Code No: RT22013 **R13** SET - 1

II B. Tech II Semester Regular Examinations, April/May - 2016
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Write about Principal stress theory
   b) Explain the Theory of pure torsion?
   c) What the different types of columns?
   d) Write the stresses in dams?
   e) What is moment of inertia?
   f) Write a note on method of joint?

PART -B

2. a) Write a note on Mohr's circle of stresses. What is the importance of this circle?
   b) A rectangular block of 1200 mm^2 cross-sectional area is subjected to a longitudinal compressive load of 1200kN. Determine the normal stress across the cross section of the block. If the block is cut by an oblique plane making an angle of 40^0 with normal section of the block. Determine:
      (i) Normal stress on the oblique plane
      (ii) Tangential stress along the oblique plane, and
      (iii) Resultant stress on the oblique plane.

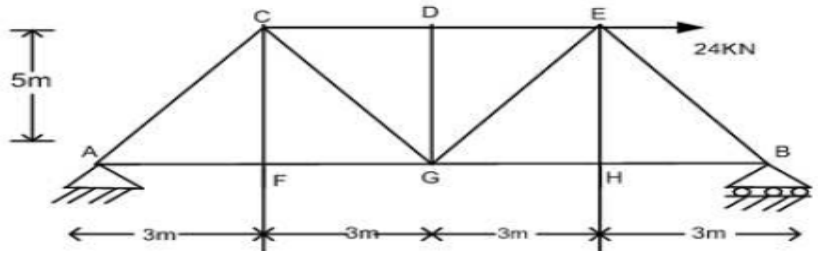
3. The external diameters of a steel collar are 200mm, and the internal diameter decreases by 0.125mm when shrunk on to a solid steel shaft of 125mm diameter. Find the reduction in diameter of the shaft, the radial pressure between the collar and the shaft and hoop stress at the inner surface of the tube. Take E = 210GN/m^2 and 1/m=0.3.

4. Starting from secant formula, derive Perry's formula for long columns

5. a) Explain briefly how stresses in beams due to un symmetric bending is considered.
   b) Explain briefly the method of locating shear centre.

6. Determine of stresses in the case of chimneys, retaining walls

7. Determine the forces in all the members of the frame by method of joints



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Code No: RT22013 **R13** SET - 2

II B. Tech II Semester Regular Examinations, April/May - 2016
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What are the different Theories of Failures?
   b) Write about close and open coiled helical springs
   c) What is the difference between short and long column?
   d) Write the stresses in retaining walls?
   e) What is the difference between symmetrical and unsymmetrical bending?
   f) Explain the concept of indeterminate trusses

PART -B

2. a) Explain the terms principal stresses and principal planes.
   b) Derive expressions for principal stresses, principal planes and max shear stress if there are like direct stresses accompanied by a state of simple shear.

3. a) Define helical spring? Name the two important types of helical springs.
   b) A hollow shaft of diameter ratio 3/5 is required to transmit 400KW at 140 r.p.m with a uniform twisting moment. The shear stress in the shaft must not exceed 60 MPa and the twist in a length 2.5 m must not exceed 1^0. Calculate the minimum external diameter of the shaft. Take $C=8X10^4$ MPa.

4. a) Derive the Rankine's formula for crippling load.
   b) A column of circular section has 160mm diameter and 4m length. Both ends of the column are fixed. The column carries a load of 150kN at an eccentricity of 15mm from the geometrical axis of the column. Find the maximum compressive stress on the column section.

5. Distinguish between direct stress and bending stress by means of a diagram.

6. a) What do you mean by unsymmetrical bending?
   b) Locate the shear centre of the section shown in Figure 1. Thickness is 6mm throughout.

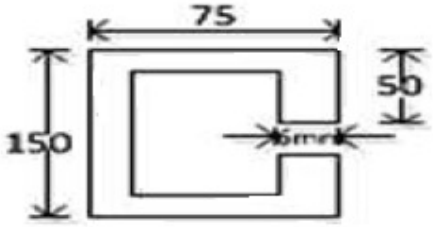

Figure 1

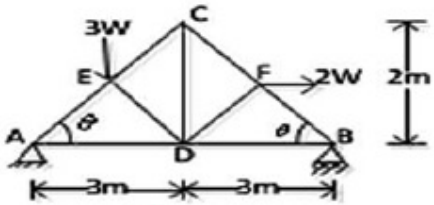

Figure 2

7. Calculate the magnitude and nature of the forces in the member of the truss as shown is Figure 2, by method of joints.

