Wiley 2013      |  |  |
| 3.                | The I<br>2009   | Elements of Statistical                            | Learning by Hastie, Trevor, Tibshirani, Robert, Friedman, Jero   | ome, Springer,  |  |  |
| 4.                | Intro<br>Tibsł  | duction to Statistical L<br>nirani, Springer, 2017 | earning by Gareth James, Daniela Witten, Trevor Hastie, and R  | Robert          |  |  |
| 5.                | Data<br>Hall,   | Mining: Practical Mac<br>The Morgan Kaufmar        | chine Learning Tools and Techniques by Ian H. Witten, Eibe Fr<br>nn Series, Elsevier, 2011   | ank, Mark A.    |  |  |
| 6.                | Designing Data-Intensive Applications by Martin Kleppmann, O'Reilly, 2017   |  |  |                 |  |  |
| 7.                | Big Data at Work: Dispelling the Myths, Uncovering the Opportunities by Thomas H. Davenport, Harvard Business School Publishing Corporation, 2014 |  |  |                 |  |  |
| 8.                | Machine Learning by Tom Mitchell, McGraw Hill Education, 2017   |  |  |                 |  |  |
| 9.                | Adva<br>Sean  | nced Analytics with S<br>Owen, Josh Wills, O'      | park: Patterns for Learning from Data at Scale by Sandy Ryza,<br>Reilly, 2017  | Uri Laserson,   |  |  |
| 10.               | Anal<br>Wile  | ytics in a Big Data Wo<br>y, 2014                  | orld: The Essential Guide to Data Science and its Applications,  | by B. Baesens,  |  |  |
| 11.               | Busin<br>Publi  | ness UnIntelligence: In cations, 2013              | sight and Innovation Beyond Analytics and Big Data, by B. De   | evlin, Technics |  |  |

|                          | Lab-wise Di cakup |   |   |                               |   |  |                  |
|--------------------------|-------------------|---|---|-------------------------------|---|--|------------------|
| Course Code              |                   | 15B29CI691  | Semester Even<br>(specify Odd/Even)   |                               | Semester VI Session 2018 -2019<br>Month from Jan-June |  |                  |
| Course Name              |                   | Minor Project (IT)  | 1   |                               |   |  |                  |
| Credits                  |                   | 5   |   | Contact l                     | Hours   |  |                  |
| Faculty (Names)          |                   | Coordinator(s)  | Kirti Aggarwal  |                               |   |  |                  |
|                          |                   | Teacher(s)<br>(Alphabetically)  | Anuja Arora, Archana Purwar, Adwitiya Sinha, Gagandeep Kaur,<br>Kirti Aggarwal, K. Rajalakshmi, Megha Rathi, Pawan Kumar,<br>Prakash Kumar, Prashant Kaushik, Vikas Hassija |                               |   |  |                  |
| COURSE OUTCOMES          |                   |   |   |                               |   |  | COGNITIVE LEVELS |
| C351.1 Company<br>meet s |                   | pare and Contrast all tools and techniques to generate solution that specific need to solve complex problems. |   | Understand Level<br>(Level 2) |   |  |                  |
| Identif                  |                   | fy, discuss and justify the technical aspects of the chosen project   |   |                               | Apply Level   |  |                  |

| C351 2 | Identify, discuss and justify the technical aspects of the chosen project | Apply Level    |
|--------|---|----------------|
| 0331.2 | with a comprehensive and systematic approach                              | (Level 3)      |
|        | Develop software systems that meet specified design and performance       | Apply Level    |
| C351.3 | requirements that contributes to global, economic, environmental and      | (Level 3)      |
|        | social-context  |                |
| C251 4 | Evaluate & justify the proposed solution using appropriate learning       | Evaluate Level |
| C351.4 | strategies  | (Level 5)      |
| C251 5 | Design & develop integrated software models and techniques towards        | Create Level   |
| C351.5 | research initiatives  | (Level 6)      |

| Module<br>No. | Title of the Module | List of Experiments | CO |
|---------------|---------------------|---------------------|----|
| 1.            |                     |                     |    |
| 2.            |                     |                     |    |