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Code No: RT22013 **R13** SET - 3

II B. Tech II Semester Regular Examinations, April/May - 2016
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Explain about Mohr's circle?
   b) Write the different Types of springs?
   c) What is slenderness ratio
   d) Write about bending stresses?
   e) Explain briefly about unsymmetrical bending?
   f) Explain the concept of determinate trusses

PART -B

2. a) Derive an expression for the normal stress and shear stress on an oblique section of a rectangular body when it is subjected to direct stress in one plane only.
   b) A rectangular element is a strained body is subjected to tensile stresses of 250 N/mm^2 and 180 N/mm^2 on mutually perpendicular planes together with a shear stress of 80N/mm^2. Determine:
   i) Principal stresses ii) Principal planes
   iii) Maximum shear stress and iv) Plane of maximum shear stress

3. A closely coiled helical spring is made out of 10mm dia. steel rod, the coil having 12 complete turns. The mean dia. of spring is 10mm. Calculate the shear stress induced in the section of the rod due to an axial load of 250N. Find also the deflection under the load, energy stored in the spring and the stiffness of spring. Take N = 8 x10^4 *N/mm*^{2}.

4. a) Deduce a formula for the critical load of a column having both ends hinged.
   b) A solid circular bar 6m long and 5 cm in diameter was found to extend 4.5 mm under a tensile load of 50KN. The bar is used as a strut with both ends hinged. Determine the buckling load for the bar and the safe load, consider factor of safety as 3.0.

5. Determine of stresses in the case of dams and explain the conditions for stability?

6. A beam of rectangular section 100mm wide and 180mm deep is subjected to a bending moment of 12kN.m The trace of the plane of loading is inclined at 45^0 to the y-y axis of the section. Locate the natural axis of the section and calculate the maximum bending stress induced is the section.

7. Find the forces in the members of truss by method of joints as shown in Figure 1.

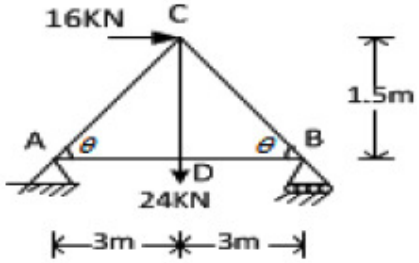

Figure 1
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Code No: RT22013 **R13** SET - 4

II B. Tech II Semester Regular Examinations, April/May - 2016
STRENGTH OF MATERIALS - II
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Explain about Normal and tangential stresses on an inclined plane
   b) Write about Polar section modulus with one example?
   c) Write the Limitations of Euler's theory
   d) Write the stresses in chimneys
   e) Explain about centroid in rectangular section
   f) Write a short nore on method of section?

PART -B

2. a) Briefly illustrate the shear strain energy theory.
   b) Using the above theory estimate the factor of safety for a certain type of steel whose Proportional limit is 280 MPa. The principal stresses were found to be 100 MPa (tensile),60 MPa (tensile) and 30 MPa (compressive)

3. Design a close coiled helical spring made of by steel wire. The diameter of the coil is 10 times the diameter of the wire. A load 650N is applied on the spring which causes a deflection of 60mm. Take allowable maximum shear stress is 80N/mm^2 and C=8X10^4 N/mm^2.

4. a) Define slenderness ratio of a column. What is its importance?
   b) A column of circular section has 160mm diameter and 4m length. Both ends of the column are fixed. The column carries a load of 150kN at an eccentricity of 15mm from the geometrical axis of the column. Find the maximum compressive stress on the column section.

5. A square chimney 25m high, having an opening of l*n* by l*n* is subjected to a horizontal wind pressure of 1.5 KN/m^2. Find the necessary thickness of brick work at base if the density of the masonry is 21 KN/m^3 and the max permissible stress on brick masonry is limited to 0.8N/mm^2.

6. a) What do you mean by unsymmetrical bending?
   b) A beam of rectangular section 80mm wide and 120mm deep is subjected to a bending moment of 12kN.m The trace of the plane of loading is inclined at 45^0 to the y-y axis of the section. Locate the natural axis of the section and calculate the maximum bending stress induced is the section

7. Find the forces in the members of truss by method of section as shown in Fig 1.

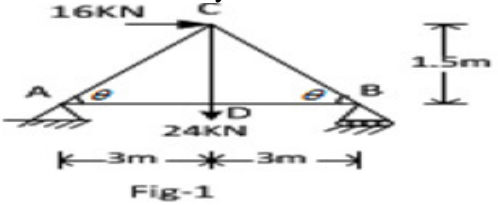

Fig-1

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Code No: RT22025 **R13** SET - 1

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART- A

1. a) What is all day efficiency? How it is different from normal efficiency.
b) What are the typical information that can be had by performing OC and SC tests?
c) Write the advantages and disadvantages of tap changers.
d) Write the merits and demerits of slip-ring induction motor.
e) Write the effects of crawling and cogging on the performance of induction motor.
f) Define specific electric and magnetic loading. (4M+4M+4M+3M+4M+3M)

PART- B

2. a) With the help of phasor diagram, explain the operation of a transformer under no load and load conditions.
b) The core of a 100 kVA, 11000/550 V, 1-phase core type transformer has a cross-section of 400 cm^2. Find (i) the number of HV and LV turns per phase and (ii) the e.m.f per turn if the maximum core density is not density is not exceeding 1.3 Tesla. Assume a stacking factor of 0.9. What will happen if its primary voltage is increased by 10% on no-load? (8M+8M)

3. a) Explain the procedure to conduct the Sumner's test and obtain the different circuit parameters to estimate the performance of the transformer.
b) A 50 kVA, 2200 V/1100 V single phase 50 Hz transformer has a full-load efficiency of 95% and iron loss of 500 W. The transformer is connected as an Auto-transformer to a 3300 V supply. When it delivers a load of 50 kW at unity power factor at 1100 V, calculate the currents in the windings. Find also the increase in output as auto-transformer also calculate the copper losses as two winding transformer. (8M+8M)

4. a) Explain about the star-star, star-delta and delta-star connections used in 3-phase connection of transformers. Discuss their advantages and disadvantages.
b) A balanced 3-phase, 100 kW load at 400V and 0.8 p.f. lag is to be obtained from a balanced 2-phase, 1100V lines. Determine the kVA rating of each unit of the Scott-connected transformer. (8M+8M)
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5. a) Describe with neat sketch the construction and principle of operation of a 3-phase cage type induction motor.
   b) A 3-phase slip-ring, induction motor with star-connected rotor has an induced e.m.f. of 120V between slip-rings at standstill with normal voltage applied to the stator. The rotor winding has a resistance per phase of 0.3 Ω and standstill leakage reactance per phase of 1.2 Ω. Calculate (i) Rotor current/phase when running short-circuited with 4% slip and (ii) the slip and rotor current per phase when the rotor is developing maximum toque. (8M+8M)

6. a) What is the purpose of using deep-bar cage rotors? Explain the construction and working of a deep-bar cage motor.
   b) A 50 kW, 6-pole, 50 Hz, 450 V, 3-phase slip ring induction motor furnished following test figures:
   No load test: 450 V, 20 A, p.f = 0.15
   Blocked rotor test : 200 V, 150 A, p.f=0.3
   The ratio of stator to rotor copper losses on short circuit was 5:4. Draw the circle diagram and determine (i) The full load current and power factor (ii) The maximum torque and the maximum power input (iii) Slip at full load (iv) Efficiency at full load. (7M+9M)

7. a) Derive the output equation of a three phase transformer and explain the factor affecting it.
   b) Find the main dimensions of a 15 kW, 3-phase, 400 V, 50 Hz, 2810 rpm, squirrel cage induction motor having an efficiency of 0.88 and a full load power factor of 0.9. Assume: specific magnetic loading=0.5 Wb/m^2; specific electric loading=25000 A/m. Take the rotor peripheral speed as approximately 20 m/s at synchronous speed. (7M+9M)

Code No: RT22025 **R13** SET - 2

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART- A

1. a) What is the need of laminating the core of the transformer.
   b) What is the need of parallel operation? What are the conditions to be satisfied for parallel operation of transformers?
   c) What advantages has the star connection over the delta connection of the transformer.
   d) What is the necessity of short-circuited rotor conductors in squirrel cage induction motor?
   e) What is the principle of induction generator?
   f) What is a helical winding? What are its properties? (4M+4M+4M+4M+3M+3M)

PART- B

2. a) Draw the approximate equivalent circuit of a transformer referred to the primary side and indicate how it differs from the exact equivalent circuit.
   b) A transformer with normal voltage impressed has a flux density of 1.4 Wb/m^2 and a core loss comprising of 1000W eddy current loss and 3000W Hysterisis loss. What do these losses become under the following conditions?
   i) Increasing the applied voltage by 10% at rated frequency.
   ii) Reducing the frequency by 10% with normal voltage impressed.
   iii) Increasing both impressed voltage and frequency by 10%. (8M+8M)

3. a) State the essential and desirable conditions which should be satisfied before two single phase transformers may be operated in parallel.
   b) A 2-winding 10 kVA, 440/110 V transformer is reconnected as a step-down 550/440 V auto transformer. Compare the volt-ampere rating of the autotransformer with that of original 2-winding transformer. Calculate the power transferred to the load: (i) inductively
   (ii) conductively. (8M+8M)
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4. a) Explain with the help of connection and phasor diagram, how the Scott connections are used to obtain two-phase supply from 3-phase supply mains.
   b) A 400 kVA load at 0.7 power factor lagging is supplied by three 'single-phase' transformers connected in Δ – Δ. Each of the Δ – Δ transformer is rated at 2000 kVA, 2300/230 V. If one defective transformer is removed from the service, calculate for the V – V connection: (i) the kVA load carried by each transformer (ii) percent rated load carried by each transformer (iii) total kVA rating of the transformer bank in V – V (iv) ratio of V – V to Δ – Δ bank transformer ratings. (8M+8M)