| 3.            |           |             |  |
|---------------|-----------|-------------|--|
| 4.            |           |             |  |
| 5.            |           |             |  |
| •••           |           |             |  |
| n.            |           |             |  |
|               |           |             |  |
| Evaluation (  | Criteria  |             |  |
| Components    | s Max     | ximum Marks |  |
| Synopsis      |           | 10          |  |
| Mid-Term ev   | valuation | 40          |  |
| Final evaluat | ion       | 50          |  |
| Total         |           | 100         |  |
| 10101         |           | 100         |  |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

| 1.  |  |
|-----|--|
| 2.  |  |
| 3.  |  |
| ••• |  |
| т.  |  |

| Course Code     | 19B13CS311                     | Semester Eve       | n | Semeste | er 6 <sup>th</sup> Session 2018-2019 |
|-----------------|--------------------------------|--------------------|---|---------|--------------------------------------|
|                 |                                |                    |   | Month   | from Jan to Jul                      |
| Course Name     | Blockchain& Cyber S            | Security           |   |         |                                      |
| Credits         |                                | Contact Hours 4hrs |   | 4hrs    |                                      |
| Faculty (Names) | Coordinator(s)                 | Dr. Gagandeep Kaur |   |         |                                      |
|                 | Teacher(s)<br>(Alphabetically) | Dr. Gagandeep Kaur |   |         |                                      |

| COURSE   | OUTCOMES  | COGNITIVE LEVELS              |
|----------|---|-------------------------------|
| C305-7.1 | Define all the basic terminologies related to blockchain,<br>Cryptocurrencies and Smart contract mechanism  | Remember Level<br>(Level 1)   |
| C305-7.2 | Understand blockchain mechanisms, Proof-of-Work, Proof-of-Stake concepts, and Block Certs.  | Understand Level<br>(Level 2) |
| C305-7.3 | Implement smart contracts based decentralized network processes;<br>Identify and implement Cryptographic concepts of Blockchain   | Apply Level<br>(Level 3)      |
| C305-7.4 | Analyze blockchain technology for integrity and availability of the information, Test for the issues in the existing implementations of blockchain and consensus algorithms | Analyze Level<br>(Level 4)    |
| C305-7.5 | Evaluate Blockchain based network protection  | Evaluate Level<br>(Level 5)   |

| Module<br>No. | Title of the<br>Module                            | List of Experiments  |                     |  |
|---------------|---|--|---------------------|--|
| 1.            | Introduction to<br>Blockchain& Cyber<br>Security  | <ol> <li>Read and understand papers:<br/>Satoshi Nakamoto, Bitcoin, "A Peer-to-Peer Electronic Cash System"<br/>Michael Crosby, Nachiappan, Pradhan Pattanayak, Sanjeev Verma,<br/>VigneshKalyanaraman, "BlockChain Technology Beyond Bitcoin"<br/>Install node js<br/>Study and implement Constructor function in java script<br/>Study and implement Prototype object in java script</li> </ol>  | CO1                 |  |
| 2.            | Basics of<br>Blockchain and<br>Cryptocurrencies   | Create the blockchain using the constructor functions and prototype<br>objects<br>install Postman<br>Create an API using express framework of node js to interact with<br>blockchain data structure, create three API methods for getting the<br>current blockchain, posting transactions and mining a block<br>Install body parser. Requests that we send using postman will go<br>through this body parser, and wecan use that data in the requests.<br>Test post request using postman. Apply POST, SEND to check<br>working of postman. Write code for allowing transactions through<br>postman method.<br>Write a new method to create new transactions. This method will take<br>threeparameters i:e amount, sender and receiver. All these transactions<br>are pending transactionsand are not recorded in any block. These<br>transactions get mined and get added to the next blockin that chain. | CO2                 |  |
| 3             | Science of<br>Blockchain-I<br>(POW, POS etc.)     | Write a proof of work and proof of stake methods. PoW method<br>validates that whatever transactionswe are adding to the blockchain are<br>valid. This method will take in the current block data, previous block<br>hash and will think of a nonce, that should create a specific hash as<br>outputtest the proof of work method, check that the block is valid, by<br>using it in hashblock method.<br>Create a genesis block in blockchain data structure. Genesis block is<br>the firstblock. It has no previous block hash. It doesn't include any<br>transactions in genesis block , so ithas no hash and we don't need to do<br>any proof of work for this, so nonce is also not required   | CO2,<br>CO3         |  |
| 4             | Science of<br>Blockchain-II<br>(Decentralization) | Create a decentralized network to host blockchain to have a look that<br>how blockchain works in real world. Create a decentralized network by<br>creating multiple instances of API. Eachinstance will represent a node<br>in the blockchain network. These all nodes will work together to host<br>our blockchain.<br>Register the nodes to a network. For this we need to createthree new<br>end point in networkNodes.js.<br>Synchronize the network , so that the copy of blockchain is same at all<br>the nodes<br>Update the mine end point, so that it broadcasts the newly created<br>block to all the other nodes in the network and we need to broadcast<br>the mining reward transaction to all nodes.   | CO3,<br>CO4         |  |
| 5             | Smart Contracts<br>(Solidity)                     | Build smart contract on Ethereum command line.<br>Construct smart contract in javascript to connect front-end.   | CO3                 |  |
| 6             | HyperLedger                                       | Build your application with hyperledger technologies   | <u>CO</u> 4         |  |
| 7             | Blockchain<br>Security                            | Create a hash block method, that will take the block data as parameter<br>and will hashthe complete data into a 256 bit string. import it in<br>blockchain<br>Use library packages to generate private keys, Public Keys<br>Generate Private Key WIF "wallet import format" Bitcoin wallet that to<br>make transactions. Check address in blockchain.info to see balance. Use  | CO2,<br>CO4,<br>CO5 |  |