5. a) Explain the principle of production of rotating magnetic field in a 3-phase induction motor.
   b) A 10 kW, 400 V, 3-phase, 4 pole, 50 Hz delta connected induction motor is running at no load with a line current of 8 A and an input power of 660 W. At full load, line current is 18 A and input power is 11.20 kW. Stator effective resistance per phase is 1.2 Ω and friction, windage loss is 420 W. For negligible rotor ohmic losses at no load, calculate (i) stator core loss (ii) total rotor losses at full load (iii) total rotor ohmic losses at full load (iv) full load speed. (8M+8M)

6. a) Derive the torque-slip equation for a 3-phase induction motor and also the equation for slip at which maximum torque occurs.
   b) An 8-pole, 50Hz, 3-phase slip ring induction motor has effective resistance of 0.08 Ω/ phase. The speed corresponding to maximum torque is 650 rpm. What is the value of resistance to be inserted in rotor circuit to obtain maximum torque at starting? (8M+8M)

7. a) Derive the output equation of a three phase induction motor and explain the factor affecting it.
   b) Discuss factors to be considered in designing number of rotor slots in a induction motor.

(8M+8M)

Code No: RT22025 **R13** SET - 3

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART- A

1. a) Draw phasor diagram of the transformer with lagging, leading and unity power factor loads.
   b) Give the applications, merits and demerits of auto transformer.
   c) What are the differences between off load and on load tap changing transformers. Why taps are provided in the distribution transformer.
   d) Why the air gap between stator core and rotor of an induction motor is made very small.
   e) Rotor resistance starting is preferred to reduced voltage starting of a wound rotor induction motor. Why?
   f) Write the output equation of a transformer and three phase induction motor.
   (4M+4M+4M+3M+4M+3M)

PART- B

2. a) Discuss the effect of variation of frequency and supply voltage on losses in a transformer.
   b) A 100 kVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 Ω and 0.01 Ω respectively and the corresponding leakage reactance are 1.1 Ω and 0.035 Ω. The supply voltage is 2200V. Calculate (i) equivalent impedance referred to primary and (ii) the voltage regulation and the secondary terminal voltage for full load having a power factor of 0.8 leading. (8M+8M)

3. a) Discuss how will you perform open-circuit and short-circuit tests on a single phase transformer in the laboratory. From test results how will you find efficiency and regulation of the transformer?
   b) Two transformers A and B are connected in parallel to a load of (2+j1.5) Ω. Their impedances in secondary terms are Z_A = (0.15+j0.5) Ω and Z_B = (0.1+j0.6) Ω. Their no load terminal voltages are $E_A = 207\angle 0^0$ volt and $E_B = 205\angle 0^0$ volt. Find the power output and power factor of each transformer. (8M+8M)

4. a) Describe the configuration and working principle of on load tap changer with neat sketches?
   b) Two single phase transformers are supplied at 250V from a 6600 V, 3-phase system through a pair of Scott-connected transformers. If the load on the main transformer is 85 kW at 0.9 p.f. lagging and that on teaser transformer is 69 kW at 0.8 p.f. lagging, find the values of line currents on the 3-phase side. Neglect the magnetizing and core loss currents in the transformers? (8M+8M)
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5. a) Show that the voltage generated in the rotor circuit of a 3-phase induction motor at any slip '*s*' is equal to '*s*' times the voltage generated at stand-still.
   b) The power input to rotor of a 400 V, 50 Hz, 6-pole, three-phase induction motor is 90 kW. The rotor e.m.f is observed to make 150 cycles per minute. Calculate (i) slip, (ii) rotor speed, (iii) mechanical power developed (iv) speed of rotor field with respect to rotor (v) speed of stator field with respect to rotor. (8M+8M)

6. a) Explain the relation between torque and rotor power factor in 3 phase induction motors.
   b) The impedances at standstill of the inner and outer windings of a double cage rotor are (0.01+j0.5) ohms and (0.05+j0.1) ohms respectively. Calculate the ratio of torques due to the two winding (i) at starting (ii) when running with a slip of 5 %. (8M+8M)

7. a) Write a short note on specific electric and magnetic loadings in three phase induction motor.
   b) Explain about various types of windings used in the core and shell type transformers. Mention merits and demerits of each type of winding. (8M+8M)

Code No: RT22025 **R13** SET - 4

II B. Tech II Semester Regular Examinations, April/May - 2016
ELECTRICAL MACHINES - II
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART- A