|                     | it to infer public key hash from node address                  |  |  |  |  |
|---------------------|--|--|--|--|--|
|                     | Apply homomorphic encryption in python                         |  |  |  |  |
|                     | Apply homomorphic encryption in blockchain                     |  |  |  |  |
|                     | Read paper Decentralizing Privacy: Using Blockchain to Protect |  |  |  |  |
|                     | Personal Data (ZNP15) in the same folder                       |  |  |  |  |
| Evaluation Criteria |  |  |  |  |  |
| Components          | Maximum Marks  |  |  |  |  |
| Lab Test 1          | 20   |  |  |  |  |
| Lab Test 2          | 20   |  |  |  |  |
| Evaluation 1        | 15   |  |  |  |  |
| Evaluation 2        | 30   |  |  |  |  |
| Attendance          | 15   |  |  |  |  |
| Total               | 100  |  |  |  |  |

| Reco<br>Refe | <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |  |  |
|--------------|--|--|--|
| 1.           | Bitcoin and Cryptocurrency Technologies, Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton   |  |  |
| 2.           | Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, Imran Bashir, Packt Publishing                                  |  |  |
| 3.           | Bitcoin: A Peer-to-Peer Electronic Cash System, Satoshi Nakamoto   |  |  |
| 4.           | Michael Crosby, Nachiappan, Pradhan Pattanayak, Sanjeev Verma, Vignesh Kalyanaraman, "BlockChain Technology Beyond Bitcoin   |  |  |
| 5.           | Using Blockchain to Protect Personal Data, Guy Zyskind, et. al.  |  |  |
| 6.           | IEEE Blockchain Initiative at https://blockchain.ieee.org/   |  |  |

| Course Code         | 19B13HS611  | Semester: Even |       | Semester: VI Session: 2018-2019  |  |
|---------------------|---|----------------|-------|----------------------------------|--|
|                     |   |                |       | Month From Jan 2019 to June 2019 |  |
| Course Name         | Morality of Everyday Living and Moral Decision Making |                |       |                                  |  |
| Credits 2 Contact H |   | Hours          | 1-0-2 |                                  |  |

| Faculty (Names) Coordinator(s) |                                | Ms Puneet Pannu, Dr Deepak Verma   |  |  |
|--------------------------------|--------------------------------|--|--|--|
|                                | Teacher(s)<br>(Alphabetically) | Ms Puneet Pannu, Dr Ekta Srivastava, Dr Praveen Sharma, Dr<br>Deepak Verma |  |  |