1. a) Draw the exact and approximate equivalent circuits of a single phase transformer.
   b) An auto transformer is supplying a power to a load of 3 kW, 115 V unity power factor from 230 V supply. Calculate the power supplied inductively and conductively.
   c) What are the characteristics of Scott connection?
   d) Why the slots on the rotor of an induction motor are usually skewed.
   e) Write is the principle of double cage induction motor.
   f) What are the steps to be followed in the design of stator of three phase induction motor?
   (4M+4M+4M+3M+4M+3M)

PART- B

2. a) What is voltage regulation of a transformer? Derive the conditions for maximum and zero voltage regulation in a transformer.
   b) A transformer has resistance and reactance drop of 2.5% and 5% respectively. Find the percentage voltage regulation of the transformer at full load and at 0.8 p.f lagging. Also find the power factor at which regulation is maximum. (8M+8M)

3. a) Derive an expression for approximate relative weights of conductor material in an autotransformer and 2-winding transformer, the primary voltage being V_1, and secondary voltage V_2. Compare the weights of conductor material when the transformation ratio is 3. Ignore the magnetizing current?
   b) A 6 kVA, 250/500V, 1-phase, 50 Hz, transformer has the following readings tests results:
   i) O.C. test (LV side): 250 V, 1.2 A, 80 W
   ii) S.C. test (HV side): 25 V, 10 A, 95 W
   Calculate regulation and efficiency of the transformer at full load and half load 0.8 power factor lagging. (8M+8M)

4. a) Explain with necessary diagrams how two 3-phase transformers can be used to convert a 3-phase supply to a 2-phase one. If the load is balanced on one side, show that it will be balanced on other side.
   b) Two single-phase furnaces working at 100V are connected to 3300-V, 3-phase mains through Scott-connected transformers. Calculate the current in each line of the 3-phase mains when the power taken by each furnace is 400-KW at a power factor of 0.8 lagging. Neglect losses in the transformer. (8M+8M)
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5. a) Explain why a three-phase induction motor, at no-load, operates at a very low power factor and at full-load, operates at good power factor.
   b) An induction motor has an efficiency of 0.9 when the shaft load is 45 kW. At this load, stator ohmic loss and rotor ohmic loss each is equal to the iron loss. The mechanical loss is one-third of the no-load losses. Neglect ohmic losses at no-load. Calculate the slip. (8M+8M)

6. a) Derive an expression for developed torque in a 3-phase induction motor and find the condition for maximum torque.
   b) For a 3-phase induction motor, the rotor ohmic loss at maximum torque is 16 times that at full load torque. The slip at full load torque is 0.03. If stator resistance and rotational losses are neglected, then calculate the starting torque in terms of full load torque. (8M+8M)

7. Determine the main dimensions, number of stator slots and number of turns per phase of a 3.7 kW, 400 V, 3-phase, 4-pole, 50 Hz squirrel cage induction motor to be started by a star delta starter. Work out winding details. Assume: Average flux density in the gap=0.45 Wb/m^2, Ampere conductors per meter=23000, efficiency=0.85 and power factor=0.84.
   Machines rated at 3.7 kW, 4-pole is sold at a competitive price and therefore choose the main dimensions to give a cheap design. Assume: winding factor=0.955, stacking factor=0.9. (16M)

Code No: RT22042 **R13** SET - 1

II B. Tech II Semester Regular Examinations, April/May - 2016
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Define probability mass function and list its properties. (3M)
   b) Show that the first central moment is zero. (4M)
   c) Define central limit theorem. (4M)
   d) Distinguish between deterministic and non-deterministic random processes. (3M)
   e) Show that $S_{XX}(-\omega) = S_{XX}(\omega)$. (4M)
   f) A WSS random process $X(t)$ is applied to the input of an LTI system with transfer function $H(\omega) = \frac{3}{2+j\omega}$. Find the mean of the output $Y(t)$ of the system if $E[X(t)] = 2$. (4M)

PART -B

2. a) Two dice are thrown. The square of the sum of the points appearing on the two dice is a random variable X. Determine the values taken by X, and the corresponding probabilities. (8M)
   b) State and prove the properties of probability density function. (8M)

3. a) Let $Y = 2X + 3$. If the random variable X is uniformly distributed over [-1, 2], determine $f_Y(y)$. (8M)
   b) Find the second central moment of a random variable with PDF $f_X(x) = ae^{-ax}u(x)$ (8M)

4. a) State central limit theorem for the following cases: (8M)
   i) Equal distributions ii) Unequal distributions
   b) Determine $f_Z(z)$ in terms of $f_X(x)$and $f_Y(y)$, if $Z = X + Y$. (8M)