**COURSE OUTCOMES** 

•

| C305-3.1 | Apply and Analyze morality in all facets of personal and professional life      |          |
|----------|---|----------|
|          |   | Analyze  |
|          |   | (C4)     |
| C305-3.2 |   | Analyze  |
|          | Discover ways to address moral dilemmas by deliberating on the pros and cons to | (C4)     |
|          | find the best possible outcome  |          |
| C305-3.3 |   | Evaluate |
|          | Justify and Formulate morally correct decisions and stand by them               | (C5)     |
| C305-3.4 |   | Create   |
|          | Adapt and develop a character respected by peers and superior alike             | (C6)     |

| Module<br>No. | Title of the<br>Module                              | Topics in the Module   | No. of<br>Lectures for<br>the module |
|---------------|---|--|--------------------------------------|
| 1.            | The Big<br>Questions:<br>Origins of<br>Morality     | What is <b>morality? Universal aspects</b> of morality, <b>Evolution</b> of Morality, <b>Development</b> of Morality, <b>Morality Theories</b> , <b>Everyday Dilemmas and Decision Making</b>  | 4                                    |
| 2.            | Compassion/<br>Empathy                              | Reason/Emotion; Where does concern for others come from?<br>Empathy—and is more empathy necessarily a good thing? And<br>what can we learn from the study of those who seemingly lack<br>normal moral feelings, such as violent psychopaths? | 3                                    |
| 3.            | Moral<br>Differences                                | How does culture influence our moral thought and moral action? What role does religion play? Why are some of us conservative and others liberal, and how do political differences influence our sense of right and wrong?                    | 2                                    |
| 4.            | Moral Circles:<br>Family, Friends,<br>and Strangers | Moral feelings: Family, Friends, and allies. Reciprocal<br>Altruism, The Morality of Group Preference, Morality of racial<br>and ethnic bias. : Stereotypes, How Do We Treat Strangers   | 2                                    |
| 5.            | Moral Decision<br>Making                            | Contemporary Everyday Ethical Issues   | 3                                    |
|               |   | Total number of Lectures   | 14                                   |

| Module<br>No. | Title of the<br>Module                                    | List of Experiments/Activities  | СО                   |
|---------------|---|---|----------------------|
| 1.            | The Big<br>Questions:<br>Origins of<br>Morality           | Experiential Sharing: Morality & its significance to them<br>Case Study: No such thing as free drink.   | C305-3.1             |
| 2.            | The Big<br>Questions:<br>Universal Aspects<br>of Morality | Universal Aspects of Morality: Big Questions: Why be good?<br>Universal Aspects of Morality: Big Questions: Is it permissible<br>to lie?<br>Universal Aspects of Morality: Big Questions: Is it good to<br>gossip?? | C305-3.1             |
| 3.            | The Big<br>Questions:<br>Everyday<br>Dilemmas and         | UPSC Case Study<br>Ethical Dilemma of a Marketing Manager   | C305-3.2<br>C305-3.3 |

|    | Decision Making                                     |  |  |
|----|---|--|--|
| 4. | Evolution &<br>Development of<br>Morality           | Ethical Analysis: A young Professor's Career   | C305-3.1<br>C305-3.2<br>C305-3.3             |
| 5. | Compassion/<br>Empathy: Reason<br>v/s Emotion       | Discussion: Can we do better than the Golden Rule<br>Discussion: Obligation to Others/ Is jealousy & Resentment<br>always bad? | C305-3.1<br>C305-3.4                         |
| 6  | Compassion/<br>Empathy                              | EI Assessment<br>Discussion on Reading: What's the matter with Empathy?  | C305-3.1<br>C305-3.4                         |
| 7  | Moral Differences                                   | Case Study: Difference in Morality<br>Experiential Exercise: Country/ Org/ Home Moral Culture                                  | C305-3.4                                     |
| 8  | Moral Circles:<br>Family, Friends,<br>and Strangers | Experiential Sharing: Moral Circles and their influence on us<br>Stereotyping in Morality                                      | C305-3.4                                     |
| 9  | Moral Decision<br>Making                            | Contemporary Real World Scenario: Analyzing it through<br>CATWOE   | C305-3.1<br>C305-3.2<br>C305-3.3<br>C305-3.4 |

| Evaluation Criteria      |   |  |  |  |
|--------------------------|---|--|--|--|
| Components               | Maximum Marks   |  |  |  |
| Mid Term                 | 30 (Project Presentation)                               |  |  |  |
| End Semester Examination | 40 ( End Term Written Paper)                            |  |  |  |
| ТА                       | 30 ( Case Study Assessment, Assignment, Oral Questions) |  |  |  |
| Total                    | 100   |  |  |  |

| Reco<br>Refe | <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format) |  |  |
|--------------|--|--|--|
| 1.           | <b>Martin, Clancy</b> "Moral Decision Making: How to approach everyday Ethics", The Great Courses, USA, 2014   |  |  |
| 2.           | Shukla T., Yadav A.& Chauhan G.S." Human Values & Professional Ethics", Cengage Learning India<br>Pvt Ltd, 2018  |  |  |
| 3.           | Khanka S.S. "Business Ethics & Corporate Governance (Principles & Practices)", S. Chand, 2014  |  |  |
| 4.           | Mruthyunjaya H.C.," Business Ethics & Value systems", PHI Learning Pvt Ltd, 2013   |  |  |

|             |                        | Lecture-wi                 | SC DI Canu    |                                  |                               |
|-------------|------------------------|----------------------------|---------------|----------------------------------|-------------------------------|
| Course Code | 18B13HS612             | Semester : Even            |               | Semeste                          | <b>r</b> VI Session 2018-2019 |
|             |                        |                            |               | Month from Jan 2019 to June 2019 |                               |
| Course Name | Effective tools for Ca | areer Management and Devel |               | elopment                         |                               |
| Credits 2   |                        |                            | Contact Hours |                                  | 1-0-2                         |

| Faculty (Names) | Coordinator(s)                 | Dr Kanupriya Misra Bakhru |
|-----------------|--------------------------------|---------------------------|
|                 | Teacher(s)<br>(Alphabetically) | Dr Kanupriya Misra Bakhru |
|                 |                                |                           |

**COURSE OUTCOMES** 

**COGNITIVE LEVELS** 

| C305-2.1 | Assess ones personal priorities, skills, interests, strengths, and values<br>using a variety of contemporary assessment tools and reflection<br>activities. | Evaluate Level (C 5) |
|----------|---|----------------------|
| C305-2.2 | Apply knowledge of all the Career Stages in making informed career decisions.   | Apply Level (C 3)    |
| C305-2.3 | Develop and maximize ones potential for achieving the desired career option.  | Create Level (C6)    |
| C305-2.4 | Analyze the processes involved in securing and managing career by employees of different organizations.   | Analyze Level (C 4)  |

| Module<br>No. | Title of the<br>Module  | Topics in the Module  | No. of<br>Lectures and<br>Tutorial for<br>the module |
|---------------|---|---|--|
| 1.            | Introduction to<br>Career Life cycle  | Introduction to Career Life Cycle of an individual-Role and<br>importance of human resource in an organization, Evolution<br>of Strategic Human Resource Management.  | 3  |
| 2.            | Self Branding and<br>strategies to do well<br>in Recruitment and<br>Selection | Introduction to complete cycle of Recruitment and<br>Selection, Introduction to various tools used for assessment<br>and testing candidates-aptitude test, personality test,<br>graphology test etc. Introduction to Workforce planning,<br>Importance and practical application of Job Analysis, Job<br>Description and Job Specification.   | 3  |
| 3.            | Personnel<br>Development and<br>your career                                   | Introduction to various learning and development,<br>Introduction to various techniques used for learning and<br>development, measure of training effectiveness, Training<br>techniques / delivery, Kirkpatrick Model, Introduction to<br>Succession Planning, Transactional Analysis.  | 3  |
| 4.            | Human Resource<br>Evaluation and<br>Compensation                              | Performance Management: Measurement Approach,<br>Developing Job Descriptions, Key Result Areas, Key<br>Performance Indicators, Assessment Centre, 360 Degree<br>feedback, Balanced Scorecard, Effective Performance<br>Metrics. Compensation Strategy and trends- Compensation<br>package, ESOPs, Performance based pay, Recognition,<br>Retrial benefits, Reward management, Team rewards. | 3  |
| 5.            | Human Resource<br>Control<br>and special topics                               | Human Resources Audit, The Human Resource Information<br>System (HRIS), Human Resources Accounting,<br>Competency Management, Human Resource Management<br>Practices in India, Internationalization of Human Resource<br>Management Commonly Used Jargons.  | 2  |
|               |   | Total number of Lectures  | 14   |