5. a) Give the classification of random processes. (8M)
   b) A random process is given by $X(t) = A\cos(\omega_c t + \Theta)$, where$\omega_c$ is a constant and A and Θ are independent random variables uniformly distributed in the ranges (-1, 1) and (0, 2 π), respectively. Determine$R_{XX}(t_1, t_2)$. (8M)

6. a) For each of the following functions, state whether it can be valid PSD of a real random process: i) $\frac{(2\pi f)^2}{(2\pi f)^2+16}$ ii) $j[\delta(f + f_o) + \delta(f - f_o)]$ (8M)
   b) State and prove the properties of power spectral density. (8M)

7. a) Let $Y(t)$ be the output of an LTI system with impulse response $h(t)$. Find the cross-correlation between the input $X(t)$ and output $Y(t)$. (8M)
   b) Write notes on the following terms: i) Thermal noise ii) Narrowband noise (8M)
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Code No: RT22042 **R13** SET - 2

II B. Tech II Semester Regular Examinations, April/May - 2016
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Define mixed random variable and give an example. (3M)
   b) The random variable X takes the values 0 and 1 with probabilities α and β respectively. Find the mean of X. (4M)
   c) List any three properties of jointly Gaussian random variables. (3M)
   d) Show that $|R_{XX}(\tau)| \leq R_{XX}(0)$. (4M)
   e) Show that $S_{XY}(\omega) = S_{YX}^{*}(\omega)$. (4M)
   f) Define generalized Nyquist theorem. (4M)

PART –B

2. a) Distinguish between discrete, continuous and mixed random variables with suitable examples. (8M)
   b) A binary source generates digits 1 and 0 randomly with probabilities 0.6 and 0.4, respectively. What is the probability that two 1s and three 0s will occur in a five-digit sequence. Hint: Let X be the random variable denoting the number of 1s generated in a five-digit sequence. (8M)

3. a) Let $Y = X^2$. Find $f_Y(y)$, if $X = N(0; 1)$. (8M)
   b) Define characteristic function and list its properties. (8M)

4. a) If X and Y are independent, then show that $E[XY] = E[X]E[Y]$. (8M)
   b) Let X and Y be defined by $X = cos\Theta$ and $Y = sin\Theta$, where Θ is a random variable uniformly distributed over $[0,2\pi]$. Show that X and Y are not independent. (8M)

5. a) Show that for a WSS process $X(t)$, $R_{XX}(0) \geq |R_{XX}(\tau)|$. (8M)
   b) Given a random process $X(t) = kt$, where k is a random variable uniformly distributed in the range (-1, 1). Is the process ergodic? (8M)

6. a) Show that the power spectrum of a real random process $X(t)$ is real. (8M)
   b) Define cross power spectral densities and list all the properties cross PSDs. (8M)

7. a) Suppose that the input to a differentiator is the WSS random process. Determine the power spectral density of output. (8M)
   b) Derive the expression for noise figure of two-stage cascaded network. (8M)

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Code No: RT22042 **R13** SET - 3

II B. Tech II Semester Regular Examinations, April/May - 2016
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) What are the conditions for a function to be a random variable? (4M)
   b) Find the relationship between $f_X(x)$ and $f_Y(y)$ if $Y = aX + b$. (4M)
   c) Define marginal probability density functions. (3M)
   d) Define : i)covariance-stationary random process (4M)
      ii) Autocorrelation-stationary random process
   e) If $R_{YY}(\tau) = R_{XX}(\tau)\cos(\omega_c\tau)$, determine $S_{YY}(\omega)$. (4M)
   f) List the properties of narrowband random process. (3M)

PART –B

2. a) The PDF of a random variable is given by $f_X(x) = ke^{-ax}u(x)$, where a is a positive constant. Determine the value of constant k. (8M)
   b) A noisy transmission channel has a per-digit error probability $p_e = 0.001$. Determine the probability of more than one error in 100 received digits using Poisson approximation. (8M)
3. a) Let $Y = aX + b$. Find the PDF of Y, if $X = N(\mu; \sigma^2)$. (8M)
   b) State and prove Chebychev's inequality. (8M)
4. a) Let Z is the sum of two independent random variables X and Y. Find the PDF of Z. (8M)
   b) List all the properties of jointly Gaussian random variables. (8M)
5. a) Sketch the ensemble of the random process $X(t) = Acos(\omega_c t + \Theta)$, where ω_c and Θ are constants and A is a random variable uniformly distributed in the range $(-A, A)$. Just by observing the ensemble, determine whether this is a stationary or a non-stationary process. (8M)
   b) List all the properties of auto-correlation function. (8M)
6. State and prove Wiener-Khinchin relation. (16M)
7. a) Derive the relationship between autocorrelation of output random process of an LTI system when the input is a WSS process. (8M)
   b) Describe the method of modeling a thermal noise source. (8M)
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Code No: RT22042 **R13** SET - 4

II B. Tech II Semester Regular Examinations, April/May - 2016
RANDOM VARIABLES AND STOCHASTIC PROCESSES
(Electronics and Communications Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) A noisy transmission channel has a per-digit error probability $p_e = 0.01$.. Calculate the probability of more than one error in 10 received digits. (4M)
   b) Determine the mean value of uniform random variable. (4M)
   c) When the two random variables X and Y are said to jointly Gaussian.? (3M)
   d) Autocorrelation of a random process $X(t)$ is given by $\frac{A^2}{2}\cos(\omega\tau)$. Determine the mean-square value of $X(t)$. (4M)
   e) If $R_{XX}(\tau) = A^2 e^{-2\alpha|\tau|}$, determine $S_{XX}(\omega)$. (4M)
   f) Draw the power spectrum of (3M)
   i) White noise ii) Band-limited white noise

PART –B

2. a) Define the conditional density and distribution functions. List all the properties of conditional density and distribution functions. (8M)
   b) In an experiment, a trial consists of two successive tosses of a fair coin. If a random variable X takes the number of tails appearing in a trial, determine the CDF of X. (8M)

3. a) Write notes on monotonic transformations for a continuous random variable. (8M)
   b) Show that $E[X + Y] = E[X] + E[Y]$. (8M)

4. a) The joint PDF of two continuous random variables is given by (8M)

   $f_{XY}(x, y) = xy\, e^{-x^2} . e^{\frac{-y^2}{2u(x)u(y)}}$

   Are X and Y independent?
   b) Write notes on linear transformation of Gaussian random variables. (8M)

5. a) A random process is given by $X(t) = at + b$, where b is a constant and a is an r.v uniformly distributed in the range (-2, 2). Is the process WSS? (8M)
   b) Derive an expression that relates autocorrelation function and auto covariance function. (8M)

6. Show that the autocorrelation function and power spectral density forms Fourier transform pair. (16M)

7. Write notes on the following:
   a) Band limited white noise (8M)
   b) Thermal noise (8M)

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Code No: R22026 **R10** SET - 1

II B. Tech II Semester Supplementary Examinations, April/May - 2016
CONTROL SYSTEMS
(Com. to EEE, ECE, EIE, ECC, AE)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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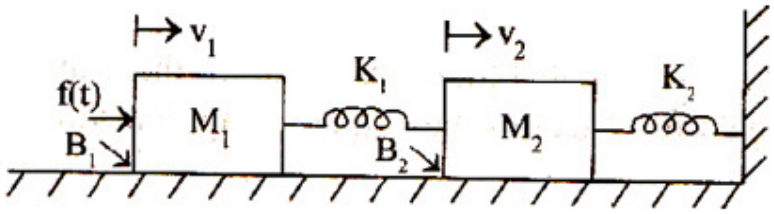
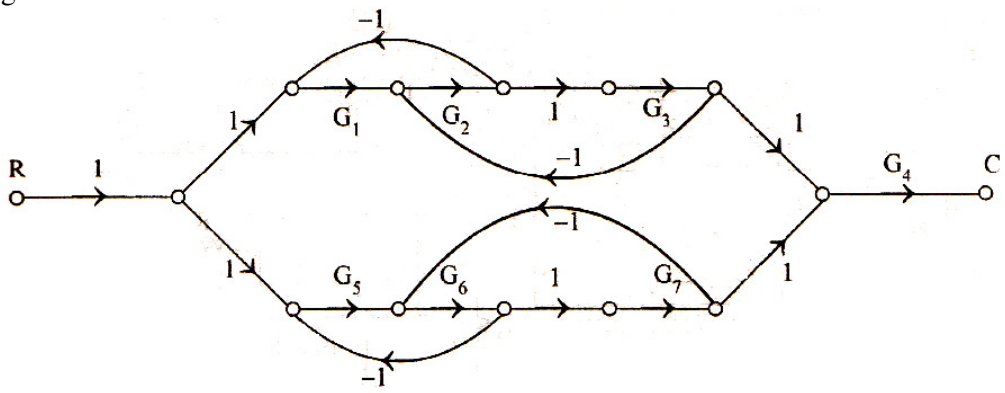
1. a) Write the differences between open and closed loop transfer functions (8M)

   b) Determine the transfer function $\frac{V2(s)}{F(s)}$,for the system show in below figure (7M)



2. a) Describe the AC servo motor and derive its transfer function (7M)

   b) Find the transfer function for control function shown below figure using Mason's gain formula (8M)



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3. a) A unity feedback servo-driven instrument has an open loop transfer function (8M)
$G(s)=\frac{10}{s(s+2)}$. Find the time domain specification for a unit step input.

b) A unity feedback control system having transfer function (7M)

$G(s)=\frac{K}{s^2(s+20)(s+30)}$. Determine steady state error coefficient and also determine the value of K to limit the error to 10 units due to input $r(t)=1+10t+20t^2$

4. a) The characteristics equation for a certain feedback control system is given by (7M)
$s^4+4s^3+7s^2+16s+12=0$. Test its stability and find the roots on imaginary axis.

b) Plot the root locus pattern of a system whose forward path transfer function is (8M)
$G(s)=\frac{K}{s(s+2)(s+3)}$.