| Module<br>No. | Title of the Module                                    | List of Experiments/Activities   | СО                    |
|---------------|--|--|-----------------------|
| 1.            | Introduction to Career Life cycle                      | Practical Sessions on Resume and Cover Letter Writing                      | C305-2.1,<br>C305-2.2 |
| 2.            | Self Branding and strategies to do well in Recruitment | Practical Sessions on Job Description, Job Specification and Self-Branding | C305-2.3,<br>CO4      |

|    | and Selection                                 |   |                       |
|----|---|---|-----------------------|
| 3. | Personnel Development and your career         | Practical Sessions on Johari Window-Knowing Thyself,<br>Transaction Analysis-Parent, Child, Adult Ego State for<br>effective interpersonal communication. | C305-2.1,<br>C305-2.3 |
| 4. | Human Resource Evaluation<br>and Compensation | Practical Sessions on HR Interview and Mock HR Interview  | C305-2.2,<br>C305-2.4 |
| 5. | Human Resource Control<br>and special topics  | Practical Sessions on Group Discussions and Mock Group Discussions  | C305-2.2,<br>C305-2.4 |

| Evaluation Criteria |  |
|---------------------|--|
| Components          | Maximum Marks                                |
| Mid Term            | 30 (Project)                                 |
| End Term            | 40 (Written)                                 |
| ТА                  | 30 (Class Mock Activities, Assignment, Quiz) |
| Total               | 100  |

| Reco | Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, |  |  |  |  |
|------|---|--|--|--|--|
| Refe | Reference Books, Journals, Reports, Websites etc. in the IEEE format)                                     |  |  |  |  |
| 1.   | Pande and Basak, Human Resource Management- Text and Cases, Pearson, 2012                                 |  |  |  |  |
| 2.   | Dessler and Varkkey, Human Resource Management, Pearson, 2011   |  |  |  |  |
| 3.   | VSP Rao, Human Resource Management, Excel Books, 2007   |  |  |  |  |
| 4.   | Aswathappa, Human Resource Management, McGraw-Hill, 2010  |  |  |  |  |
| 5.   | Gary Dessler, Human Resource Management, Pearson/Prentice Hall, 2005                                      |  |  |  |  |

| Course Code | 19B13BT311 | Semester Even | Semester VI Session 2018 -2019 |
|-------------|------------|---------------|--------------------------------|
|-------------|------------|---------------|--------------------------------|

|                 |                                | (specify Odd/          | Even)           | Month | from January-June |
|-----------------|--------------------------------|------------------------|-----------------|-------|-------------------|
| Course Name     | Nanoscience in Food Technology |                        |                 |       |                   |
| Credits         | 2                              |                        | Contact Hours 2 |       |                   |
|                 |                                |                        |                 |       |                   |
| Faculty (Names) | Coordinator(s)                 | Prof. Sudha Srivastava |                 |       |                   |
|                 | Teacher(s)<br>(Alphabetically) | Prof. Sudha Srivastava |                 |       |                   |
|                 |                                |                        |                 |       |                   |
| COURSE OUTCO    | OMES                           |                        |                 |       | COGNITIVE LEVELS  |
| E               |                                | سنامه مسط سمسم         |                 |       |                   |

| C305-1.1 | Explain properties of nanoparticles and nanoemulsions                          | Understand Level (C2) |
|----------|--|-----------------------|
| C305-1.2 | Outline food processing, packaging and preservation                            | Understand Level (C2) |
| C305-1.3 | Apply nanotechnology concepts to improve food quality, texture, and shelf life | Apply Level (C3)      |
| C305-1.4 | Apply concepts of nanoscience for improving agriculture yields                 | Apply Level (C3)      |
| C305-1.5 | Analyze food quality degradation and pathogens detection, using nanosensors    | Analyze Level (C4)    |