5. Draw the bode plot of unity feedback system having $G(s)=\frac{10(s+10)}{s(s+2)(s+5)}$. (15M)
determine phase margin and gain margin

6. Sketch the polar plot for $G(s)=\frac{1}{s(1+sT1)(1+sT2)}$. (15M)

7. a) Explain the Lag Controllers design in frequency domain (8M)

b) Explain PID Controllers with necessary expressions (7M)

8. a) Solve the following differential equation by converting it into state variable form (8M)
$\ddot{y}+2\dot{y}+5y=3u(t)$, where $y_{(0)}=\dot{y}_{(0)}=0$ and u(t) = unit step input.

b) Determine the state controllability and observability of the system described by (7M)

$$\dot{x}=\begin{bmatrix}-3 & 1 & 1\\ -1 & 0 & 1\\ 0 & 0 & 1\end{bmatrix}x+\begin{bmatrix}0 & 1\\ 0 & 0\\ 2 & 1\end{bmatrix}u$$

$$y=\begin{bmatrix}0 & 0 & 1\\ 1 & 1 & 0\end{bmatrix}x$$

Code No: R22055 **R10** SET - 1

II B. Tech II Semester Supplementary Examinations, April/May - 2016
FORMAL LANGUAGES AND AUTOMATA THEORY
(Computer Science and Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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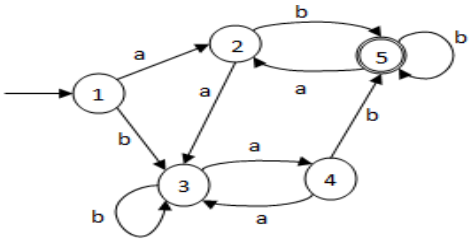
1. a) What is an equivalence relation? Two relations on set {1,2,3} is given as R={(1,3), (3, 1), (2,2)} and R={(1,1), (2,2), (3,3),(1,2)}. Which of the three properties does R has? Explain. (8M)
   b) Prove that for every n ≥ 1, 7 + 13 + 19 + …+ (6n+1) = n (3n +4) (7M)

2. a) Find the minimum state finite automaton for the following finite automata: (8M)



   b) Design a DFA equivalent for the NFA given in the following table: (7M)

Current State	Input Symbol	
	a	b
→ q_0	q_0 , q_1	q_0 , q_2
q_1	--	q_3
q_2	q_0 , q_3	q_1
(q_3)	q_2	--

3. a) Construct the NFA for the following regular expression, 0* + 1* + 2*. (8M)
   b) Construct a DFA that accepts all words whose second letter is a, have an even number of letters in total and a in every even position. (7M)

4. a) Consider the CFG: S→ X Y Z X→ a X | b X | c Y→ b b b . Show that this generates the language defined by (a + b)* bbb (a + b)* (8M)
   b) Construct the CFG for the language: L = { $a^n b^n c^m d^m$ | n, m ≥ 1} ∪ { $a^m b^n c^n d^m$ | n, m ≥ 1 } (7M)

5. a) Reduce the grammar into Chomsky Normal Form. S → aAD A→ aB | bAB B→b D→ d (8M)
   b) Find the equivalent unambiguous grammar for the following S→ SS | a | b. (7M)

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6. a) Design a PDA accepting the following language by null store: (8M)
   $L= \{ c\, a^n\, b^m \mid n, m \geq 1\}$
   b) Given a CFG G=({ S, A, B}, {0, 1}, P, S) with the production set P as follows: (7M)
   $S \rightarrow 0B \mid 1A \quad A \rightarrow 0S \mid 1AA \mid 0 \quad B \rightarrow 1S \mid 0BB \mid 1$. Show that the string 0001101110 belongs to CFL L(G).

7. a) Design a Turing Machine to compute *n mod 2*. (8M)
   b) Define unrestricted grammar. Give the unrestricted grammar generating $\{ a^i b^i c^i \mid i \geq 1\}$ (7M)

8. a) How is one language reduced into another language? Explain. (8M)
   b) What is a modified post correspondence problem(MPCP)? Can MPCP be reduced to PCP. (7M)

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