| Module<br>No.                               | Title of the<br>Module   | Topics in the Module   | No. of<br>Lectures for<br>the module |
|---|--|--|--------------------------------------|
| 1.  | Introduction to<br>Nanomaterials                               | Introduction to nanomaterials, nanoemulsions, method of synthesis and identification of nanoemulsions  | 5                                    |
| 2.  | Food Packaging<br>and Preservation                             | Introduction to food processing, packaging and preservation. Modified atmosphere packaging, active packaging and intelligent packaging.  | 6                                    |
| 3.  | Application of<br>nanotechnology in<br>Food and<br>agriculture | Microemulsions for delivery of nutraceuticals, edible films<br>and coating for food, Polymer nanocomposites, effect of<br>nanomaterials on mechanical, thermal and barrier properties<br>of polymers. Application of nanotechnology for pesticide<br>delivery, nutrient uptake etc. Nanomaterials in Food-<br>Health and Safety Issues | 7                                    |
| 4.  | Biosensors for<br>monitoring food<br>quality                   | sorsforTime temperature indicators, pathogen detection usingringfoodbiosensors, Pesticide detection using biosensor.   |                                      |
|   |  | Total number of Lectures   | 24                                   |
| Evaluation                                  | <b>Criteria</b>  |  |                                      |
| ComponentsMaximum MarksMid Term30End Term40 |  |  |                                      |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

VellaichamyChelladurai, Digvir S. Jayas, 2018 Nanoscience and Nanotechnology in Foods andBeveragesCRC Press, ISBN 9781498760638

| 0               |   |                                       |   | Lecture-wise B   | геакир   |                                |                             |  |
|-----------------|---|---------------------------------------|---|--|--|--------------------------------|-----------------------------|--|
| Course Code     |   | 16B1NMA633                            |   | Semester : Even  | Semester VI Session 2018 -2019<br>Month from Jan 2019 to June 2019 |                                |                             |  |
| Course Name     |   | Statistics                            |   |  |  |                                |                             |  |
| Credits         |   | 4                                     |   | Contact Hours 3-1-0  |  |                                |                             |  |
| Faculty (Names) |   | Coordinator(s) Dr. Himanshu Agarwal   |   |  |  |                                |                             |  |
|                 |   | Teacher(s)<br>(Alphabetically)        |   | Dr. Anuj Bhardwaj, Dr. Himanshu Agarwa<br>Chauhan  |  |                                | al, Dr. Pinkey              |  |
| COURSE OUTCOMES |   |                                       |   |  |  |                                | COGNITIVE<br>LEVELS         |  |
| After pursu     |   |                                       |   |  |  |                                |                             |  |
| C302-1.1        | make u<br>kurtosi   | use of measures<br>is for description | s of cent<br>on and v   | of central tendency, dispersion, skewness and,<br>and visualization of population data.  |  |                                | Applying Level (C3)         |  |
| C302-1.2        | apply correlation and regression in statistical analysis of data.     |                                       |   |  |  |                                | Applying Level (C3)         |  |
| C302-1.3        | explain sampling theory and its distributions.                        |                                       |   |  |  |                                | Understanding<br>Level (C2) |  |
| C302-1.4        | explain the concepts and properties of estimation theory.             |                                       |   |  |  |                                | Understanding<br>Level (C2) |  |
| C302-1.5        | apply sampling and estimation theory to find the confidence interval. |                                       |   |  |  | Applying Level (C3)            |                             |  |
| C302-1.6        | analyze small and large sample data by using the test of hypothesis.  |                                       |   |  |  | Analyzing Level (C4)           |                             |  |
| Module<br>No.   | Title of the<br>Module  |                                       | Topics in the Module  |  |  | No. of Lectures for the module |                             |  |
| 1.              | Descriptive<br>Statistics   |                                       | Graphical representation such as histogram,<br>frequency polygon, AM, GM, HM, median,<br>mode, measures of dispersion, skewness and<br>kurtosis such as central and non-central<br>moments, population variance, $\beta$ , $\gamma$ coefficient,<br>Box and Whisker plot. |  |  | 8                              |                             |  |
| 2.              | Correlation and<br>Regression<br>Analysis                             |                                       | Scatter diagram. Karl Pearson's and Spearman's<br>rank correlation coefficient, regression lines,<br>regression coefficient and their properties.   |  |  | 5                              |                             |  |
| 3.              | Sampling and<br>Sampling<br>Distributions                             |                                       | Populations and Sample, random sample,<br>statistics, sample moments, law of large<br>numbers, central limit theorem, distribution of<br>sample mean and sample variance, MGF, Chi-<br>square distribution, F-distribution, Student's <i>t</i><br>distribution.           |  |  | 7                              |                             |  |
| 4.              | Parametric Point<br>Estimation  |                                       | Genera<br>momen<br>estima<br>efficien<br>sufficien<br>Rao-B   | eneral concept of point estimation, methods of<br>oments and maximum likelihood for finding<br>timators, unbiasedness, consistency,<br>ficiency, UMVUE, Cramer-Rao inequality,<br>fficiency, factorization theorem, completeness,<br>ao-Blackwell theorem. |  | 10                             |                             |  |
| 5.              | Param<br>Estima   | etric Interval<br>ation               | definit<br>quantit<br>differe<br>for sma  | ton of confidence<br>ty, confidence interva-<br>ence of means and di<br>all and large samples.   | e interval, p<br>Il for mean, van<br>fference of var               | vivotal<br>iance,<br>iances    | 5                           |  |

# Detailed Syllabus

| 6   | <b>5</b> .   | Hypothesis Testing   | The basic idea of significance test. null and      | 7 |  |  |  |  |
|---|--|--|--|---|--|--|--|--|
|   |  |  | alternative hypothesis, type-I and type II errors, |   |  |  |  |  |
|   |  |  | testing of small and large samples for mean,       |   |  |  |  |  |
|   |  |  | variance, difference in means, and difference in   |   |  |  |  |  |
|   |  |  | variances.   |   |  |  |  |  |
| Tota  | 42   |  |  |   |  |  |  |  |
| Evaluation Criteria   |  |  |  |   |  |  |  |  |
| Components  |  |  | Maximum Marks                                      |   |  |  |  |  |
| T1  |  |  | 20   |   |  |  |  |  |
| T2  |  |  | 20   |   |  |  |  |  |
| End Semester Examination  |  |  | 35   |   |  |  |  |  |
| ТА  |  |  | 25 (Quiz, Assignments, Tutprials)                  |   |  |  |  |  |
| Total   |  |  | 100  |   |  |  |  |  |
| <b>Recommended Reading material:</b> Author(s), Title, Edition, Publisher, Year of Publication etc. (Text |  |  |  |   |  |  |  |  |
| book  | s, Ref   | erence Books, Journals   | , Reports, Websites etc. in the IEEE format)       |   |  |  |  |  |
| 1   | Biswas and Srivastava, A Textbook, Mathematical Statistics Ist Edition, Narosa Publishing    |  |  |   |  |  |  |  |
| 1.  | House, New Delhi.  |  |  |   |  |  |  |  |
| 2   | W.F  | W. Feller, Introduction to Probability Theory and its Applications Vol. I and II. Wiley Eastern- |  |   |  |  |  |  |
| 4.  | Ltd, 1971  |  |  |   |  |  |  |  |
| 2   | V. K.Rohatgi, An Introduction to Probability Theory and Mathematical Statistics Wiley Easter |  |  |   |  |  |  |  |
| э.  | 1984   |  |  |   |  |  |  |  |
| 4.  | R. V. Hogg, A. T. Craig, Introduction to Mathematical Statistics, McMillan, 1971             |  |  |   |  |  |  |  |
| 5   | AM. Mood, F. A. Graybill, and D. C. Boes, Introduction to the Theory of Statistics McGraw    |  |  |   |  |  |  |  |
| 2   | Hill,  | 1974   |  |   |  |  |  |  |
| 6.  | Des Raj & Chandak, Sampling Theory, Narosa Publishing House, 1998.                           |  |  |   |  |  |  |  |
| 7.  | Sheldon Ross, A First Course in Probability, 6th edition, Pearson Education Asia, 2002.      |  |  |   |  |  |  |  |
| 0   | Mey  | Meyer, P.L, Introductory Probability and Statistical Applications Addison-Wesley Publishing      |  |   |  |  |  |  |
| ð.  | Com  | Company, 1965.   |  |   |  |  |  |  |